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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

OFFICIAL RECORD
SUBJECTS DIVISION
SCIENTIFIC DATA REVIEWS
EPA SERIES 361

MEMORANDUM

Date: 8-JUNE-2007

Subject: **PP# 6F7509. Pyrasulfotole.** Section 3 Request for Use on Small Cereal Grains. Summary of Analytical Chemistry and Residue Data.

DP#:	333412	Decision #:	366490
PC Code:	000692	40 CFR:	180.xxx
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From: Jennifer R. Tyler, Chemist
Registration Action Branch (RAB1)
Health Effects Division (HED) (7509P)

Through: George F. Kramer, Ph.D., Senior Chemist
RAB1/HED (7509P)

To: Tracy White/Dan Kenny, RM Team 23
Registration Division (RD) (7505P)

Bayer CropSciences has submitted a petition for the use of the new active ingredient (ai) pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone) on small grains, including wheat, barley, oat, and triticale. In addition, Bayer has requested the establishment of permanent tolerances for pyrasulfotole and its metabolite, 5-hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone, in or on the following raw agricultural commodities (RACs):

Wheat, grain	0.07 ppm	Oat, hay	0.8 ppm
Wheat, straw	0.25 ppm	Barley, grain	0.07 ppm
Wheat, forage	0.25 ppm	Barley, straw	0.25 ppm
Wheat, hay	0.8 ppm	Barley, hay	0.8 ppm
Wheat, aspirated grain fractions	1.4 ppm	Triticale, grain	0.07 ppm
Oat, grain	0.07 ppm	Rye, grain	0.07 ppm
Oat, straw	0.25 ppm	Rye, straw	0.25 ppm
Oat, forage	0.25 ppm	Rye, forage	0.25 ppm

In addition, Bayer has requested permanent tolerances for pyrasulfotole *per se* in or on the

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following livestock commodities:

Milk	0.005 ppm	Hog, fat	0.01 ppm
Cattle, meat	0.01 ppm	Hog, meat byproducts	0.3 ppm
Cattle, fat	0.01 ppm	Sheep, meat	0.01 ppm
Cattle, meat byproducts	0.3 ppm	Sheep, fat	0.01 ppm
Goat, meat	0.01 ppm	Sheep, meat byproducts	0.3 ppm
Goat, fat	0.01 ppm	Horse, meat	0.01 ppm
Goat, meat byproducts	0.3 ppm	Horse, fat	0.01 ppm
Hog, meat	0.01 ppm	Horse, meat byproducts	0.3 ppm

Executive Summary

Pyrasulfotole is a postemergence dicot herbicide for use on small cereal grains, including wheat, barley, oat, rye and triticale. There are currently no food/feed uses or tolerances for pyrasulfotole in the United States (U.S.). Pyrasulfotole is being evaluated as part of a trilateral joint review with Canada and Australia.

Pyrasulfotole will be formulated as AE 0317309 SE06 Herbicide, a suspo-emulsion (SE) containing 50 grams (g)/liter (L) of pyrasulfotole and the safener mefenpyr-diethyl; and AE 0317309 + Bromo Herbicide, an emulsifiable concentrate (EC) comprised of 37.5 g/L of pyrasulfotole, bromoxynil (present as the mixed heptanoate and octanoate esters), and the safener mefenpyr-diethyl on cereal grains. The SE and EC formulations are being proposed for one ground or foliar application per season to the above crops at rates of 0.045 lb pyrasulfotole/A and 0.037 lb pyrasulfotole/A, respectively. *HED notes that this document pertains to the ai pyrasulfotole only.*

The available wheat metabolism studies are adequate, and indicate that the metabolism of pyrasulfotole in spring wheat involves the demethylation and subsequent glucosylation of the parent compound, yielding pyrasulfotole-desmethyl-*O*- glucoside. There was also cleavage of the complete pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite as detected by the phenyl-label study and a polar fraction (p1) formed from the pyrazole-label study. Fraction p1 was characterized as being natural or incorporated into the matrix. See Figure 1 for the proposed metabolic pathway in wheat. Based on the results of the wheat metabolism studies, parent and pyrasulfotole-desmethyl are the residues of concern for tolerances and risk assessment purposes (Memo, J. Tyler *et al.*, 06/08/07; D328640). This conclusion applies only to the use of pyrasulfotole on small cereal grains. Any future uses on other crops, such as leafy vegetables, or legumes, may require the submission of additional metabolism data.

The nature of the pyrasulfotole residues in livestock is understood based on the acceptable phenyl- and pyrazole-labeled lactating goat and laying hen metabolism studies. The goat study indicates that the metabolism of pyrasulfotole in lactating goats involved either *N*-demethylation of pyrasulfotole to form pyrasulfotole-desmethyl, or oxidation of pyrasulfotole to form pyrasulfotole-hydroxymethyl. The hen study indicates that the metabolism of pyrasulfotole in laying hens involved the *N*-demethylation of pyrasulfotole to yield the pyrasulfotole-desmethyl

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metabolite. The residues of concern in livestock for tolerance and risk assessment purposes are parent and the desmethyl metabolite (Memo, J. Tyler, 06/08/07; D328640).

An adequate high-performance liquid chromatography (HPLC)/mass spectrometry (MS)/MS method (Method AI-001-P04-1) is available for collecting data on residues of pyrasulfotole and its metabolite pyrasulfotole-desmethyl in/on plant commodities. The limit of quantitation (LOQ) is 0.010 ppm for each analyte. Method AI-001-P04-1, which is also the proposed enforcement method for plant commodities, has been adequately radiovalidated and undergone a successful independent laboratory validation (ILV) trial. The proposed method was forwarded to the Analytical Chemistry Branch of the Biological Biological & Economics Analysis Division (ACB/BEAD)for a petition method validation (PMV, Memo, J. Tyler, 1/30/07; DP# 335558). ACB reviewed the proposed enforcement method data without an ACB validation (Memo, C. Stafford, 6/7/07; D335559). Provided the method is revised as specified in the ACB review, Method AI-001-P04-01 is a suitable enforcement method for determination of pyrasulfotole and pyrasulfotole-desmethyl in crop matrices. In particular, the ACB determined that the plant method does not meet general requirement as a confirmatory method since only one MS/MS ion transition is documented. The ACB recommends that the petitioner provide information for a second MS/MS ion transition to provide a confirmation of analyte identities. If two ion transitions are not available, HED recommends that the petitioner provide an alternate chromatographic column and/or mobile-phase combination to add an additional degree of specificity and further reduce the possibility of false positive residues.

The HPLC-MS/MS method (Method AI-004-A05-01) is adequate for collecting data on pyrasulfotole in livestock tissues, including milk, matrices. However, based on the results of the livestock metabolism studies, the residues of concern in livestock are pyrasulfotole and pyrasulfotole-desmethyl for tolerance and risk assessment purposes (Memo, J. Tyler *et al.*, 06/08/07; D328640). Therefore, the petitioner should submit a ruminant analytical enforcement method to determine residues of pyrasulfotole and pyrasulfotole-desmethyl as well as adequate radiovalidation and ILV data. Upon submission, the method will be forwarded to ACB/BEAD for a PMV trial. Successful completion of the PMV trial will be necessary before Method AI-004-A05-01 can be considered adequate for tolerance-enforcement purposes. It should be noted that ACB believes that the proposed analytical enforcement method will work for pyrasulfotole-desmethyl (e-mail from C. Stafford to J. Tyler; 3/3/007). Therefore, HED is recommending for a conditional registration until an updated method is submitted.

Pyrasulfotole and the metabolite pyrasulfotole-desmethyl were subjected to analysis by selected Protocols of the Food and Drug Administration (FDA) Pesticide Analytical Manual, Volume I (PAM I), third edition. The results indicate that pyrasulfotole is partially recovered through Protocol B, and completely recovered through Protocol C module DG-17. Pyrasulfotole-desmethyl was not recovered through any of the Protocols. The report has been forwarded to FDA for inclusion in PAM I (Memo, J. Tyler, 1/30/07; D335562).

The storage stability data are acceptable and indicate that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in soybean seed and wheat matrices for up to 11 months, and residues of pyrasulfotole-desmethyl decline in wheat forage and hay (ca. 0.12 % per day) in frozen storage. Therefore, corrections to residues of pyrasulfotole and pyrasulfotole-benzoic

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acid due to in-storage dissipation are not necessary, but residues of pyrasulfotole-desmethyl in wheat hay and forage will require corrections for in-storage dissipation. The data support the sample storage intervals and conditions in the submitted crop field trials, and processing study.

The results of the cattle feeding study are adequate for purposes of this action only, and indicate that separate tolerances will be required for residues in liver and meat-byproducts, except liver, of cattle, goats, horse, and sheep. HED assumed the transfer of pyrasulfotole-desmethyl from plant to livestock to be equivalent to that of the parent pyrasulfotole based on the similar structure. For any new uses which significantly increase the maximum theoretical dietary burden (MTDB) of the metabolite, the petitioner may be required to submit a metabolism and feeding study for pyrasulfotole-desmethyl.

Based on the MTDB for dairy cattle (0.39 ppm), the actual dose levels in the feeding study are equivalent to 7.7x, 23x, and 77x the MTDB for dairy cattle. Residues of pyrasulfotole in milk were <0.01 ppm (<LOQ) in all samples from the 23x group and were ≤0.0134 ppm in all samples from the 77x group; and residues in milk fat were <0.01 ppm (<LOQ) in all samples from the 77x group. Residues of pyrasulfotole in muscle were <0.01 (LOQ) in all samples from the 7.7x, 23x, and 77x groups. Residues of pyrasulfotole in fat were ≤0.0062 ppm (<LOQ) in all samples from the 7.7x and 23x group. Although residues were ≤0.0143 ppm in all fat samples from the 77x group, extrapolation to the 1x would be 0.000019 ppm. There is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in milk; milk, fat; and fat and muscle of cattle, goat, horse and sheep. However, PMRA policy requires the establishment of tolerances at the LOQ level for commodities in which there is no expectation of finite residues. Therefore, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.01 ppm in milk; and 0.02 ppm in fat and meat of cattle, goat, horse and sheep.

Quantifiable residues were detected in liver and kidney of cattle at all feeding levels in the feeding study. Residues were 1.230 ppm in liver and 0.2224 ppm in kidney at the 7.7x feeding level. Therefore, based on these residues, tolerances should be established for residues of pyrasulfotole and pyrasulfotole-desmethyl on liver of cattle, goat, horse, and sheep at 0.20 ppm; and meat byproducts, except liver, of cattle, goat, horse, and sheep at 0.05 ppm. Therefore, based on these residues and in order to harmonize with PMRA, tolerances should be established for residues of pyrasulfotole and pyrasulfotole-desmethyl on liver of cattle, goat, horse, and sheep at 0.35 ppm; and meat byproducts, except liver, of cattle, goat, horse, and sheep at 0.06 ppm.

Based upon a MTDB of 0.014 ppm for hogs, the 3-ppm feeding level in the ruminant feeding study is equivalent to 210x the MTDB for hogs. At the 210x feeding level, the maximum pyrasulfotole residues were 0.0010 ppm in muscle, 0.224 ppm in kidney and 1.230 ppm in liver. Residues at the 1x feeding level would be 0.0000046 ppm in muscle, 0.0011 ppm in kidney, and 0.0059 ppm in liver. There is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in hog tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of hogs.

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The results of the poultry feeding study are inadequate to determine the need for poultry tolerances as only residues of pyrasulfotole-benzoic acid were measured in the study. However, for purposes of this petition only, the results of the poultry metabolism studies can be used to determine the need for a new poultry feeding study and/or poultry tolerances. Based on the MTDB of 0.058 ppm for poultry, the phenyl-labeled (8.6 ppm) and pyrazole-labeled (10.5 ppm) poultry metabolism studies were conducted at 150x and 180x the MTDB for poultry, respectively. In the phenyl-labeled study, total residues of pyrasulfotole and pyrasulfotole-desmethyl were 0.037 ppm in muscle, 0.065 ppm in fat, and 1.557 ppm in liver. Residues of pyrasulfotole and pyrasulfotole-desmethyl at a 1x feeding level would be 0.00025 ppm in muscle, 0.00043 ppm in fat, and 0.010 ppm in liver. In the pyrazole-labeled study, total residues of pyrasulfotole and pyrasulfotole-desmethyl were 0.018 ppm in muscle, 0.014 ppm in fat, and 1.277 ppm in liver. Residues of pyrasulfotole and pyrasulfotole-desmethyl at a 1x feeding level would be 0.00010 ppm in muscle, 0.000078 ppm in fat, and 0.0071 ppm in liver. In both radiolabeled studies, as the total extractable residues in eggs were < 0.01 ppm; the samples were not analyzed further for identification purposes. Based on the results of the poultry metabolism study, there is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in eggs and poultry tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of poultry.

The available wheat, barley and oat residue data on both the SE06 and EC23 end-use products are classified as scientifically acceptable for determination of the magnitude of residue for the active ingredient pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl when treated with the end use products AE 017309 02 SE06 or AE 017309 03 + Bromo. Although pyrasulfotole-benzoic acid was a primary residue in most commodities, it was determined by the pyrasulfotole risk assessment team to be not of toxicological concern; and, therefore, should not be included in the tolerance expression for small cereal grains (Memo, J. Tyler *et al.*, 06/08/07; D328640).

Although the number and geographical representation of the wheat, barley and oat trials are slightly different than the number and geographical locations recommended in OPPTS Guideline 860.1500, the residue data are adequate to support the proposed uses.

In general, in wheat and barley, residues of pyrasulfotole, and pyrasulfotole-desmethyl appeared to be slightly higher following application of the SE06 formulation. In oats, the amount of each analyte detected was essentially the same between formulations. In wheat, barley and oats, the highest residue levels were observed in/on the hay samples and the lowest levels observed in/on the grain samples. Available residue decline data on wheat, barley and oats indicate that residues of pyrasulfotole and pyrasulfotole-desmethyl decreased with time in forage and wheat hay, but decreased only slightly or remained unchanged in straw and grain with increasing preharvest intervals.

The wheat crop field trial data support a maximum seasonal application rate of 0.049 pound (lb) ai/acre (A) (~1x the maximum proposed application rate; 0.055 kg ai/ha) for SE06 or 0.038 lbs ai/A (~1x the maximum proposed application rate; 0.042 kg ai/ha) for EC23 on wheat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw

and grain). With these use patterns, total residues of pyrasulfotole and pyrasulfotole-desmethyl are not expected to exceed 0.212 ppm (forage, 25-day PHI), 0.900 ppm (hay), 0.013 ppm (grain), and 0.158 ppm (straw). Using the North American Free Trade Agreement (NAFTA) Maximum Residue Limit (MRL)/Tolerance Harmonization Workgroup methodology for hay and straw and rounding up from the highest-average field trial value (HAFT) values for forage and grain, the available wheat crop field trial data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl in/on wheat commodities are 0.20 ppm for wheat, forage; 0.80 ppm for wheat, hay; 0.02 ppm for wheat, grain; and 0.20 ppm for wheat, straw (see Section 860.1550 Proposed Tolerances).

The barley crop field trial data support a maximum seasonal application rate of 0.048 lb ai/A (~1x the maximum proposed application rate; 0.054 kg ai/ha) for SE06 or 0.037 lbs ai/A (1x the maximum proposed application rate; 0.041 kg ai/ha) for EC23 on barley grain, hay, and straw (PHI of 21 to 25 days for hay, 35 to 45 days for straw and grain). With these use patterns, total pyrasulfotole and pyrasulfotole-desmethyl residue levels are not expected to exceed 0.208 ppm (hay), 0.011 ppm (grain) and 0.251 ppm (straw). Using the NAFTA MRL/Tolerance Harmonization Workgroup methodology for hay and straw and rounding up from the HAFT value for grain, the available barley crop field trial data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl in/on barley commodities are 0.30 ppm for barley, hay; 0.02 ppm for barley, grain; and 0.20 ppm for barley, straw (see Section 860.1550 Proposed Tolerances).

The oat crop field trial data support a maximum seasonal application rate of 0.047 lb ai/A (~1x the maximum proposed application rate; 0.053 kg ai/ha) for AE 017309 02 SE06 or 0.037 lb ai/A (1x the maximum proposed application rate; 0.041 kg ai/ha) for AE 017309 03 EC23 on oat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw and grain). With these use patterns, the total pyrasulfotole and pyrasulfotole-desmethyl residue levels are not expected to exceed 0.120 ppm (forage, 25-day PHI), 0.677 ppm (hay), 0.111 ppm (grain), and 0.170 ppm (straw). Using the NAFTA MRL/Tolerance Harmonization Workgroup methodology, the available oat crop field trial data indicate that the appropriate tolerances for pyrasulfotole and pyrasulfotole-desmethyl in/on oat commodities are 0.10 ppm for oat, forage; 0.50 ppm for oat, hay; 0.08 ppm for oat, grain; and 0.20 ppm for oat, straw (see Section 860.1550 Proposed Tolerances).

In addition, the wheat, barley and oat crop field trial data are adequate to support the proposed uses on rye and triticale. The available data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl are 0.02 ppm for rye, grain; 0.20 ppm, for rye, straw; and 0.20 ppm for rye, forage. HED notes that the proposed tolerance for triticale, grain is not needed as it is covered under the wheat, grain tolerance.

Under the conditions and parameters used in the study, the wheat processed food and feed data are classified as scientifically acceptable. The results of the processing study indicate that total residues of pyrasulfotole and pyrasulfotole-desmethyl do not appear to concentrate in wheat flour (0.26x), middling (0.38x), shorts (0.56x) and germ (0.70x). Total residues of pyrasulfotole and pyrasulfotole-desmethyl do appear to concentrate in aspirated wheat grain fractions (33x), and wheat bran (1.6x). Based on the 1.6x processing factor for wheat bran, and a HAFT residue of

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0.011 ppm from the wheat field trials, the maximum expected residues in wheat bran would be 0.018 ppm, which is below the recommended 0.02 ppm tolerance for wheat, grain. Therefore, a separate tolerance is not needed for wheat, bran. However, based on the 33x processing factor for aspirated grain fractions, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in aspirated grain fractions would be 0.36 ppm, which is above the recommended 0.02 ppm tolerance for wheat, grain. Therefore, a separate tolerance should be established for aspirated grain fractions at 0.40 ppm

In addition, based on the results of the processing study on wheat HED concludes that residues of pyrasulfotole and pyrasulfotole-desmethyl are not expected to concentrate in pearled barley, barley flour, oat flour, groats/rolled oats, and rye flour. Therefore, tolerances on these processed commodities are not needed. Because the results of the processing study indicate that residues concentrated in wheat bran, residues can be expected to concentrate in barley bran, oat bran and rye bran as well. Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.010 ppm from the barley field trials, the maximum expected residues in barley bran would be 0.016 ppm, which is below the recommended 0.02 ppm tolerance for barley, grain. Therefore, a separate tolerance is not needed for barley, bran. Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.109 ppm from the oat field trials, the maximum expected residues in oat bran would be 0.17 ppm, which is above the recommended 0.08 ppm tolerance for oat, grain. Therefore, a separate tolerance should be established for oat, bran at 0.20 ppm. However, according to current HED guidelines, HED does not currently set tolerances on oat, bran. The residue level will be incorporated into the dietary exposure assessment for this action (Memo, J. Tyler 06/08/07; D333435). Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in rye bran would be 0.018 ppm, which is below the recommended 0.02 ppm tolerance for rye, grain. Therefore, a separate tolerance is not needed for wheat, bran.

Section F of the petition should be revised to include the aforementioned HED-recommended tolerances and the correct commodity definitions for small grain RACs and processed commodities. In addition, the proposed tolerance for triticale, grain should be removed from the Section F.

The submitted confined rotational crop study is adequate, and indicates that the metabolic breakdown of pyrasulfotole involves the cleavage of the complete pyrazole moiety yielding the benzoic acid metabolite. Pyrasulfotole was not extensively metabolized in rotational crops, and the predominant residue is the pyrasulfotole-benzoic acid metabolite. Total residues amounting to 27.0 to 91.3% of the TRR were identified in rotational crop matrices following application of [phenyl-UL-^{14}C]-pyrasulfotole. Total identified residues were 3 to 9% of the TRR (<0.001-0.002 ppm) following application of [pyrazole-3-^{14}C]-pyrasulfotole. A number of components were characterized as ACN/H2O soluble. Nonextractable residues following extraction procedures accounted for 3.1 to 29% of the TRR (0.001-0.008 ppm) in phenyl-label samples, and 40 to 47% of the TRR (0.006-0.008 ppm) in pyrazole-label samples. Based on the results of the confined rotational crop study, the residues of concern in rotational crops are pyrasulfotole *per se* for tolerance purposes, and pyrasulfotole and pyrasulfotole-desmethyl for risk assessment purposes (Memo, J. Tyler *et al.*, 06/08/07; D328640). Although pyrasulfotole-benzoic acid was a primary residue, it was determined by the pyrasulfotole risk assessment team to be not of

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toxicological concern; and, therefore, should not be included in the tolerance expression for rotational crops

The results of the submitted confined and limited field rotational crop studies together are adequate to determine appropriate PBIs for rotational crops. In the confined rotational crop study, following application of either phenyl- or pyrazole-labeled pyrasulfotole, the TRR in the 122-DAT Swiss chard, turnip tops, and turnip roots were <0.01 (<LOQ). In the limited field rotational crop study, maximum residue levels of pyrasulfotole and pyrasulfotole-desmethyl were <LOD in all corn and soybean RACs at PBIs of 114-123 days. Maximum residues levels for pyrasulfotole-benzoic acid were 0.0018 ppm in corn forage, 0.0027 ppm in soybean forage, 0.0126 ppm in soybean hay and <LOD in corn grain, corn stover and soybean seed. However, it was determined that residues of pyrasulfotole-benzoic acid are not of concern for both tolerance and risk assessment purposes (Memo, J. Tyler *et al.*, 06/08/07; D328640). Therefore, the submitted confined and limited field trial data support the proposed PBIs.

HED Conclusion/Recommendations

Recommendations for Tolerances: Provided revised Sections B and F are submitted and analytical reference standards for pyrasulfotole, pyrasulfotole-desmethyl and labeled internal standards are submitted to the EPA National Pesticide Standards Repository, the residue chemistry database supports the establishment of a *conditional registration* and the following permanent tolerances for residues of pyrasulfotole and its metabolite pyrasulfotole-desmethyl:

Wheat, grain	0.02 ppm	Cattle, meat byproducts, except liver	0.06 ppm
Wheat, straw	0.20 ppm	Cattle, liver	0.35 ppm
Wheat, forage	0.20 ppm	Goat, fat	0.02 ppm
Wheat, hay	0.80 ppm	Goat, meat byproducts, except liver	0.06 ppm
Aspirated grain fractions	0.40 ppm	Goat, liver	0.35 ppm
Oat, grain	0.08 ppm	Sheep, meat	0.02 ppm
Oat, straw	0.20 ppm	Sheep, fat	0.02 ppm
Oat, forage	0.10 ppm	Sheep, meat byproducts, except liver	0.06 ppm
Oat, hay	0.50 ppm	Sheep, liver	0.35 ppm
Barley, grain	0.02 ppm	Horse, meat byproducts, except liver	0.05 ppm
Barley, straw	0.20 ppm	Horse, liver	0.30 ppm
Barley, hay	0.30 ppm	Hog, meat	0.02 ppm
Rye, grain	0.02 ppm	Hog, fat	0.02 ppm
Rye, straw	0.20 ppm	Hog, meat byproducts	0.02 ppm
Rye, forage	0.20 ppm	Poultry, meat	0.02 ppm
Milk	0.01 ppm	Poultry, fat	0.02 ppm
Cattle, meat	0.02 ppm	Poultry, meat byproducts	0.02 ppm
Cattle, fat	0.02 ppm	Eggs	0.02 ppm
Goat, meat	0.02 ppm		

The registration should be made unconditional upon submission of the following:

- Submission of a new ruminant analytical enforcement method to determine residues of

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pyrasulfotole and pyrasulfotole-desmethyl as well as adequate radiovalidation and ILV data. Upon submission, the method will be forwarded to ACB/BEAD for a PMV trial. Successful completion of the PMV trial will be necessary before Method AI-004-A05-01 can be considered adequate for tolerance-enforcement purposes.

- For Method AI-001-P04-01, the ACB recommends that the petitioner provide information for a second MS/MS ion transition to provide a confirmation of analyte identities. If two ion transitions are not available, HED recommends that the petitioner provide an alternate chromatographic column and/or mobile-phase combination to add an additional degree of specificity and further reduce the possibility of false positive residues.

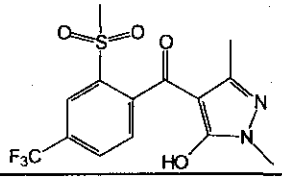
A human-health risk assessment will be prepared as a separate document.

Background

Pyrasulfotole is a postemergence dicot herbicide for use on small cereal grains, including wheat, barley, oat and triticale. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

As pyrasulfotole is a new ai, there are no tolerances currently established for pyrasulfotole under 40 CFR. Pyrasulfotole is being evaluated as part of a trilateral joint review with Canada and Australia.

The nomenclature and physicochemical properties of pyrasulfotole are presented below in Tables 1 and 2.

Table 1. Test Compound and Metabolite Nomenclature.	
Compound	Chemical Structure 
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	5-hydroxy-1,3-dimethylpyrazol-4-yl 2-mesyl-4-(trifluoromethyl)phenyl ketone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone
CAS #	365400-11-9
End-use products (EPs)	AE 0317309 SE06 Herbicide and AE 0317309 +Bromo Herbicide
Compound	Chemical Structure

US EPA ARCHIVE DOCUMENT

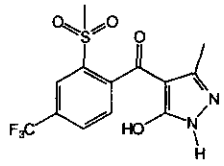
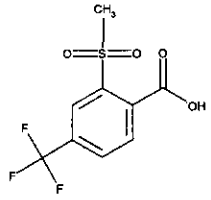
	
Common name	Pyrasulfotole-desmethyl
Company Experimental name	AE 1073910
CAS name	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone
Compound	Chemical Structure 
Common name	Pyrasulfotole-benzoic acid
Company Experimental name	AE B197555
CAS name	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid

Table 2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		MRID 46801701
pH at 22.9°C	3.03		
Density	1.53		
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Tolune Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	
Vapor pressure at 20°C	2.7×10^{-7} Pa		
Dissociation constant (pK_a)	4.2		
n-octanol-water partition coefficient $Log(K_{OW})$ at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		

860.1200 Directions for Use

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Pyrasulfotole will be formulated as AE 0317309 SE06 Herbicide, a SE formulation containing 50 g/L of pyrasulfotole and the safener mefenpyr-diethyl; and AE 0317309 + Bromo Herbicide, an EC formulation comprised of 37.5 g/L of pyrasulfotole, bromoxynil (present as the mixed heptanoate and octanoate esters), and the safener mefenpyr-diethyl for use on cereal grains. The SE and EC formulations are being proposed for one ground or foliar application per season to wheat, barley, oats and triticale at rates of 0.045 lb ai/A and 0.037 lb ai/A, respectively. Information on spray additives such as non-ionic surfactants was included on the label for the EC formulation. The following rotational crop restrictions are listed on both the SE and EC labels: 7 days for wheat (spring, durum, winter) and spring barley; 4 months for soybeans; 9 months for alfalfa, canaryseed, canola, corn, flax, field peas, lentils, and tame oats; and 12 months for mustards. Table 3 is a summary of the proposed use patterns.

Table 3. Summary of Proposed Use Patterns.

Crops	Product (EPA Reg. No.)	Application Timing; Type; and Equip.	# App.	Application Rate (lb ai/A)		RTI[1] (days)	PHI[1] (days)	Restrictions
				Per app.	Per season			
Wheat, barley, oats and triticale.	AE 0317309 02 SE06 (No EPA Reg. No.)	Crop application – apply between 1 leaf and up to flag leaf emergence. Ground and aerial equipment.	1	0.045	0.045	NA	Barley and oats grain or straw- 45; Wheat and triticale grain or straw – 50; grazing or foraging – 25 days.	Apply ground app. in 10-15 gal/A, and aerial app. in minimum of 5 gal/A.
Wheat, barley, oats, rye and triticale.	AE 0317309 + Bromo Herbicide (No EPA Reg. No.)	Crop application – apply between 1 leaf and up to flag leaf emergence. Fallow application – apply in fallow period prior to planting or the emergence of crops listed on label. Ground, sprinkler irrigation (wheat and barley only), and aerial equipment.	1	0.0037	0.0037	NA	Grain and straw – 60 days; grazing or foraging – 25 days.	Ground app.- Apply in minimum of 5 gal/A; Aerial app. – Apply in minimum of 5 gal/A. Instructions on additives, such as non-ionic surfactants are included on label.

[1] RTI = retreatment interval; PHI = preharvest interval; NA = not applicable.

HED Conclusions: The use directions provided by the petitioner are adequate to allow evaluation of the residue data relative to the proposed uses on small cereal grains, with the exception of the rotational crop restrictions. **Section B of the petition should be revised to include instructions on rotation to all other crops not currently listed.**

860.1300 Nature of the Residue - Plants

US EPA ARCHIVE DOCUMENT

46801748.der.doc (wheat without safener)
46801801.der.doc (wheat with and without safener)

Data concerning the metabolism of pyrasulfotole in spring wheat were submitted in conjunction with the proposed uses on small cereal grains. A total of three studies were submitted, including a phenyl-labeled study (MRID 46801749), a pyrazole-labeled study (MRID 46801748), and a phenyl-labeled study comparing the nature of the residue in spring wheat with and without the safener (MRID 46801801).

Wheat Without Safener: The metabolism of pyrasulfotole was investigated following spray applications of pyrasulfotole to spring wheat. [Phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole were formulated as an oil suspension (OD 5) and applied by spraying at a nominal rate of 0.089 lb ai/A (100 g ai/ha; ~2x maximum proposed application rate). A 0.178 lb ai/A (200 g ai/A; ~4x the maximum proposed application rate) experiment was performed in parallel to isolate metabolites for use as reference compounds. Wheat was treated at BBCH growth stage 21-22 (early tillering). Some plants were sampled approximately 3 hours after application. Following growth under outdoor conditions, further samples were taken at stage 43 (forage, 27-28 days after treatment, DAT), stage 73 (hay, 49-50 DAT), and stage 89 (harvest, 89-90 DAT). Untreated control samples were taken at each growth stage.

All samples from the 0.089 lb ai/A application were homogenized and the TRR determined immediately after each sampling by combustion and liquid-scintillation counting (LSC). Aliquots were extracted with acetonitrile (ACN) and water, and analyzed by HPLC and thin-layer chromatography (radio-TLC). Non-extractable residues of forage and straw were additionally released by Soxhlet extraction. The solids of forage, grain, and straw were further characterized by enzymatic, acidic or alkaline hydrolysis.

At maturity, the overall distribution of radioactivity from the whole plant was 74.4-95.1% of the TRR in straw, and 4.9-25.6% of the TRR in grain. TRR levels were 0.44 ppm in forage, 0.18 ppm in hay, 0.55 ppm in straw, and 0.30 ppm in grain for the [phenyl-U-^{14}C]-label study. TRR levels amounted to 0.47 ppm in forage, 0.06 ppm in hay, 0.38 ppm in straw, and 0.03 ppm in grain for the [pyrazole-3-^{14}C]-label study.

The majority of extractable residue in the phenyl-label study was identified (60.2-89.5% of the TRR; 0.13-0.39 ppm) in all of the wheat matrices, with 1.6 to 11.5% of the TRR (0.007-0.02 ppm) remaining non-extractable. Polar components were characterized at levels of 4.5-35.8% of the TRR (0.02-0.15 ppm). The predominant residue was pyrasulfotole-benzoic acid in all wheat matrices with levels increasing as the plant matured (24.1-89.5% of the TRR; 0.11-0.35 ppm). Pyrasulfotole-desmethyl-*O*-glucoside was also a major component in wheat forage and hay, and a minor component in straw. Repeated analysis of the 90-DAT straw sample, as well as re-extraction, did not show any significant variation in the extraction efficiency over four months.

In the pyrazole-label study, 0.7-43.4% of the TRR (<0.001-0.2 ppm) was identified in wheat matrices, with 1.8-34.8% of the TRR remaining non-extractable. Many polar components were characterized (38.1-77.1% of the TRR; 0.021-0.273 ppm) in wheat matrices. Pyrasulfotole-desmethyl-*O*-glucoside was the only metabolite identified in forage, hay, straw (21.7-43.0% of

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the TRR; 0.015-0.20 ppm), and grain (0.7% of the TRR; <0.001 ppm). A polar fraction, p1, was a major part of the residue in hay (20.9% of the TRR; 0.01 ppm), straw (10.9% of the TRR; 0.04 ppm), and grain (11.2% of the TRR; 0.003 ppm). Several unknown metabolite fractions of varying polarity were detected in wheat matrices, none of them exceeding 7.7% of the TRR (0.04 ppm).

The metabolic profile of pyrasulfotole in spring wheat involved the demethylation and subsequent glucosylation of the parent compound, yielding pyrasulfotole-desmethyl-*O*-glucoside. There was also cleavage of the complete pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite as detected by the phenyl label study and a polar fraction (p1) formed from the pyrazole label. Fraction p1 was characterized as being natural or incorporated into the matrix.

Wheat With and Without Safener: The metabolism of pyrasulfotole was investigated in spring wheat following spray application. [Phenyl-U-^{14}C]-labeled pyrasulfotole was formulated as an oil-based suspension (OD 5) and applied by spraying at a nominal rate of 0.089 lb ai/A (100 g ai/ha; ~2x maximum proposed application rate). A corresponding application including the safener mefenpyr-diethyl was performed in parallel, in order to investigate the influence of the safener on the metabolism of pyrasulfotole. Mefenpyr-diethyl was added to the formulation. The wheat was treated at growth stage 21 (early tillering) according to BBCH code. Following growth under semi-field conditions, samples were taken at stage 39 (forage, 21 days after treatment, DAT), stage 73 (hay, 44 DAT), and stage 92 (harvest, 79 DAT). Grain and straw were analyzed separately.

The TRR were determined by LSC. Identification and characterization of the residues was achieved by radio-HPLC and radio-TLC. The amount of non-extractable residues was determined by combustion. Aliquots of the solids were subjected to successive microwave extraction with ACN/water (1/1, v/v) and ACN/0.1 N NaOH (1/1, v/v).

The TRR levels in the trial with safener were 2.40 ppm in forage, 3.14 ppm in hay, 2.90 ppm in straw, and 0.16 ppm in grain. Without the safener, the TRR were 2.44 ppm in forage, 3.12 ppm in hay, 2.80 ppm in straw, and 0.24 ppm in grain. Therefore, the overall distribution of the radioactive residues was quantitatively similar in the trial with and without safener.

In both experiments, in the livestock feed commodities a total of 92.4-97.6% of the TRR (2.33-2.99 ppm) was extractable. Approximately 70 to 83% of the TRR was identified in livestock feed items, and 14 to 23% of the TRR (0.33-0.63 ppm) was characterized. Several unknown metabolite fractions and regions were detected, none of which exceeded 4.3% (0.10 ppm) of the TRR in forage, 5.4% (0.17 ppm) of the TRR in hay and 4.4% (0.12 ppm) of the TRR in straw. Non-extractable solids comprised 2.5-7.7% of the TRR (0.06-0.22 ppm). The overall accountability of the TRR was 99.3-100.3%.

In the trial with safener, the predominant residue in wheat forage, hay and straw was comprised of the metabolites pyrasulfotole-benzoic acid (16.3-30.5% of the TRR; 0.39-0.88 ppm) and pyrasulfotole-desmethyl-*O*-glucoside (27.9-43.5% of the TRR; 0.81-1.16 ppm). Minor

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components were pyrasulfotole (4.4-7.3% of the TRR; 0.13-0.18 ppm), and pyrasulfotole-sulfinyl-lactate (7.8-9.6% of the TRR; 0.19-0.28 ppm).

In the trial without safener, the predominant residues in livestock feed items were pyrasulfotole-benzoic acid (20.1-37.2% of the TRR; 0.49-1.06 ppm), pyrasulfotole-desmethyl-*O*-glucoside (19.6-30.2% of the TRR; 0.55-0.80 ppm) and pyrasulfotole (7.5-28.7% of the TRR; 0.21-0.71 ppm). Pyrasulfotole-sulfinyl-lactate was a minor metabolite identified at 3.8-5.7% of the TRR (0.09-0.17 ppm).

Independent of safener use, pyrasulfotole-benzoic acid was the only residue identified in wheat grain (97.6-97.7% of the TRR; 0.15-0.23 ppm). The remaining radioactive residue was non-extractable solids at 2.3-2.4% of the TRR (0.004-0.005 ppm). The overall accountability of the radioactive residue was 96.3-97.9%.

There are two main metabolic pathways for pyrasulfotole in wheat RACs. The first pathway involves the demethylation of pyrasulfotole yielding pyrasulfotole-desmethyl. This intermediate metabolite is glucosylated (pyrasulfotole-desmethyl-*O*-glucoside), or conjugated with glutathione leading to pyrasulfotole-sulfinyl-lactate. The second pathway is the result of cleavage of the pyrazole moiety leaving the pyrasulfotole-benzoic acid and multiple polar constituents.

HED Conclusions: The available wheat metabolism studies are adequate, and indicate that the metabolism of pyrasulfotole in spring wheat involves the demethylation and subsequent glucosylation of the parent compound, yielding pyrasulfotole-desmethyl-*O*- glucoside. There was also cleavage of the complete pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite as detected by the phenyl-label study and a polar fraction (p1) formed from the pyrazole-label study. Fraction p1 was characterized as being natural or incorporated into the matrix. See Figure 1 for the proposed metabolic pathway in wheat.

Based on the results of the wheat metabolism studies, parent and pyrasulfotole-desmethyl are the residues of concern for tolerances and risk assessment purposes (Memo, J. Tyler *et al.*, 06/08/07; D328640). This conclusion applies only to the use of pyrasulfotole on small cereal grains. Any future uses on other crops, such as leafy vegetables, or legumes, may require the submission of additional metabolism data.

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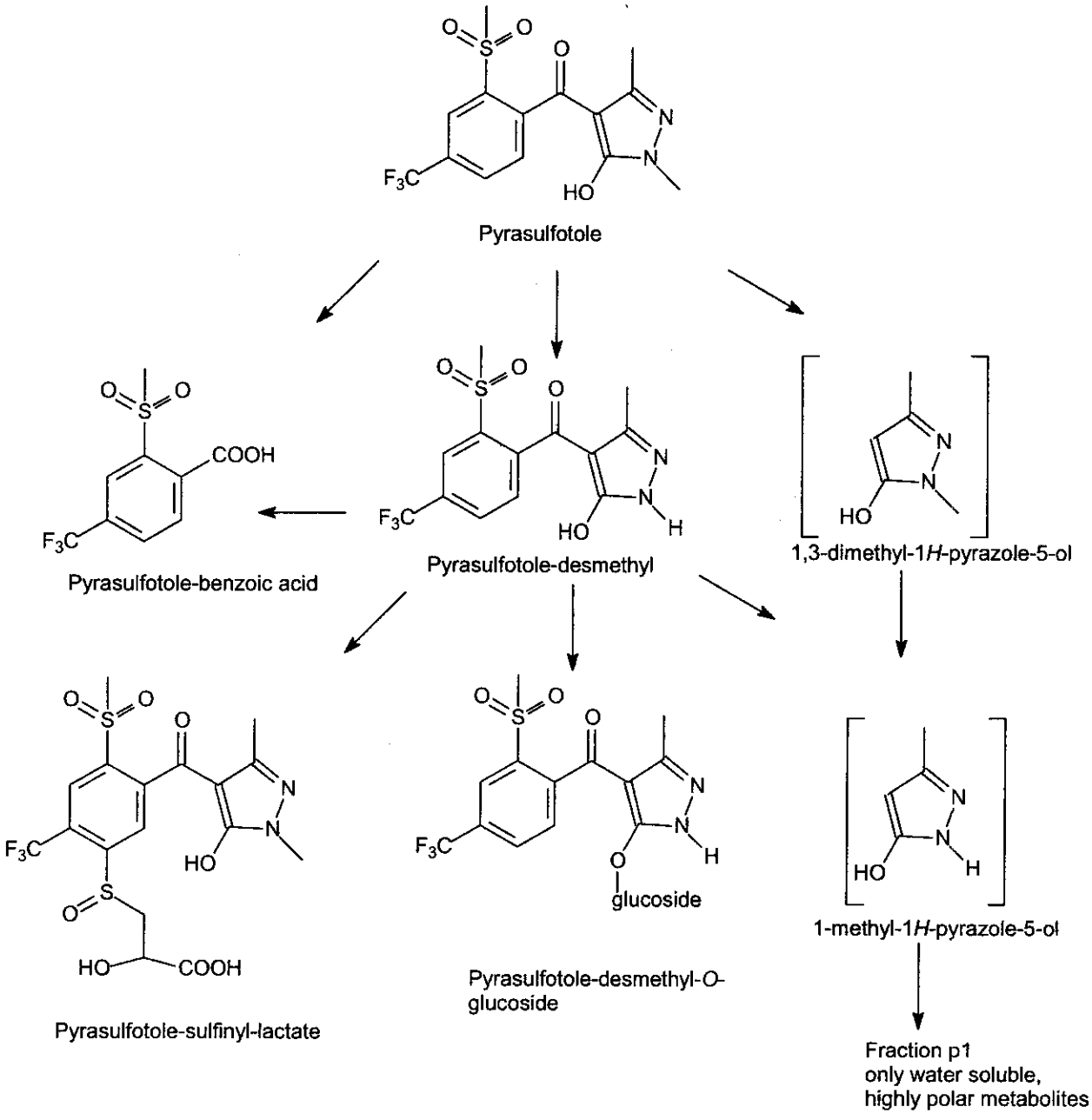
FIGURE 1. Proposed Metabolic Pathway of Pyrasulfotole in Spring Wheat.



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860.1300 Nature of the Residue - Livestock

46801804.der.doc (ruminant - lactating goat)
46801802.der.doc (poultry – laying hen)

Data concerning the metabolism of pyrasulfotole in ruminants (lactating goat) and poultry (laying hen) were submitted in conjunction with the proposed uses.

Lactating Goat: Bayer CropScience has submitted two studies investigating the metabolism of [phenyl-U-^{14}C]-pyrasulfotole and [pyrazole-3-^{14}C]-pyrasulfotole in lactating goats. Two lactating goats were dosed orally once daily for 3 consecutive days at a dose level equal to 51.2 ppm [phenyl-U-^{14}C]-pyrasulfotole equivalents (130x the MTDB to dairy cattle; specific activity of 56.8 µCi/mg) in the diet, based on dry weight of feed, corresponding to 0.93 mg /kg body weight per day. Also, two lactating goats were dosed orally once daily for 3 consecutive days at a dose level equal to 28.1 ppm [pyrazole-3-^{14}C]- pyrasulfotole equivalents (72x the MTDB to dairy cattle; specific activity of 59.4 µCi/mg) in the diet, based on dry weight of feed, corresponding to 1.24 mg /kg body weight per day.

Milk, feces and urine were collected twice a day during the treatment period. Approximately 23 hours after the last dose, the goats were sacrificed and the edible tissues (liver, kidney, muscle and composite fat) were collected for analysis. Identification and quantitation of the metabolites in the extractable residue was accomplished by using HPLC and HPLC-MS/MS.

In the phenyl-label study, the TRR (expressed as pyrasulfotole equivalents) were 1.477 ppm in liver, 0.533 ppm in kidney, 0.010 ppm in fat, 0.010 ppm in muscle, 0.016 ppm in Day-1 milk, 0.017 ppm in Day-2 milk, and 0.017 ppm in Day-3 milk. The majority of the residue in the tissues was extractable (92.4-99.6% of the TRR). All tissue extracts were analyzed by HPLC with the exception of the fat extracts, which represented residues less than 0.010 ppm. The majority of the residue was identified/characterized in all analyzed matrices (88.5 -99.6% of the TRR). The majority of the residue was comprised of pyrasulfotole in muscle (80.2% of the TRR; 0.008 ppm), kidney (99.6% of the TRR; 0.532 ppm), liver (95.5% of the TRR; 1.411 ppm) and milk (82.7% of the TRR; 0.014 ppm). Lesser amounts were identified as pyrasulfotole-desmethyl metabolite in milk (11.7% of the TRR, 0.002 ppm), and hydroxymethyl pyrasulfotole in muscle (8.3% of the TRR; 0.001 ppm) and milk (4.4% of the TRR; 0.002 ppm). More than 67% of the administered dose was recovered in urine and feces, with less than 1.15% in tissues, and 0.012% in milk.

In the pyrazole-label study, the TRR (expressed as pyrasulfotole equivalents) were 1.723 ppm in liver, 0.269 ppm in kidney, 0.008 ppm in fat, 0.007 ppm in muscle, 0.039 ppm in Day-1 milk, 0.031 ppm in Day-2 milk, and 0.044 ppm in Day-3 milk. The majority of the residue in the tissues was extractable (69.8-97.2% of the TRR). All tissue extracts were analyzed by HPLC with the exception of the fat and muscle extracts, which represented residues < 0.010 ppm. Pyrasulfotole was identified as the major residue in the liver (93.3% of the TRR, 1.603ppm) and kidney (92.4% of the TRR, 0.249 ppm). Additionally, two minor metabolites were identified/characterized from the extractable liver residue as pyrasulfotole-desmethyl (1.4% of the TRR, 0.025 ppm), and an unidentified polar metabolite (1.7% of the TRR, 0.030 ppm). In

milk, the predominant residue was pyrasulfotole (38.8% of the TRR, 0.017 ppm) with lesser amounts of three unknown polar compounds, none of which exceeded 0.006 ppm. Most of the radioactivity (>92%) was recovered in urine and feces, with less than 0.1% in milk, and 0.925% in tissues.

The metabolic fate of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in lactating goats involved either *N*-demethylation of pyrasulfotole to form pyrasulfotole-desmethyl, or oxidation of pyrasulfotole to form pyrasulfotole-hydroxymethyl (see Figure 2).

Poultry: Bayer CropScience has submitted two studies investigating the metabolism of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in laying hens. Six laying hens were dosed orally once daily for 14 consecutive days at a dose level equal to 8.6 ppm [phenyl-U-^{14}C]-pyrasulfotole equivalents (150x the MTDB to poultry; specific activity of 62.4 μCi/mg) in the diet, corresponding to 0.82 mg/kg body weight per day. Also, six laying hens were dosed with 10.5 ppm [pyrazole-3-^{14}C]-pyrasulfotole equivalents (180x the MTDB to poultry; specific activity of 65.4 μCi/mg) in the diet, corresponding to 0.81 mg/kg body weight per day.

Eggs were collected twice a day during the treatment period and excreta were collected daily during the treatment period. Approximately 30 minutes after the last dose, the hens were sacrificed and the edible tissues (liver, muscle, and composite fat) were collected for analysis. Identification and quantitation of the metabolites in the extractable residue was accomplished by using HPLC and HPLC-MS/MS.

In the phenyl-label study, TRR (expressed as pyrasulfotole equivalents) was 1.560 ppm in liver, 0.066 ppm in fat, 0.038 ppm in muscle and <0.001-0.002 ppm in eggs. The majority of the residue in the tissues and eggs was extractable (83.8-99.8% of the TRR). The majority of the residue was identified in the liver, fat and muscle matrices (97.5-99.8 % of the TRR). The predominant residue was pyrasulfotole, with lesser amounts of the pyrasulfotole-desmethyl metabolite. More than 97% of the administered dose was recovered in the excreta, with less than 0.4% in tissues and eggs.

In the pyrazole-label study, TRR (expressed as pyrasulfotole equivalents) were 1.285 ppm in liver, 0.015 ppm in fat, 0.020 ppm in muscle and 0.001-0.004 ppm in eggs. The majority of the residue in the tissues was extractable (96.8-99.4% of the TRR) and approximately half of the egg residue was extractable (47.4% of the TRR). The majority of the residue was identified in the liver and muscle matrices (95.1 –99.4 % of the TRR). The predominant residue was pyrasulfotole, with lesser amounts of the pyrasulfotole-desmethyl metabolite. Most of the radioactivity (>85%) was recovered in excreta, with less than 0.2% remaining in the tissues and eggs.

The metabolic fate of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in laying hens involved the *N*-demethylation of pyrasulfotole to yield the pyrasulfotole-desmethyl metabolite (see Figure 3).

HED Conclusions: The nature of the pyrasulfotole residues in livestock is understood based on the acceptable phenyl- and pyrazole-labeled lactating goat and laying hen metabolism studies.

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The goat study indicates that the metabolism of pyrasulfotole in lactating goats involved either *N*-demethylation of pyrasulfotole to form pyrasulfotole-desmethyl, or oxidation of pyrasulfotole to form pyrasulfotole-hydroxymethyl. The hen study indicates that the metabolism of pyrasulfotole in laying hens involved the *N*-demethylation of pyrasulfotole to yield the pyrasulfotole-desmethyl metabolite. The residues of concern in livestock for tolerance and risk assessment purposes are parent and the desmethyl metabolite (Memo, J. Tyler, 06/08/07; D328640).

FIGURE 2. Proposed Metabolic Pathway in Lactating Goats.

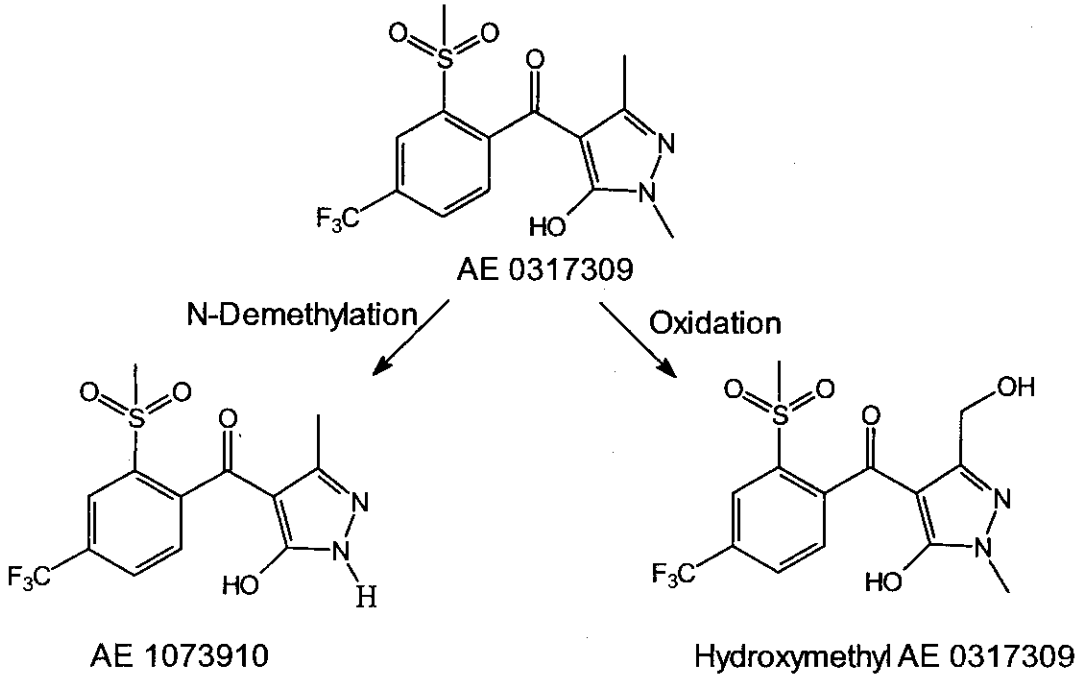

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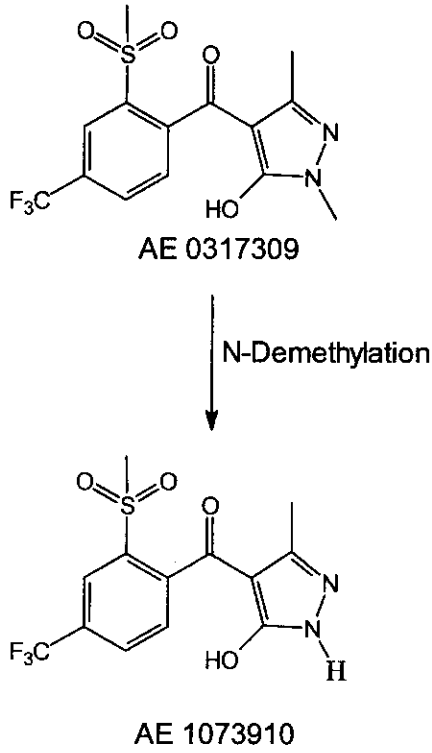
FIGURE 3. Proposed Metabolic Pathway in Laying Hen.



US EPA ARCHIVE DOCUMENT

860.1340 Residue Analytical Method – Plants

46801806.der.doc (Method)

Bayer CropScience has developed a HPLC-MS/MS, Method AI-001-P04-01, as the data-collection and enforcement method for residues of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in crop matrices.

Briefly, the crop matrices are extracted with a mixture of ACN/water/concentrated hydrochloric acid (HCl) (30:15:3, v/v). The sample extract is heated to 60°C for at least 30 minutes then cooled and a mixture of isotopic internal standards is added to the sample extract. A small aliquot is purified by C18 solid-phase extraction (SPE). The solvent is removed from the sample and the residue is reconstituted for analysis by HPLC-MS/MS.

The LOQ is 0.010 ppm for each analyte in each matrix. The proposed enforcement method was adequately validated in soybean seed, corn grain, corn stover, wheat forage, barley hay, and barley grain. A successful ILV was completed with samples of wheat grain and soybean seed. Extraction efficiency data demonstrated that the enforcement method can account for incurred residues of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in plant matrices.

Method validation recoveries of pyrasulfotole from soybean seed, corn grain, corn stover, wheat forage, barley grain, and barley hay fortified with pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid at 0.010 and 0.250 ppm were all within the acceptable 70-120% range. Apparent residues of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid were <0.01 ppm in/on all control samples. This method was also adequately validated in conjugation with the submitted field trials and processing studies. Concurrent method recoveries from samples fortified with pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid at 0.01-7.50 ppm were within the acceptable 70-120% range.

HED Conclusions: The HPLC-MS/MS method (Method AI-001-P04-01) has been adequately radiovalidated and has undergone a successful ILV trial. The proposed method was forwarded to ACB/BEAD for a PMV (Memo, J. Tyler, 1/30/07; DP# 335558). ACB reviewed the proposed enforcement method data without an ACB validation (Memo, C. Stafford, 6/7/07; D335559). Provided the method is revised as specified in the ACB review, Method AI-001-P04-01 is a suitable enforcement method for determination of pyrasulfotole and pyrasulfotole-desmethyl in crop matrices. In particular, the ACB determined that the plant method does not meet general requirement as a confirmatory method since only one MS/MS ion transition is documented. The ACB recommends that the petitioner provide information for a second MS/MS ion transition to provide a confirmation of analyte identities. If two ion transitions are not available, HED recommends that the petitioner provide an alternate chromatographic column and/or mobile-phase combination to add an additional degree of specificity and further reduce the possibility of false positive residues.

860.1340 Residue Analytical Method – Livestock

US EPA ARCHIVE DOCUMENT

46801809.der.doc (ruminant)
46801812.der.doc (poultry)

Ruminant: Bayer CropScience developed a HPLC-MS/MS, Method AI-004-A05-01, as the data gathering and enforcement method for residues of pyrasulfotole in/on ruminant tissues including milk. Briefly, livestock tissues are extracted using ACN/water (H_2O) (2/1, v/v). Milk samples are diluted with water and filtered. In the case of cream, the samples are extracted with ACN. The tissue sample extracts are heated to 60°C for at least 30 minutes; afterwards the samples are cooled down and centrifuged (only liver). The stable isotopic internal standard is added to sample extracts and mixed. An aliquot is purified by C18 SPE. Milk and cream samples are syringe filtered or partitioned with n-hexane. The solvent is removed from the samples and the residues are reconstituted for analysis using HPLC-MS/MS.

The LOQ is 0.010 ppm for bovine muscle, liver, kidney, and fat; and 0.005 ppm for milk. The proposed enforcement method was adequately validated in bovine tissues and milk matrices. A successful ILV was completed with samples of kidney, liver, cream and whole milk. Extraction efficiency data demonstrated that the enforcement method can account for incurred residues of pyrasulfotole in kidney, liver and whole milk.

Poultry: Bayer CropScience developed a HPLC-MS/MS method (AI-005-A05-01) as the data gathering and enforcement method for residues of the metabolite pyrasulfotole-benzoic acid in/on poultry tissues, including eggs. Briefly, the poultry tissues are extracted twice using ACN/2M HCl (2/1, v/v). The sample extracts are heated to 60°C for at least 30 minutes; afterwards the samples are cooled down and centrifuged. In the case of eggs, samples are extracted twice with ACN, and partitioned with n-hexane. The stable isotopic internal standard is added to the sample extract and mixed. An aliquot is purified by C18 SPE. The solvent is removed from the samples and the residues are reconstituted in methanol/10mM ammonium acetate for analysis using HPLC-MS/MS.

The LOQ is 0.010 ppm for poultry matrices, including eggs. The proposed enforcement method was adequately validated for the determination of pyrasulfotole-benzoic acid in poultry liver, muscle, skin and eggs. A successful ILV was completed with samples of breast muscle and eggs.

HED Conclusions: The HPLC-MS/MS method (Method AI-004-A05-01) is adequate for collecting data on pyrasulfotole in livestock tissues, including milk, matrices. However, based on the results of the livestock metabolism studies, the residues of concern in livestock are pyrasulfotole and pyrasulfotole-desmethyl for tolerance and risk assessment purposes *(Memo in progress, J. Tyler et al., x/xx/07; D328640)*. Therefore, the petitioner should submit a ruminant analytical enforcement method to determine residues of pyrasulfotole and pyrasulfotole-desmethyl as well as adequate radiovalidation and ILV data. Upon submission, the method will be forwarded to ACB/BEAD for a PMV trial. Successful completion of the PMV trial will be necessary before Method AI-004-A05-01 can be considered adequate for tolerance-enforcement purposes. It should be noted that ACB believes that the proposed analytical enforcement method will work for pyrasulfotole-desmethyl (e-mail from C. Stafford to J. Tyler; 3/3/007). Therefore, HED is recommending for a conditional registration until an updated method is submitted.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

860.1360 Multiresidue Methods (MRM)

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Pyrasulfotole and the metabolite pyrasulfotole-desmethyl were subjected to analysis by selected Protocols of the FDA PAM I, third edition. Pyrasulfotole and pyrasulfotole-desmethyl were tested according to Protocols A, B, and C of the FDA PAM I testing procedures.

Protocol A of the PAM I testing procedures is not suitable for the detection of either pyrasulfotole or pyrasulfotole-desmethyl because neither compound is an *N*-methyl carbamate, nor a compound that is naturally fluorescent. Protocol B of the PAM I testing procedures is not suitable for the detection of pyrasulfotole-desmethyl; however, pyrasulfotole is partially recovered through Protocol B. Protocol C module DG-17 can be used for the detection of pyrasulfotole. No other module in Protocol C can be reliably utilized for the detection of either pyrasulfotole or pyrasulfotole-desmethyl. Since pyrasulfotole and pyrasulfotole-desmethyl are not soluble in hexane, Protocols D, E, and F are not suitable for analysis and detection.

HED Conclusions: The results of the MRM analysis indicate that pyrasulfotole is partially recovered through Protocol B, and completely recovered through Protocol C module DG-17. Pyrasulfotole-desmethyl was not recovered through any of the Protocols. The report has been forwarded to FDA for inclusion in PAM I (Memo in progress, J. Tyler; D335562).

860.1380 Storage Stability

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This study was initiated to evaluate the freezer storage stability of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in soybean and wheat matrices.

Two gram samples of soybean seed, wheat grain, wheat forage, and wheat hay were spiked individually at 0.250 ppm each with pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid. Triplicate spiked samples of each matrix were analyzed immediately (0-Day). Stored soybean seed, wheat grain, wheat forage and wheat hay samples were analyzed for pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid at nominal intervals of 1, 3, 6, and 11 months (336 days). All spiked samples were stored at $\leq$ -10°C during the course of the study. Sample analysis for pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid was performed using HPLC-MS/MS (Method AI-001-P04-01).

Residues of pyrasulfotole, and pyrasulfotole-benzoic acid were stable in all crop matrices during 11 months (336 days) of frozen storage. Residues of pyrasulfotole-desmethyl were stable in soybean seed and wheat grain for up to 11 months (336 days) of frozen storage. However, residues of pyrasulfotole-desmethyl were found to decline in wheat forage and hay (ca. 0.12 % per day) in frozen storage.

HED Conclusions: The storage stability data are acceptable and indicate that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in soybean seed and wheat matrices for up to 11 months, and residues of pyrasulfotole-desmethyl decline in wheat forage and hay (ca. 0.12 % per day) in frozen storage. Therefore, corrections to residues of pyrasulfotole and

pyrasulfotole-benzoic acid due to in-storage dissipation are not necessary, but residues of pyrasulfotole-desmethyl in wheat hay and forage will require corrections for in-storage dissipation.

The data support the sample storage intervals and conditions in the submitted crop field trials, and processing study. Samples of wheat, barley and oats were stored frozen a maximum of 9 months (272 days), with the exception of forage samples from a single wheat trial that were stored frozen a maximum of 15 months (462 days). In the processing study, wheat grain samples were stored frozen a maximum of 5.5 month (164 days), and wheat aspirated grain fractions and all processed wheat commodities were analyzed within 30 days of storage.

860.1480 Meat, Milk, Poultry, and Eggs

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46801823.der.doc (laying hen)

Using the HED-recommended tolerances for small cereal grains, the MTDB for beef/dairy cattle, poultry and swine are calculated below in Table 4.

Table 4. Calculation of MTDB of Cattle, Poultry and Hogs for Pyrasulfotole.

Feed Commodity	Feedstuff Type[1]	% Dry Matter[2]	% Diet[2]	Proposed or Recommended Tolerances (ppm)	MTDB (ppm)[3]
Beef/Dairy Cattle (R=15/45%; CC=80/45%; PC=5/10%)					
Wheat hay	R	88	15/20	0.80	0.14/0.18
Wheat forage	R	25	0/25	0.20	0/0.20
Barley grain	CC	88	50/45	0.02	0.01/0.01
Wheat grain	CC	89	25/0	0.02	0.006/0
Aspirated grain fractions	CC	85	5/0	0.40	0.02/0
Untreated	PC	NA	5/10	NA	-0-
				Total	0.18/0.39
Poultry (CC=75-80%; PC=20-25%)					
Oat grain	CC	-	70	0.08	0.056
Wheat milled byproducts	CC	-	10	0.02	0.002
Untreated	PC	NA	20	NA	-0-
				Total	**0.058**
Hogs (CC=80-85%; PC=15-20%)					
Barley grain	CC	-	20	0.02	0.004
Wheat milled byproducts	CC	-	50	0.02	0.01
Untreated	CC	NA	15	NA	-0-
Untreated	PC	NA		NA	-0-
				Total	**0.014**

1 CC = Carbohydrate concentrate; R = Roughage; PC = Protein concentrate.
2 Table 1 (860.1000 OPPTS Test Guidelines; August 1996): Revisions of Livestock Diets Percents Reasonable Balanced Diets.
3 Contribution = [tolerance /% DM (if cattle)] X % diet.

Ruminants: Bayer CropScience conducted a dairy cattle feeding study for pyrasulfotole. Pyrasulfotole was administered orally via gelatin capsule to 10 lactating Holstein cows (*Bos taurus*) for 29 consecutive days. There were 3 animals per treatment group and a single control animal. Dosing was conducted at 0 (control), 3, 9, or 30 ppm/day in the feed (dry weight basis); these levels were 7.7x, 23x, and 77x the MTDB for dairy cattle. Residue data for pyrasulfotole

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in milk and tissues were obtained using HPLC-MS/MS. The LOQ for pyrasulfotole was 0.005 ppm (milk, cream), and 0.010 ppm (tissues).

The tissue and milk samples in this study were analyzed within 26 days of collection. Pyrasulfotole residues in the milk samples from the 77x feeding level reached a plateau by the third day of dosing (max = 0.013 ppm) and remained relatively constant for the rest of the study (mean = 0.010 ± 0.002, n = 30). Since the pyrasulfotole residue in the milk samples from the 23x feeding level were all below the LOQ (0.005 ppm), milk samples from the 7.7x dose group were not analyzed. There was no tendency for pyrasulfotole residues to concentrate in the skim milk or milk fat (concentration factors <1).

Pyrasulfotole residues were observed in significant amounts in the kidney and liver from all animals in all dose groups. Pyrasulfotole residue ranged from 0.123 ppm to 0.424 ppm in the kidney and from 0.692 ppm to 1.939 ppm in the liver. Pyrasulfotole residues were observed above the LOQ (0.014 ppm) in only one of the 77x fat tissue samples. No pyrasulfotole residue above the LOQ (0.010 ppm) was observed in any of the muscle tissue samples from any animal in any dose group. Table 5 is a summary of the residue data from the dairy cattle feeding study.

Table 5. Summary of Residue Data from Dairy Cattle Feeding Study with Pyrasulfotole.

Matrix	Feeding Level (ppm/day) [exaggeration]	Residue Levels (ppm)						
		N	LOD	Min	Max	Median	Mean	Standard Deviation
Milk	30 [77x][a]	30	0.0015	0.0042	0.0134	0.0103	0.0096	0.0024
Milk	9 [23x]	30		<LOD	0.0033	0.0024	0.0022	0.0007
Milk Fat	30 [77x]	3	0.0003	0.0061	0.0085	0.0074	0.0073	0.0012
Milk Skim	30 [77x]	3	0.0002	0.0086	0.0105	0.0090	0.0094	0.0010
Fat	3 [7.7x]	3	0.0007	0.0017	0.0062	0.0040	0.0040	0.0022
	9 [23x]	3		<LOD	0.0033	—	—	—
	30 [77x]	3		0.0024	0.0143	0.0046	0.0071	0.0064
Kidney	3 [7.7x]	3	0.0004	0.1748	0.2224	0.1973	0.1982	0.0238
	9 [23x]	4		0.1232	0.4240	0.2420	0.2631	0.1515
	30 [77x]	3		0.3778	0.4144	0.3811	0.3911	0.0202
Liver	3 [7.7x]	3	0.0005	1.019	1.230	1.187	1.145	0.1113
	9 [23x]	3		0.6922	1.594	1.577	1.288	0.5159
	30 [77x]	3		1.642	1.939	1.795	1.792	0.1488
Muscle	3 [7.7x]	3	0.0006	<LOD	0.0010	—	—	—
	9 [23x]	3		<LOD	0.0007	—	—	—
	30 [77x]	3		0.0013	0.0039	0.0025	0.0026	0.0013

[a] For milk samples at the 30 ppm level Day 0 were excluded from the statistical analysis because dosing was not started until Day 1 (*i.e.* Day 0 was predosing).

HED Conclusions: Based on the results of the livestock metabolism studies, the residues of concern in livestock are pyrasulfotole and pyrasulfotole-desmethyl for tolerance and risk assessment purposes *(Memo in progress, J. Tyler et al., x/xx/07; D328640)*. However, only pyrasulfotole was analyzed for in the available dairy cattle feeding study. HED assumed the transfer of pyrasulfotole-desmethyl from plant to livestock to be equivalent to that of the parent pyrasulfotole based on the structure similarity.

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Based on the MTDB for dairy cattle (0.39 ppm; see Table 4), the actual dose levels in the cow feeding study are equivalent to 7.7x, 23x, and 77x the MTDB for dairy cattle. Residues of pyrasulfotole in milk were <0.01 ppm (<LOQ) in all samples from the 23x group and were ≤0.0134 ppm in all samples from the 77x group; and residues in milk fat were <0.01 ppm (<LOQ) in all samples from the 77x group. Residues of pyrasulfotole in muscle were <0.01 (LOQ) in all samples from the 7.7x, 23x, and 77x groups. Residues of pyrasulfotole in fat were ≤0.0062 ppm (<LOQ) in all samples from the 7.7x and 23x group. Although residues were ≤0.0143 ppm in all fat samples from the 77x group, extrapolation to the 1x would be 0.000019 ppm. There is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in milk; milk, fat; and fat and muscle of cattle, goat, horse and sheep. However, PMRA policy requires the establishment of tolerances at the LOQ level for commodities in which there is no expectation of finite residues. Therefore, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.01 ppm in milk; and 0.02 ppm in fat and meat of cattle, goat, horse and sheep.

Quantifiable residues were detected in liver and kidney of cattle at all feeding levels in the feeding study. Residues were 1.230 ppm in liver and 0.2224 ppm in kidney at the 7.7x feeding level. Residues at the 1x feeding level would be 0.16 ppm in liver and 0.029 ppm in kidney. Therefore, based on these residues and in order to harmonize with PMRA, tolerances should be established for residues of pyrasulfotole and pyrasulfotole-desmethyl on liver of cattle, goat, horse, and sheep at 0.35 ppm; and meat byproducts, except liver, of cattle, goat, horse, and sheep at 0.06 ppm.

Based upon a MTDB of 0.014 ppm for hogs, the 3-ppm feeding level in the ruminant feeding study is equivalent to 210x the MTDB for hogs. At the 210x feeding level, the maximum pyrasulfotole residues were 0.0010 ppm in muscle, 0.224 ppm in kidney and 1.230 ppm in liver. Residues at the 1x feeding level would be 0.0000046 ppm in muscle, 0.0011 ppm in kidney, and 0.0059 ppm in liver. There is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in hog tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of hogs.

The available dairy cattle feeding study is adequate for this action only. For any new uses which significantly increase the MTDB of pyrasulfotole and pyrasulfotole-desmethyl, the petitioner may be required to submit a metabolism and feeding study in with pyrasulfotole-desmethyl.

Poultry: Bayer CropScience has submitted a hen feeding study for pyrasulfotole-benzoic acid, a metabolite present in poultry feeds from crops treated with pyrasulfotole. Pyrasulfotole-benzoic acid was administered orally *via* gelatin capsule to forty laying hens for 29 days. There were three treatment groups with three sub-groups of four hens each and four control hens. Dosing was conducted at 0 (control), 0.4, 1.2, or 4.0 ppm/day in the feed (w/w).

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Residue data for pyrasulfotole-benzoic acid in eggs and tissues were obtained using HPLC, and HPLC-MS/MS using isotope labeled internal standards. The LOQ was 0.010 ppm for all tissue and egg matrices.

Pyrasulfotole-benzoic acid residues were less than the LOQ in all egg samples analyzed from the 4-ppm dose group. Therefore, egg samples from the 1.2-ppm and 0.4-ppm dose groups were not analyzed.

In the 0.4- and 1.2-ppm dose groups, average pyrasulfotole-benzoic acid residues were less than the LOQ in all tissue matrices. In the 4-ppm dose group, the maximum pyrasulfotole-benzoic acid residues in liver, skin, fat, and muscle were 0.021, 0.022, <0.010, and <0.010 ppm, respectively. Therefore, at the highest dose examined (4.0 ppm), pyrasulfotole-benzoic acid residues accumulate in the liver and skin.

Table 6. Summary of Egg and Tissues Residue Data from Pyrasulfotole-Benzoic Acid Fed Poultry.

Matrix	Feeding Level (ppm)	Residue Levels (ppm)						
		N	LOD	Min	Max	Median	Mean	Standard Deviation
Egg	4.0[1]	30	0.0022	<LOD	<LOD	—	—	—
Fat	0.4	3	0.0014	<LOD	<LOD	—	—	—
	1.2	3		<LOD	0.0085	—	—	—
	4.0	3		0.0025	0.0057	0.0052	0.0045	0.0018
Liver	0.4	3	0.0010	<LOD	0.0016	—	—	—
	1.2	3		0.0024	0.0035	0.0031	0.0029	0.0008
	4.0	3		0.0102	0.0209	0.0105	0.0139	0.0061
Muscle	0.4	3	0.0018	<LOD	<LOD	—	—	—
	1.2	3		<LOD	<LOD	—	—	—
	4.0	3		0.0023	0.0038	0.0036	0.0032	0.0008
Skin	0.4	3	0.0014	0.0014	0.0030	0.0017	0.0021	0.0009
	1.2	3		0.0040	0.0073	0.0042	0.0052	0.0019
	4.0	3		0.0203	0.0226	0.0207	0.0212	0.0013

[1] For egg samples at 4.0 ppm dosing level, samples from Day 0 were excluded in the statistical analysis since dosing was not started until Day 1 (i.e., Day 0 was pre-dosing day).

HED Conclusions: The residues of concern in livestock are pyrasulfotole and pyrasulfotole-desmethyl for tolerance and risk assessment purposes *(Memo in progress, J. Tyler et al., x/xx/07; D328640)*. The results of the poultry feeding study are inadequate to determine the need for poultry tolerances as only residues of pyrasulfotole-benzoic acid were measured in the study. However, for purposes of this petition only, the results of the poultry metabolism studies can be used to determine the need for a new poultry feeding study and/or poultry tolerances. Based on the MTDB of 0.058 ppm for poultry, the phenyl-labeled (8.6 ppm) and pyrazole-labeled (10.5-ppm) poultry metabolism studies were conducted at 150x and 180x the MTDB for poultry, respectively.

In the phenyl-labeled study, total residues of pyrasulfotole and pyrasulfotole-desmethyl were 0.037 ppm in muscle, 0.065 ppm in fat, and 1.557 ppm in liver. Residues of pyrasulfotole and

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pyrasulfotole-desmethyl at a 1x feeding level would be 0.00025 ppm in muscle, 0.00043 ppm in fat, and 0.010 ppm in liver. In the pyrazole-labeled study, total residues of pyrasulfotole and pyrasulfotole-desmethyl were 0.018 ppm in muscle, 0.014 ppm in fat, and 1.277 ppm in liver. Residues of pyrasulfotole and pyrasulfotole-desmethyl at a 1x feeding level would be 0.00010 ppm in muscle, 0.000078 ppm in fat, and 0.0071 ppm in liver. In both radiolabeled studies, as the total extractable residues in eggs were < 0.01 ppm; the samples were not analyzed further for identification purposes. Based on the results of the poultry metabolism study, there is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in eggs and poultry tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of poultry.

860.1500 Crop Field Trials

46801825.der.doc (wheat), 46801830.der.doc (barley), 46801831.der.doc (oats)

The petitioner has submitted crop field trial data on wheat, barley and oats to support the use of pyrasulfotole on small cereal grains. In all studies, field trials were conducted to evaluate the magnitude of residues of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid following application of either end-use product, AE 0317309 02 SE06 A1 (SE06) or AE 0317309 03 EC23 A8 (EC23). The results of these field trials are presented below by crop and summarized in Tables 7-12.

Wheat:

Table 7. Summary of Wheat Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	0.003	0.447	0.437	0.030	0.081	0.100
		41-46	68	0.002	0.296	0.273	0.024	0.058	0.071
Grain		40-56	72	0.028	0.873	0.502	0.121	0.149	0.117
Hay		21-25	70	0.015	1.149	1.100	0.176	0.236	0.202
Straw		40-56	72	0.022	0.420	0.388	0.083	0.104	0.085
Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	<LOD	0.165	0.169	0.009	0.032	0.047
		41-46	68	<LOD	0.072	0.064	0.007	0.013	0.018
Grain		40-56	72	0.001	0.009	0.008	0.005	0.004	0.002
Hay		21-25	70	0.016	0.567	0.492	0.150	0.165	0.115
Straw		40-56	72	0.005	0.154	0.149	0.049	0.055	0.038
Pyrasulfotole									
Forage	0.040–0.049 (0.046–	18-25	68	<LOD	0.061	0.058	0.005	0.008	0.011
		41-46	68	<LOD	0.026	0.026	0.005	0.006	0.004

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Grain	0.055)	40-56	72	0.001	0.009	0.008	0.005	0.005	0.001
Hay		21-25	70	<LOD	0.625	0.563	0.009	0.042	0.108
Straw		40-56	72	0.001	0.030	0.025	0.003	0.005	0.005
Pyrasulfotole and Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	0.003	0.212	0.193	0.014	0.042	0.057
		41-46	68	0.003	0.084	0.084	0.012	0.019	0.021
Grain		40-56	72	0.003	0.013	0.011	0.010	0.008	0.002
Hay		21-25	70	0.026	0.900	0.830	0.165	0.206	0.170
Straw		40-56	72	0.010	0.158	0.158	0.053	0.060	0.039

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

Table 8. Summary of Wheat Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	0.005	0.362	0.350	0.029	0.076	0.091
		41-46	64	0.003	0.214	0.208	0.022	0.049	0.059
Grain		40-56	72	0.022	0.386	0.354	0.110	0.127	0.081
Hay		21-25	62	0.036	0.795	0.727	0.174	0.207	0.140
Straw		40-56	72	0.019	0.281	0.246	0.065	0.088	0.059
Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	<LOD	0.138	0.135	0.010	0.029	0.035
		41-46	64	<LOD	0.050	0.044	0.005	0.010	0.013
Grain		40-56	72	0.001	0.006	0.006	0.005	0.004	0.002
Hay		21-25	62	0.014	0.601	0.594	0.142	0.165	0.118
Straw		40-56	72	0.004	0.151	0.146	0.043	0.051	0.037
Pyrasulfotole									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	<LOD	0.060	0.060	0.005	0.009	0.012
		41-46	64	<LOD	0.026	0.024	0.005	0.006	0.004
Grain		40-56	72	0.001	0.005	0.005	0.005	0.005	0.001
Hay		21-25	62	<LOD	0.361	0.294	0.008	0.031	0.062
Straw		40-56	72	0.001	0.016	0.016	0.004	0.005	0.004
Pyrasulfotole and Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	0.006	0.152	0.149	0.014	0.038	0.043
		41-46	64	0.004	0.073	0.069	0.010	0.017	0.016
Grain		40-56	72	0.006	0.011	0.010	0.008	0.008	0.002
Hay		21-25	62	0.016	0.619	0.603	0.171	0.195	0.136
Straw		40-56	72	0.007	0.157	0.151	0.048	0.056	0.038

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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Bayer CropScience has submitted field trial data for pyrasulfotole on wheat. During the 2004 and 2005 wheat growing seasons, field trials were conducted to evaluate the magnitude of residues in/on wheat forage, hay, grain, and straw following application of either end-use product, SE06 or EC23.

In total, 35 hay trials, 34 forage trials, and 32 grain and straw trials were conducted using SE06, while 31 hay trials and 32 forage, grain and straw trials were conducted using EC23. Trials for both formulations occurred in Regions 2 (GA; 2 trials), 4 (MS; 1 trial), 5 (KS, IL, NE, MN, ON; 6 trials), 6 (TX; 1 trial), 7 (ND, NE, SD, ND, SA; 10 trials), 7A (AB; 1 trial), 8 (KS, TX; 6 trials), 11 (ID; 1 trial) and 14 (SA, AB, MB; 15 trials). At each trial location, SE06 (5% ai) or EC23 (3.75 % ai) was applied once to pre-emergent wheat as a foliar broadcast spray at a rate of 0.040 to 0.049 lb ai/A (0.046 to 0.055 kg ai/ha) or 0.031 to 0.038 lb ai/A (0.035 to 0.042 kg ai/ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 24 (forage) BBCH 37 to 51 (hay, grain, and straw). All trials used ammonium sulfate as an adjuvant.

PHIs for wheat RACs were 18 to 25 days or 41 to 46 days for forage, 21 to 25 days for hay and 40 to 56 days for grain and straw. In the decline trials, forage samples were collected at five intervals (± 2 days) corresponding to PHIs of 15, 25, 35, 45, and 55 days and hay samples were collected at five intervals (± 2 days) corresponding to PHIs of 0, 15, 25, 30, and 35 days. Grain and straw samples were collected at five intervals (± 3 days) corresponding to PHIs of 40, 50, 55, 60, and 70 days.

Pyrasulfotole residues and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl were quantified by HPLC-MS/MS using stable isotope labeled analytes as internal standards. The LOQ for each analyte was 0.010 ppm in wheat forage, hay, grain, and straw.

The samples in this study were frozen a maximum of 9 months (272 days), with the exception of forage samples from a single trial (SE06 formulation) that were stored frozen a maximum of 15 months (462 days), prior to analysis. Data from an 11-month storage stability study on wheat RACs demonstrate that residues of pyrasulfotole and pyrasulfotole-benzoic acid were stable in all wheat matrices. Residues of pyrasulfotole-desmethyl were also stable in soybeans and wheat grain but were found to decline in wheat forage and hay (ca. 0.12 % per day).

With the exception of pyrasulfotole-desmethyl in/on wheat hay, the levels of analyte residues appeared to be slightly higher following SE06 application. The maximum amounts of pyrasulfotole-benzoic acid reported were 0.447 ppm (forage, 25-day PHI), 1.15 ppm (hay), 0.873 ppm (grain) and 0.420 ppm (straw); maximum amounts of pyrasulfotole-desmethyl reported were 0.165 ppm (forage, 25-day PHI), 0.601 ppm (hay), 0.009 ppm (grain) and 0.154 ppm (straw); and the maximum amounts of pyrasulfotole reported were 0.061 ppm (forage, 25-day PHI), 0.625 ppm (hay), 0.009 ppm (grain) and 0.030 ppm (straw). The maximum amount of pyrasulfotole and pyrasulfotole-desmethyl reported were 0.212 ppm (forage, 25-day PHI), 0.900 ppm (hay), 0.013 ppm (grain) and 0.158 ppm (straw).

Residue decline data showed that residues of pyrasulfotole and the metabolites decreased with time in wheat forage and wheat hay, but decreased only slightly or remained unchanged in wheat

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grain and wheat straw with increasing PHIs.

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Barley:

Table 9. Summary of Barley Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid (AE B197555)									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	0.004	0.116	0.110	0.031	0.034	0.025
Hay		21-25	56	0.027	0.631	0.614	0.133	0.184	0.140
Straw		34-45	48	0.008	0.451	0.380	0.054	0.084	0.092
Pyrasulfotole-desmethyl									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	<LOD	0.008	0.008	0.002	0.003	0.002
Hay		21-25	56	0.010	0.185	0.171	0.067	0.082	0.045
Straw		34-45	48	0.004	0.220	0.156	0.027	0.043	0.040
Pyrasulfotole									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.001
Hay		21-25	56	<LOD	0.050	0.044	0.008	0.013	0.012
Straw		34-45	48	<LOD	0.031	0.022	0.003	0.006	0.006
Pyrasulfotole and Pyrasulfotole-desmethyl									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	0.003	0.011	0.010	0.007	0.008	0.002
Hay		21-25	56	0.011	0.208	0.189	0.074	0.093	0.053
Straw		34-45	48	0.009	0.251	0.178	0.033	0.049	0.044

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

Table 10. Summary of Barley Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	0.003	0.080	0.077	0.026	0.031	0.022
Hay		21-25	48	0.024	0.401	0.391	0.116	0.155	0.104
Straw		35-45	50	0.007	0.326	0.289	0.050	0.062	0.054
Pyrasulfotole-desmethyl									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.002
Hay		21-25	48	0.007	0.168	0.161	0.059	0.062	0.039
Straw		35-45	50	0.003	0.070	0.066	0.024	0.026	0.017
Pyrasulfotole									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.001
Hay		21-25	48	0.001	0.027	0.024	0.007	0.009	0.007
Straw		35-45	50	<LOD	0.011	0.010	0.004	0.004	0.003
Pyrasulfotole and Pyrasulfotole-desmethyl									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	0.004	0.010	0.010	0.007	0.008	0.002
Hay		21-25	48	0.010	0.183	0.175	0.064	0.071	0.043
Straw		35-45	50	0.004	0.100	0.084	0.028	0.032	0.022

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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Bayer CropScience conducted a total of 35 field trials (33 harvest and 2 decline) to measure the magnitude of the residue for pyrasulfotole in/on barley hay, grain, and straw following application of either end-use product, SE06 or EC23.

Trials for both formulations occurred in Regions 2 (GA; 1 trial), 5 (NE, MN, ON, WI; 4 trials), 5B (ON, QC; 1 trial), 7 (ND, NE, SK; 4 trials), 9 (ID; 1 trials), 10 (CA; 1 trial), 11 (OR, WA; 2 trials), and 14 (SK, AB, MB; 10 trials). At each trial location, SE06 (5% ai) or EC23 (3.75 % ai) was applied once to pre-emergent barley as a foliar broadcast spray at a rate of 0.043 to 0.048 lb ai/A (0.048 to 0.054 kg ai/ha) or 0.032 to 0.036 lb ai/A (0.035 to 0.041 kg ai/ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 24 (forage) BBCH 37 to 51 (hay, grain, and straw). All trials used ammonium sulphate as an adjuvant.

PHIs for barley RACs were 21 to 25 days for hay and 35 to 45 days for grain and straw. In the decline trials, hay samples were collected at five intervals (± 2 days) corresponding to PHIs of 0, 15, 25, 30 and 35 days. Grain and straw samples were collected at five intervals (± 2 days) corresponding to PHIs of 35, 45, 50, 60 and 70 days.

Residues of pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl were quantified by HPLC-MS/MS using stable isotope labelled analytes as internal standards. The LOQ for each analyte was 0.010 ppm in barley hay, grain, and straw.

All barley samples were frozen a maximum of 9 months prior to analysis. Data from an 11-month storage stability study suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all barley matrices. Residues of pyrasulfotole-desmethyl are also expected to be stable in barley grain, but decline in barley forage and hay (ca. 0.12 % per day).

The amount of each analyte detected in/on barley RACs appeared to be higher following SE06 application, with the highest residue levels observed in/on barley hay and the lowest levels observed in/on barley grain. The maximum pyrasulfotole-benzoic acid residue levels observed were 0.631 ppm (hay), 0.116 ppm (grain) and 0.451 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.185 ppm (hay), 0.008 ppm (grain) and 0.220 ppm (straw); the maximum pyrasulfotole residue levels observed were 0.050 ppm (hay), 0.005 ppm (grain) and 0.031 ppm (straw); and the maximum pyrasulfotole and pyrasulfotole-desmethyl levels observed were 0.208 ppm (hay), 0.011 ppm (grain) and 0.0251 ppm (straw). In decline trials, the amount of all analytes decreased with time in/on barley hay and straw, but did not change significantly in/on barley grain.

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Oats:

Table 11. Summary of Oat Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	0.001	0.133	0.124	0.014	0.026	0.031
		41-46	60	<LOD	0.156	0.146	0.008	0.019	0.035
Grain		35-50	54	0.002	0.085	0.080	0.006	0.016	0.021
Hay		21-26	60	0.026	0.509	0.431	0.142	0.168	0.115
Straw		35-50	54	0.007	0.107	0.097	0.033	0.041	0.029
Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	0.001	0.116	0.100	0.014	0.023	0.023
		41-46	60	<LOD	0.072	0.066	0.005	0.010	0.014
Grain		35-50	54	0.001	0.083	0.080	0.008	0.011	0.016
Hay		21-26	60	0.036	0.587	0.527	0.147	0.167	0.107
Straw		35-50	54	0.010	0.156	0.144	0.048	0.053	0.031
Pyrasulfotole									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	<LOD	0.006	0.006	0.003	0.003	0.002
		41-46	60	<LOD	0.005	0.005	0.005	0.004	0.001
Grain		35-50	54	<LOD	0.022	0.020	0.005	0.004	0.004
Hay		21-26	60	0.002	0.105	0.081	0.010	0.016	0.020
Straw		35-50	54	<LOD	0.014	0.012	0.004	0.004	0.003
Pyrasulfotole and Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	0.003	0.120	0.103	0.016	0.025	0.023
		41-46	60	0.003	0.074	0.067	0.010	0.014	0.013
Grain		35-50	54	0.002	0.105	0.105	0.011	0.016	0.019
Hay		21-26	60	0.041	0.677	0.608	0.161	0.183	0.120
Straw		35-50	54	0.011	0.170	0.156	0.050	0.054	0.032

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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Table 12. Summary of Oat Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb ai/A (kg ai/ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median	Mean	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	0.003	0.131	0.105	0.013	0.025	0.030
		41-46	48	<LOD	0.146	0.118	0.005	0.017	0.032
Grain		35-50	52	0.003	0.128	0.116	0.007	0.019	0.029
Hay		21-26	48	<LOD	0.510	0.472	0.163	0.188	0.129
Straw		35-50	52	0.007	0.108	0.106	0.035	0.041	0.028
Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	0.001	0.107	0.105	0.018	0.026	0.027
		41-46	48	0.001	0.087	0.077	0.005	0.010	0.016
Grain		35-50	52	0.001	0.089	0.088	0.005	0.010	0.017
Hay		21-26	48	<LOD	0.623	0.606	0.167	0.209	0.143
Straw		35-50	52	0.012	0.137	0.134	0.046	0.052	0.030
Pyrasulfotole									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	<LOD	0.005	0.005	0.003	0.003	0.002
		41-46	48	<LOD	0.005	0.005	0.005	0.005	0.001
Grain		35-50	52	<LOD	0.022	0.022	0.005	0.004	0.004
Hay		21-26	48	<LOD	0.050	0.046	0.012	0.013	0.010
Straw		35-50	52	<LOD	0.012	0.011	0.003	0.004	0.003
Pyrasulfotole and Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	0.002	0.109	0.108	0.020	0.029	0.026
		41-46	48	0.006	0.088	0.077	0.010	0.015	0.014
Grain		35-50	52	0.003	0.111	0.109	0.008	0.015	0.020
Hay		21-26	48	0.010	0.642	0.623	0.178	0.222	0.149
Straw		35-50	52	0.013	0.143	0.140	0.048	0.055	0.031

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

Bayer CropScience has submitted field trial data for pyrasulfotole on oats. During the 2004 and 2005 growing seasons, field trials were conducted in 39 locations to evaluate the magnitude of residues in/on oat forage, hay, grain, and straw following application of either end-use product, SE06 or EC23.

In total, 30 forage and hay, and 25 grain and straw trials were conducted using the SE06 formulation, while 24 forage, hay, grain and straw trials were conducted using the EC23 formulation. Trials for both formulations occurred in regions 1 (PA; 1 trial), 2 (FL; 1 trial), 5 (KS, IL, NE, MN, OH, ON, ND; 9 trials), 5A (ON; 1 trial), 5B (ON; 1 trial), 6 (TX; 1 trial), 7 (ND, SK; 6 trials), 8 (KS; 1 trial) and 14 (SK, AB, MB; 17 trials). At each trial location, SE06 (5% ai) or EC23 (3.75 % ai) was applied once to pre-emergent oats as a foliar broadcast spray at a rate of 0.042 to 0.047 lb ai/A (0.048 to 0.053 kg ai/ha) or 0.031 to 0.037 lb ai/A (0.035 to 0.041 kg ai/ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 23 (forage) BBCH 37 to 61 (hay, grain, and straw). All trials used ammonium sulfate as an adjuvant.

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PHIs for oat RACs were 21 to 26 days or 41 to 46 days for forage, 21 to 26 days for hay and 35 to 50 days for grain and straw. In decline trials, forage samples were collected at five intervals (± 1 day) corresponding to PHIs of 15, 25, 35, 45, and 55 days and hay samples were collected at five intervals (± 1 day) corresponding to PHIs of 0, 15, 25, 30, and 35 days. Grain and straw samples were collected at five intervals (± 1 day) corresponding to PHIs of 40, 50, 55, 60, and 70 days.

Residues of pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl were quantified by HPLC-MS/MS using stable isotope labeled analytes as internal standards. The LOQ for each analyte was 0.010 ppm in all oat RACs.

All oat samples (with one exception) were stored frozen for a maximum of 9 months (272 days) prior to analysis. Data from an 11 month (336 days) storage stability study suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all oat matrices. Residues of pyrasulfotole-desmethyl are also stable in oat grain, but decline in oat forage and hay (ca. 0.12 % per day).

The amount of each analyte detected was essentially the same between formulations, with oat hay retaining the highest amounts of analyte residues (≥3 times the amount of other oat RACs). The maximum pyrasulfotole-benzoic acid residue levels observed were 0.133 ppm (forage, 25-day PHI), 0.156 ppm (forage, 45-day PHI), 0.510 ppm (hay), 0.128 ppm (grain), 0.108 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.116 ppm (forage, 25-day PHI), 0.087 ppm (forage, 45-day PHI), 0.623 ppm (hay), 0.089 ppm (grain), 0.156 ppm (straw); the maximum pyrasulfotole residue levels observed were 0.006 ppm (forage, 25-day PHI), 0.005 ppm (forage, 45-day PHI), 0.105 ppm (hay), 0.022 ppm (grain), 0.014 ppm (straw); and the maximum pyrasulfotole and pyrasulfotole-desmethyl residue levels observed were 0.120 ppm (forage, 25-day PHI), 0.088 ppm (forage, 45-day PHI), 0.677 ppm (hay), 0.111 ppm (grain), 0.170 ppm (straw).

Residue decline data showed decreased amounts of each analyte over time in oat forage and oat hay. In oat grain, pyrasulfotole and pyrasulfotole-desmethyl decreased slightly, while the amount of pyrasulfotole-benzoic acid increased slightly with EC23 treatment and remained unchanged with SE06 treatment. In oat straw, there was no significant decrease in the amount of pyrasulfotole or pyrasulfotole-desmethyl, while the amount of pyrasulfotole-benzoic acid decreased over time.

HED Conclusions: The above wheat, barley and oat residue data on both the SE06 and EC23 end-use products are classified as scientifically acceptable for determination of the magnitude of residue for the active ingredient pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl when treated with the end use products AE 017309 02 SE06 or AE 017309 03 EC23. Although pyrasulfotole-benzoic acid was a primary residue in most commodities, it was determined by the pyrasulfotole risk assessment team to be not of toxicological concern; and, therefore, should not be included in the tolerance expression for small cereal grains *(Memo in progress, J. Tyler et al., x/xx/07; D328640)*. For both tolerance and risk assessment purposes, the residues of concern in small cereal grains are pyrasulfotole and

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pyrasulfotole-desmethyl.

Although the number and geographical representation of the wheat, barley and oat trials are slightly different than the number and geographical locations recommended in OPPTS Guideline 860.1500, the residue data are adequate to support the proposed uses.

For wheat, a total of 35 forage and hay trials, 32 grain and straw trials were conducted using SE06; and 31 hay trials and 32 forage, grain and straw trials were conducted using EC23. Trials for the SE06 formulation occurred in NAFTA Regions 2 (GA; 1 trial), 4 (MS; 1 trial), 5 (KS, IL, NE, MN, ON; 5 trials), 6 (TX; 1 trial), 7 (ND, NE, SD, SA; 9 trials), 7A (AB; 1 trial), 8 (KS, TX, OK; 6 trials), 11 (ID; 1 trial) and 14 (SA, AB, MB; 10 forage and hay trials/7 grain and straw trials). Trials for the EC23 formulation occurred in NAFTA Regions 2 (GA; 1 trial), 4 (MS; 1 trial), 5 (KS, IL, NE, MN, ON; 5 trials), 6 (TX; 1 trial), 7 (ND, NE, SD, ND, SA; 8 hay trials/9 forage, grain and straw trials), 7A (AB; 1 trial), 8 (KS, TX, OK; 6 trials), 11 (ID; 1 trial) and 14 (SA, AB, MB; 7 trials). In order to support a tolerance on wheat, current HED guidelines recommend that a total of 33 crop field trials be conducted in NAFTA Regions 2 (1 trial), 4 (1 trial), 5 (5 trials), 6 (1 trial), 7 (9 trials), 7A (1 trial), 8 (6 trials), 11 (1 trial) and 10 (10 trials).

For barley, a total of 28 hay trials and 24 grain and straw trials were conducted using SE06; and 24 hay, grain and straw trials were conducted using EC23. Trials for the SE06 formulation occurred in NAFTA Regions 2 (GA; 1 trial), 5 (NE, MN, ON, WI; 4 trials), 5B (ON, QC; 1 trial), 7 (ND, NE, SK; 4 trials), 9 (ID; 1 trials), 10 (CA; 1 trial), 11 (OR, WA; 2 trials), and 14 (SK, AB, MB; 8 hay trials/10 grain and straw trials). Trials the EC23 formulation occurred in NAFTA Regions 2 (GA; 1 trial), 5 (NE, MN, ON, WI; 4 trials), 5B (ON, QC; 1 trial), 7 (ND, NE, SK; 4 trials), 9 (ID; 1 trials), 10 (CA; 1 trial), 11 (OR, WA; 2 trials), and 14 (SK, AB, MB; 10 trials). In order to support a tolerance on barley, current HED guidelines recommend that a total of 25 crop field trials be conducted in NAFTA Regions 2 (1 trial), 5 (3 trials), 5B (1 trial), 7 (4 trials), 9 (1 trial), 10 (1 trial), 11 (2 trials), and 14 (12 trials).

For oats, a total of 30 forage and hay trials, and 35 grain and straw trials were conducted using SE06; and 24 forage and hay trials, and 29 forage, grain and straw trials were conducted using EC23. Trials for the SE06 formulation occurred in NAFTA Regions 1 (PA; 1 trial), 2 (FL; 1 trial), 5 (KS, IL, NE, MN, OH, ON, ND; 9 trials), 5A (ON; 1 trial), 5B (ON; 1 trial), 6 (TX; 1 trial), 7 (ND, SK; 3 trials), 8 (KS; 1 trial) and 14 (SK, AB, MB; 17 trials - 12 forage and hay trials/7 grain and straw trials). Trials for the EC23 formulation occurred in NAFTA Regions 1 (PA; 1 trial), 2 (FL; 1 trial), 5 (KS, IL, NE, MN, OH, ON, ND; 9 trials), 5A (ON; 1 trial), 5B (ON; 1 trial), 7 (ND, SK; 3 trials), 8 (KS; 1 trial) and 14 (SK, AB, MB; 12 trial - 8 forage and hay trials/7 grain and straw trials). In order to support a tolerance on oats, current HED guidelines recommend that a total of 28 crop field trials be conducted in NAFTA Regions 1 (1 trial), 2 (1 trial), 5 (9 trials), 5A (1 trial), 5B (1 trial), 6 (1 trial), 7 (3 trials), 8 (1 trial), and 14 (10 trials).

In general, in wheat and barley, residues of pyrasulfotole, and pyrasulfotole-desmethyl appeared to be slightly higher following application of the SE06 formulation. In oats, the amount of each analyte detected was essentially the same between formulations. In wheat, barley and oats, the highest residue levels were observed in/on the hay samples and the lowest levels observed in/on

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the grain samples.

Available residue decline data on wheat, barley and oats indicate that residues of pyrasulfotole and pyrasulfotole-desmethyl decreased with time in forage and wheat hay, but decreased only slightly or remained unchanged in straw and grain with increasing preharvest intervals.

The wheat crop field trial data support a maximum seasonal application rate of 0.049 lb ai/A (~1x the maximum proposed application rate; 0.055 kg ai/ha) for SE06 or 0.038 lbs ai/A (~1x the maximum proposed application rate; 0.042 kg ai/ha) for EC23 on wheat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw and grain). With these use patterns, total residues of pyrasulfotole and pyrasulfotole-desmethyl are not expected to exceed 0.212 ppm (forage, 25-day PHI), 0.900 ppm (hay), 0.013 ppm (grain), and 0.158 ppm (straw). Using the NAFTA MRL/Tolerance Harmonization Workgroup methodology for hay and straw and the HAFT value for forage and grain, the available wheat crop field trial data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl in/on wheat commodities are 0.20 ppm for wheat, forage; 0.80 ppm for wheat, hay; 0.02 ppm for wheat, grain; and 0.20 ppm for wheat, straw (see Section 860.1550 Proposed Tolerances).

The barley crop field trial data support a maximum seasonal application rate of 0.048 lb ai/A (~1x the maximum proposed application rate; 0.054 kg ai/ha) for SE06 or 0.037 lbs ai/A (1x the maximum proposed application rate; 0.041 kg ai/ha) for EC23 on barley grain, hay, and straw (PHI of 21 to 25 days for hay, 35 to 45 days for straw and grain). With these use patterns, total pyrasulfotole and pyrasulfotole-desmethyl residue levels are not expected to exceed 0.208 ppm (hay), 0.011 ppm (grain) and 0.251 ppm (straw). Using the NAFTA MRL/Tolerance Harmonization Workgroup methodology for hay and straw and the HAFT value for grain, the available barley crop field trial data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl in/on barley commodities are 0.30 ppm for barley, hay; 0.02 ppm for barley, grain; and 0.20 ppm for barley, straw (see Section 860.1550 Proposed Tolerances).

The oat crop field trial data support a maximum seasonal application rate of 0.047 lb ai/A (~1x the maximum proposed application rate; 0.053 kg ai/ha) for AE 017309 02 SE06 or 0.037 lb ai/A (1x the maximum proposed application rate; 0.041 kg ai/ha) for AE 017309 03 EC23 on oat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw and grain). With these use patterns, the total pyrasulfotole and pyrasulfotole-desmethyl residue levels are not expected to exceed 0.120 ppm (forage, 25-day PHI), 0.677 ppm (hay), 0.111 ppm (grain), and 0.170 ppm (straw). Using the NAFTA MRL/Tolerance Harmonization Workgroup methodology, the available oat crop field trial data indicate that the appropriate tolerances for pyrasulfotole and pyrasulfotole-desmethyl in/on oat commodities are 0.10 ppm for oat, forage; 0.50 ppm for oat, hay; 0.08 ppm for oat, grain; and 0.20 ppm for oat, straw (see Section 860.1550 Proposed Tolerances).

In addition, the wheat, barley and oat crop field trial data are adequate to support the proposed uses on rye and triticale. The available data indicate that the appropriate tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl are 0.02 ppm for rye, grain; 0.20 ppm, for rye,

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straw; and 0.20 ppm for rye, forage. HED notes that the proposed tolerance for triticale, grain is not needed as it is covered under the wheat, grain tolerance.

Section F of the petition should be revised to include the aforementioned HED-recommended tolerances and the correct commodity definitions. In addition, the proposed tolerance for triticale, grain should be removed from the Section F.

860.1520 Processed Food and Feed

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Bayer CropScience conducted a processing study to measure the potential for concentration of pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl related residues in wheat grain, aspirated grain fractions and the processed wheat commodities of bran, flour, middling, shorts and germ. Spring wheat was grown at a single test site in Sabin, MN (NAFTA Region 5). The test substance, AE 0317309 02 SE06 A1, is a SE formulation nominally containing the ai pyrasulfotole at 50 g ai/L (0.045 lb ai/gal) and the safener mefenpyr-diethyl at 12.5 g/L. A single broadcast foliar spray application of AE 0317309 02 SE06 A1 was made to wheat plants at flag leaf stage (BBCH 39) at a rate of 0.230 lb ai/A (5x the maximum proposed application rate; 0.258 kg ai/ha) using a spray volume of 12.8 gal/A (120 L/ha). No adjuvants were used in the tank mixture.

Subsamples of the wheat grain were removed for analysis. The remainder of the wheat grain was used to generate aspirated grain fractions, bran, flour, middling, shorts, and germ using batch procedures that simulated commercial processing practices.

It should be noted that the aspirated grain fraction samples were fractionated into five different particle size ranges, and the percent of the total sample mass was calculated for each fraction. The average ash content of these samples was 8%. The average percent mass of the individual particle size fractions was 10% (>2030 µm), 5% (>1180 µm), 5% (>850 µm), 28% (>425 µm), and 52% (<425 µm).

The total pyrasulfotole residue in each matrix was quantitated by HPLC-MS/MS using isotopically labeled internal standards. The individual analyte residues of pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl were summed to give a total pyrasulfotole residue in parent equivalents. The LOQ was 0.010 ppm for each analyte (pyrasulfotole and pyrasulfotole-desmethyl) in wheat grain and all wheat processed products, and 0.020 ppm in wheat aspirated grain fractions. Although pyrasulfotole-benzoic acid was a primary residue in most commodities, it was determined by the pyrasulfotole risk assessment team to be not of toxicological concern; and, therefore, should not be included in the tolerance expression for small cereal grains *(Memo in progress, J. Tyler et al., x/xx/07; D328640).* The total combined residues of pyrasulfotole and pyrasulfotole-desmethyl concentrated only in the aspirated wheat grain fractions (33x), and in wheat bran (1.6x). The total pyrasulfotole and pyrasulfotole-desmethyl residues did not concentrate in wheat flour (0.26x), middling (0.38x), shorts (0.56x), and germ (0.70x).

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Table 13. Residue Data and Processing Factors from the Wheat Processing Study.

RAC	Processed Commodity	Total Rate (lb ai/A)	PHI (days)	Residues (ppm)			Processing Factor
				Pyrasulfotole	Pyrasulfotole-desmethyl	Total Pyrasulfotole and Pyrasulfotole-desmethyl	
Grain	NA	0.230 (5x)	57	0.0010 <LOD <LOD	0.0178 0.0175 0.0177	0.0188 0.0184 0.0186 Avg.=0.0186	NA
	Aspirated Grain Fractions	NA	NA	0.0523 0.0504 0.0478	0.5614 0.5447 0.5689	0.6137 0.5951 0.6167 Avg.=0.6085	33
	Bran	NA	NA	0.0012 0.0014 0.0020	0.0266 0.0275 0.0306	0.0278 0.0289 0.0326 Avg.=0.0298	1.6
	Flour	NA	NA	0.0014 0.0010 <LOD	0.0039 0.0037 0.0036	0.0053 0.0047 0.0045 Avg.=0.0048	0.26
	Middling	NA	NA	<LOD 0.0011 0.0014	0.0062 0.0057 0.0060	0.0071 0.0068 0.0074 Avg.=0.0071	0.38
	Shorts	NA	NA	<LOD <LOD <LOD	0.0096 0.0100 0.0091	0.0105 0.0109 0.0100 Avg.=0.0105	0.56
	Germ	NA	NA	<LOD <LOD <LOD	0.0144 0.0116 0.0103	0.0153 0.0125 0.0112 Avg.=0.0130	0.70

LOD for pyrasulfotole is 0.0009 ppm.

HED Conclusions: Processed commodities associated with this petition include pearled barley, barley flour, barley bran, oat flour, groats/rolled oats; rye flour, rye bran, wheat bran, wheat flour, wheat middlings, wheat shorts, and wheat aspirated grain fractions.

Under the conditions and parameters used in the study, the wheat processed food and feed data are classified as scientifically acceptable. The results of the processing study indicate that total residues of pyrasulfotole and pyrasulfotole-desmethyl do not appear to concentrate in wheat flour (0.26x), middling (0.38x), shorts (0.56x) and germ (0.70x). Total residues of pyrasulfotole and pyrasulfotole-desmethyl do appear to concentrate in aspirated wheat grain fractions (33x), and wheat bran (1.6x). Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in wheat bran would be 0.018 ppm, which is below the recommended 0.02 ppm tolerance for wheat, grain. Therefore, a separate tolerance is not needed for wheat, bran. However, based on the 33x processing factor for aspirated grain fractions, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in aspirated grain fractions would be 0.36 ppm, which is above the recommended 0.02 ppm tolerance for wheat, grain. Therefore, a separate tolerance should be established for aspirated grain fractions at 0.40 ppm.

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In addition, based on the results of the processing study on wheat HED concludes that residues of pyrasulfotole and pyrasulfotole-desmethyl are not expected to concentrate in pearled barley, barley flour, oat flour, groats/rolled oats, and rye flour. Therefore, tolerances on these processed commodities are not needed. Because the results of the processing study indicate that residues concentrated in wheat bran, residues can be expected to concentrate in barley bran, oat bran and rye bran as well. Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.010 ppm from the barley field trials, the maximum expected residues in barley bran would be 0.016 ppm, which is below the recommended 0.02 ppm tolerance for barley, grain. Therefore, a separate tolerance is not needed for barley, bran. Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.109 ppm from the oat field trials, the maximum expected residues in oat bran would be 0.17 ppm, which is above the recommended 0.08 ppm tolerance for oat, grain. Therefore, a separate tolerance should be established for oat, bran at 0.20 ppm. However, according to current HED guidelines, HED does not currently set tolerances on oat, bran. The residue level will be incorporated into the dietary exposure assessment for this action (Memo, J. Tyler 06/08/06; D333436). Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in rye bran would be 0.018 ppm, which is below the recommended 0.02 ppm tolerance for rye, grain. Therefore, a separate tolerance is not needed for rye, bran.

860.1650 Submittal of Analytical Reference Standards

Analytical reference standards for pyrasulfotole, metabolites and labeled internal standards have not been received by the EPA National Pesticide Standard Repository for distribution to State and Federal regulatory labs. These standards should be sent to the Analytical Chemistry Lab to the attention of either Theresa Cole or Dallas Wright at the following address:

USEPA
National Pesticide Standards Repository/Analytical Chemistry Branch/OPP
701 Mapes Road
Fort George G. Meade, MD 20755-5350

The extended zip code must be used or the mail will be returned to you.

860.1850 Confined Accumulation in Rotational Crops

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The accumulation and nature of pyrasulfotole residues was studied in confined rotational crops following an application of either [phenyl-UL-^{14}C] pyrasulfotole (specific activity 192,000 dpm/µg) or [pyrazole-3-^{14}C] pyrasulfotole (specific activity 332,000 dpm/µg) to soil in large troughs at a rate of 0.073 lb ai/A (1.6x and 2.2x the maximum proposed application rates for the SE06 and EC23 formulations, respectively; 82 g ai/ha). Wheat (small grain), Swiss chard (leafy vegetable), and turnips (root crop) were planted approximately 120 days after treatment (DAT). Wheat was also planted approximately 300 DAT. RACs were harvested from each crop.

The TRR was determined using combustion/LSC techniques. RACs with a TRR greater than 0.01 ppm were extracted with ACN/water (4:1, v/v), and if necessary, refluxed with MeOH followed by an acid (1*N* HCl) and a base (1*N* NaOH) reflux. Extracts were analyzed by HPLC with radioactive detection to determine the distribution of the metabolites. Isolated metabolites were identified based on HPLC-MS/MS analysis and the HPLC retention times of standards compounds.

After application of [phenyl-UL-^{14}C]-pyrasulfotole, the TRR in the 120-DAT wheat forage, hay, straw, and grain was 0.027 ppm, 0.061 ppm, 0.023 ppm, and 0.031 ppm, respectively. The TRR in the 122-DAT Swiss chard, turnip tops, and turnip roots was 0.007 ppm, 0.008 ppm, and 0.002 ppm, respectively. The TRR in the 301-DAT wheat forage, hay, straw, and grain was 0.085 ppm, 0.036 ppm, 0.016 ppm, and 0.011 ppm, respectively.

After application of [pyrazole-3-^{14}C]-pyrasulfotole, the TRR in the 120-DAT wheat forage, hay, straw, and grain was 0.004 ppm, 0.012 ppm, 0.021 ppm, and 0.003 ppm, respectively.
For both the [phenyl-UL-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole studies, the TRR in the 122-DAT Swiss chard, turnip tops, and turnip roots, and 301-DAT wheat forage, hay, straw and grain were less than 0.01 ppm; therefore, no further identification and characterization was performed.

For those matrices with TRR greater than 0.01 ppm, 71.0-95.9% of the [phenyl-UL-^{14}C], and 53-60% of the [pyrazole-3-^{14}C]-pyrasulfotole derived residues were extractable. The overall accountability of the TRR was 91-109% for the 120-DAT and 301-DAT wheat commodities for both radiolabels.

The predominant residue was identified as pyrasulfotole-benzoic acid in all wheat matrices (27.0-91.3% of the TRR; 0.004-0.078 ppm) at 120-DAT and 301-DAT when dosed with [phenyl-U-^{14}C]-pyrasulfotole. Pyrasulfotole-benzoic acid was not identified in the 120-DAT wheat straw and hay following application of [pyrazole-3-^{14}C]-pyrasulfotole. Pyrasulfotole was identified in 120-DAT wheat grain and 301-DAT wheat hay samples (0.9-2.0% of the TRR; 0.001 ppm) for the [phenyl-U-^{14}C]-label study. Pyrasulfotole was the only identified component in the 120-DAT wheat hay and straw samples (3-9% of the TRR; <0.001-0.002 ppm) for the [pyrazole-3-^{14}C]-label study. Multiple components were characterized as ACN/H2O soluble or remaining solid phase extraction fractions in wheat matrices for the [phenyl-U-^{14}C]-label (3.9-47.2% of the TRR; 0.001-0.025 ppm) and the [pyrazole-3-^{14}C]-label (37-50% of the TRR; 0.003-0.013 ppm).

For the 120-DAT and 301-DAT wheat samples, remaining solids ranged from 3.1 to 12.6% of the TRR (0.001-0.008 ppm), and 4.1 to 29.0% of the TRR (0.001-0.005 ppm) for the [phenyl-U-^{14}C]-label study, respectively. Unextractable residues were 40 to 47% of the TRR (0.006-0.008 ppm) in wheat hay and straw for the [pyrazole-3-^{14}C]-label study.

The metabolic breakdown of pyrasulfotole involved the cleavage of the complete pyrazole moiety yielding the benzoic acid metabolite.

HED Conclusions: The submitted confined rotational crop study is adequate, and indicates that the metabolic breakdown of pyrasulfotole involves the cleavage of the complete pyrazole moiety yielding the benzoic acid metabolite. Pyrasulfotole was not extensively metabolized in rotational

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crops, and the predominant residue is the pyrasulfotole-benzoic acid metabolite. Total residues amounting to 27.0 to 91.3% of the TRR were identified in rotational crop matrices following application of [phenyl-UL-^{14}C]-pyrasulfotole. Total identified residues were 3 to 9% of the TRR (<0.001-0.002 ppm) following application of [pyrazole-3-^{14}C]-pyrasulfotole. A number of components were characterized as ACN/H2O soluble. Nonextractable residues following extraction procedures accounted for 3.1 to 29% of the TRR (0.001-0.008 ppm) in phenyl-label samples, and 40 to 47% of the TRR (0.006-0.008 ppm) in pyrazole-label samples.

Based on the results of the confined rotational crop study, the residues of concern in rotational crops are pyrasulfotole *per se* for tolerance purposes, and pyrasulfotole and pyrasulfotole desmethyl for risk assessment purposes (Memo, J. Tyler et al., 06/08/07; D328640). Although pyrasulfotole-benzoic acid was a primary residue, it was determined by the pyrasulfotole risk assessment team to be not of toxicological concern; and, therefore, should not be included in the tolerance expression for rotational crops

860.1860 Field Accumulation in Rotational Crops

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AE 0317309 02 SE06 A1 (SE06) was applied to wheat planted in silty loam soil at a nominal rate of 0.050 kg ai/ha (0.044 lb ai/A; ~1x the maximum proposed application rate for cereal grains) with one application at three sites (NAFTA Regions 4 and 5) in 2004. The wheat crop was harvested and/or destroyed to allow planting of corn and soybeans with PBIs of 114 to 123 days following the application to wheat.

The harvested samples were analyzed for residues of pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl by using HPLC-MS/MS and stable isotope labelled internal standards. The LOQ for each analyte was 0.010 ppm in/on all matrices.

Maximum residues levels in 114- to 123-day PBI samples were less than the respective LODs for pyrasulfotole and pyrasulfotole-desmethyl in all corn and soybean RACs. Maximum residues levels for pyrasulfotole-benzoic acid were 0.0018 ppm in corn forage, 0.0027 ppm in soybean forage, 0.0126 ppm in soybean hay and <LOD in corn grain, corn stover and soybean seed.

HED Conclusions: The proposed labels list the following rotational crop restrictions: 7 days for wheat (spring, durum, winter) and spring barley; 4 months for soybeans; 9 months for alfalfa, canaryseed, canola, corn, flax, field peas, lentils, and tame oats; and 12 months for mustards.

The results of the submitted confined and limited field rotational crop studies together are adequate to determine appropriate PBIs for rotational crops. In the confined rotational crop study, following application of either phenyl- or pyrazole-labeled pyrasulfotole, the TRR in the 122-DAT Swiss chard, turnip tops, and turnip roots were <0.01 (<LOQ). In the limited field rotational crop study, maximum residue levels of pyrasulfotole and pyrasulfotole-desmethyl were <LOD in all corn and soybean RACs at PBIs of 114-123 days. Maximum residues levels for pyrasulfotole-benzoic acid were 0.0018 ppm in corn forage, 0.0027 ppm in soybean forage,

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0.0126 ppm in soybean hay and <LOD in corn grain, corn stover and soybean seed. However, it was determined that residues of pyrasulfotole-benzoic acid are not of concern for both tolerance and risk assessment purposes (Memo, J. Tyler et al., 06/08/07; D328640). Therefore, the submitted confined and limited field trial data support the proposed PBIs.

860.1550 Proposed Tolerances

A summary of the recommended tolerances and the correct commodity definitions for the proposed uses are listed in Table 14.

The available crop field trial data on wheat, barley and oats are adequate to support the proposed uses of pyrasulfotole on small cereal grains. For purposes of determining appropriate tolerance levels for the proposed uses, individual pyrasulfotole and pyrasulfotole-desmethyl residues were summed to yield a total residue value. In many cases, individual residues were either <LOQ (<0.01 ppm) but >LOD (>0.005 ppm), or <LOD (0.005 ppm). In cases where the individual value (pyrasulfotole and/or pyrasulfotole-desmethyl) was <LOQ (<0.01 ppm) but >LOD (>0.005 ppm), the actual value was used. In cases where an individual value (pyrasulfotole or pyrasulfotole-desmethyl) was <LOD (<0.005 ppm), the LOD (0.005 ppm) was used. The pyrasulfotole and pyrasulfotole-desmethyl were then summed, and in cases where either parent or desmethyl was <LOD, the data were considered to be censored.

Therefore, based on the percentage of censored data, appropriate tolerances where either determined using either rounding up from the HAFT values from the respective crop field trial studies, or the methodology formulated by the NAFTA MRL/Tolerance Harmonization Workgroup for calculating statistically based pesticide tolerances for plant commodities based on field trial residue data. For wheat hay, wheat straw, barley hay, barley straw, oat forage, oat grain, and oat hay, the appropriate tolerance levels were calculated using the NAFTA MRL/Tolerance Harmonization Workgroup methodology (see Attachment 2). For wheat forage, wheat grain, and barley grain the appropriate tolerance levels were calculated by rounding up from the HAFT values from the respective crop field trial data.

The results of the processing study indicate that residues of pyrasulfotole and pyrasulfotole-desmethyl do not appear to concentrate in wheat flour (0.26x), middling (0.38x), shorts (0.56x) and germ (0.70x). Total residues of pyrasulfotole and pyrasulfotole-desmethyl do appear to concentrate in aspirated wheat grain fractions (33x), and wheat bran (1.6x). Based on these processing factors and a HAFT residue of 0.011 ppm from the wheat field trials, a separate tolerance is not needed for wheat, bran, but a tolerance should be established for aspirated grain fractions at 0.40 ppm. In addition, based on the results of the processed food/feed data on wheat, HED concludes that residues of pyrasulfotole and pyrasulfotole-desmethyl are not expected to concentrate in pearled barley, barley flour, oat flour, groats/rolled oats, and rye flour. Therefore, tolerances on these processed commodities are not needed. Because the results of the processing study indicate that residues concentrated in wheat bran, residues can be expected to concentrate in barley bran, oat bran and rye bran as well. Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.010 ppm from the barley field trials, the maximum expected residues in barley bran would be 0.016 ppm, which is below the recommended 0.02 ppm tolerance for barley, grain. Therefore, a separate tolerance is not needed for barley, bran. Based on the 1.6x

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processing factor for wheat bran, and a HAFT residue of 0.109 ppm from the oat field trials, the maximum expected residues in oat bran would be 0.17 ppm, which is above the recommended 0.08 ppm tolerance for oat, grain. Therefore, a separate tolerance should be established for oat, bran at 0.20 ppm. However, according to current HED guidelines, HED does not currently set tolerances on oat, bran. The residue level will be incorporated into the dietary exposure assessment for this action (Memo, J. Tyler 06/08/07; D333435). Based on the 1.6x processing factor for wheat bran, and a HAFT residue of 0.011 ppm from the wheat field trials, the maximum expected residues in rye bran would be 0.018 ppm, which is below the recommended 0.02 ppm tolerance for rye, grain. Therefore, a separate tolerance is not needed for rye, bran.

Using the data from the adequate cattle feeding study and a calculated MTDB of 0.39 ppm for pyrasulfotole and pyrasulfotole-desmethyl residues in dairy cattle diets, estimated pyrasulfotole and pyrasulfotole-desmethyl residues in ruminants at a 1x dose level are 0.16 ppm in liver, 0.029 ppm in kidney; and <LOQ in milk, meat and fat. Based on the quantifiable residues and in order to harmonize with PMRA, tolerances should be established for residues of pyrasulfotole and pyrasulfotole-desmethyl on liver of cattle, goat, horse, and sheep at 0.35 ppm; and meat byproducts, except liver, of cattle, goat, horse, and sheep at 0.06 ppm. Although, there is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in milk; milk, fat; and fat and muscle of cattle, goat, horse and sheep, PMRA policy requires the establishment of tolerances at the LOQ level for commodities in which there is no expectation of finite residues. Therefore, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.01 ppm in milk; and 0.02 ppm in fat and meat of cattle, goat, horse and sheep.

Using data from the adequate cattle feeding study and a calculated MTDB of 0.014 ppm pyrasulfotole and pyrasulfotole-desmethyl in hogs, the estimated pyrasulfotole and pyrasulfotole-desmethyl residues in hogs were 0.0000046 ppm in muscle, 0.0011 ppm in kidney, and 0.0059 ppm in liver. There is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in hog tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of hogs.

For purposes of this petition, using the data from the poultry metabolism studies and a calculated MTDB of 0.058 ppm for poultry, the maximum estimated pyrasulfotole and pyrasulfotole-desmethyl residues in poultry were 0.00025 ppm in muscle, 0.00043 ppm in fat, and 0.010 ppm in liver. As the total extractable residues in eggs were <0.01 ppm; the samples were not analyzed further for identification purposes. Based on the results of the poultry metabolism study, there is no reasonable expectation of finding quantifiable residues of pyrasulfotole and pyrasulfotole-desmethyl in eggs and poultry tissues. However, in order to harmonize with PMRA, the following tolerances for residues of pyrasulfotole and pyrasulfotole-desmethyl should be established: 0.02 ppm in fat, meat, and meat byproducts of poultry.

The residue chemistry database supports the establishment of the permanent tolerances for the combined residues of pyrasulfotole and pyrasulfotole-desmethyl in/on the RACs listed in Table 14.

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Table 14. Tolerance Summary for Pyrasulfotole.

Commodity	Proposed Tolerance (ppm)	Recommended Tolerance (ppm)	Comments (*correct commodity definition*)
Wheat, grain	0.07	0.02	
Wheat, straw	0.25	0.20	
Wheat, forage	0.25	0.20	
Wheat, hay	0.8	0.80	
Wheat, aspirated grain fractions	1.4	0.40	*Aspirated grain fractions*
Oat, grain	0.07	0.08	
Oat, straw	0.25	0.20	
Oat, forage	0.25	0.10	
Oat, hay	0.8	0.50	
Barley, grain	0.07	0.02	
Barley, straw	0.25	0.20	
Barley, hay	0.8	0.30	
Triticale, grain	0.07	-	Tolerance not required. Triticale is covered under wheat, grain tolerance.
Rye, grain	0.07	0.02	Tolerance translated from wheat, grain.
Rye, straw	0.25	0.20	Tolerance translated from barley, straw; wheat, straw; and oat, straw.
Rye, forage	0.25	0.20	Tolerance translated from wheat, forage.
Milk	0.005	0.01	
Cattle, meat	0.01	0.02	
Cattle, fat	0.01	0.02	
Cattle, meat byproducts	0.3	0.06	*Cattle, meat byproducts, except liver*
Cattle, liver	-	0.35	
Goat, meat	0.01	0.02	
Goat, fat	0.01	0.02	
Goat, meat byproducts	0.3	0.06	*Goat, meat byproducts, except liver*
Goat, liver	-	0.35	
Hog, meat	0.01	0.02	
Hog, fat	0.01	0.02	
Hog, meat byproducts	0.3	0.02	
Sheep, meat	0.01	0.02	
Sheep, fat	0.01	0.02	
Sheep, meat byproducts	0.3	0.06	*Sheep, meat byproducts, except liver*
Sheep, liver	-	0.35	
Horse, meat	0.01	0.02	
Horse, fat	0.01	0.02	
Horse, meat byproducts	0.3	0.06	*Horse, meat byproducts, except liver*
Horse, liver	-	0.35	
Poultry, meat	-	0.02	
Poultry, fat	-	0.02	
Poultry, meat byproducts	-	0.02	
Eggs	-	0.02	

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The International Residue Limit Status (IRLS) Sheet is attached as Attachment 1. There are no established Mexican, Canadian or Codex MRLs for the proposed uses. As mentioned previously, pyrasulfotole is being evaluated as part of a trilateral joint review with Canada and Australia. Harmonization is not an issue at this time.

Attachments

Attachment 1: IRLS Sheet.
Attachment 2: Inputs for calculating statistically based pesticide tolerances.

cc: J. Tyler (RAB1)
RDI: RAB1 Chemists: (5/2/07), G. Kramer (5/2/07); HED ChemSAC (5/16/07), PV Shah (5/2/07)
J. Tyler: S-10943: Potomac Yard: (703) 305-5564: RAB1

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Attachment 1. IRLS Sheet.

INTERNATIONAL RESIDUE LIMIT STATUS			
Chemical Name: **5-hydroxy-1,3-dimethylpyrazol-4-yl 2-mesyl-4-(trifluoromethyl)phenyl ketone**	Common Name: **Pyrasulfotole**	**x Proposed tolerance** Reevaluated tolerance Other	Date: **1/12/07**

Codex Status (Maximum Residue Limits)	U. S. Tolerances
X No Codex proposal step 6 or above No Codex proposal step 6 or above for the crops requested	Petition Number: **6F7509** DP#s: **333412** Other Identifier:
Residue definition (step 8/CXL): N/A	Reviewer/Branch: **J. Tyler/RAB1**
	Residue definition: PLANTS: pyrasulfotole and its metabolite (5-hydroxy-1,3-dimethylpyrazol-4-yl) (2-mesyl-4-trifluoromethylphenyl) methanone. LIVESTOCK: pyrasulfotole *per se.*

Crop (s)	MRL (mg/kg)	Crop(s)	Tolerance (ppm)
		Wheat, grain	0.07 ppm
		Wheat, straw	0.25 ppm
		Wheat, forage	0.25 ppm
		Wheat, hay	0.8 ppm
		Wheat, aspirated grain fractions	1.4 ppm
		Oat, grain	0.07 ppm
		Oat, straw	0.25 ppm
		Oat, forage	0.25 ppm
		Oat, hay	0.8 ppm
		Barley, grain	0.07 ppm
		Barley, straw	0.25 ppm
		Barley, hay	0.8 ppm
		Triticale, grain	0.07 ppm
		Rye, grain	0.07 ppm
		Rye, straw	0.25 ppm
		Rye, forage	0.25 ppm
		Milk	0.005 ppm
		Cattle, meat	0.01 ppm
		Cattle, fat	0.01 ppm
		Cattle, meat byproducts	0.3 ppm

		Goat, meat	0.01 ppm
		Goat, fat	0.01 ppm
		Goat, meat byproducts	0.3 ppm
		Hog, meat	0.01 ppm
		Hog, fat	0.01 ppm
		Hog, meat byproducts	0.3 ppm
		Sheep, meat	0.01 ppm
		Sheep, fat	0.01 ppm
		Sheep, meat byproducts	0.3 ppm
		Horse, meat	0.01 ppm
		Horse, fat	0.01 ppm
		Horse, meat byproducts	0.3 ppm

Limits for Canada		Limits for Mexico	
X No Limits No Limits for the crops requested		X No Limits No Limits for the crops requested	
Residue definition: N/A		Residue definition: N/A	
Crop(s)	MRL (mg/kg)	Crop(s)	MRL (mg/kg)
Notes/Special Instructions: S.Funk, 01/12/2007			

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Attachment 2. Inputs for calculating statistically based pesticide tolerances.

Wheat hay

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Wheat Hay
PHI: 21-25 day
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.026	-3.65	-1.78
0.028	-3.58	-1.63
0.056	-2.88	-0.97
0.057	-2.86	-0.92
0.104	-2.26	-0.23
0.100	-2.30	-0.31
0.277	-1.28	0.67
0.329	-1.11	1.16
0.126	-2.07	-0.09
0.154	-1.87	0.13
0.186	-1.68	0.35
0.167	-1.79	0.23
0.098	-2.32	-0.35
0.171	-1.77	0.31
0.761	-0.27	1.99
0.060	-2.81	-0.81
0.070	-2.66	-0.67
0.247	-1.40	0.46
0.168	-1.78	0.27
0.276	-1.29	0.63
0.312	-1.16	0.97
0.277	-1.28	0.72
0.278	-1.28	0.76
0.139	-1.97	-0.02
0.158	-1.85	0.16
0.043	-3.15	-1.23
0.045	-3.10	-1.09
0.136	-2.00	-0.05
0.141	-1.96	0.05
0.102	-2.28	-0.27
0.118	-2.14	-0.16
0.287	-1.25	0.81
0.249	-1.39	0.50
0.263	-1.34	0.58
0.260	-1.35	0.54
0.450	-0.80	1.63
0.459	-0.78	1.78
0.231	-1.47	0.42
0.204	-1.59	0.38
0.340	-1.08	1.23
0.289	-1.24	0.92
0.066	-2.72	-0.72
0.063	-2.76	-0.76
0.140	-1.97	0.02
0.141	-1.96	0.09
0.083	-2.49	-0.46
0.073	-2.62	-0.63
0.076	-2.58	-0.54
0.108	-2.23	-0.20
0.022	-3.82	-2.37
0.025	-3.69	-1.99
0.044	-3.12	-1.16
0.028	-3.58	-1.51
0.033	-3.41	-1.40
0.074	-2.60	-0.58
0.094	-2.36	-0.38
0.160	-1.83	0.20
0.123	-2.10	-0.13
0.090	-2.41	-0.42
0.078	-2.55	-0.50
0.319	-1.14	1.03
0.433	-0.84	1.51
0.328	-1.11	1.09
0.352	-1.04	1.40
0.287	-1.25	0.86
0.345	-1.06	1.31
0.057	-2.86	-0.86
0.053	-2.94	-1.03
0.900	-0.11	2.37

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Wheat Hay
PHI:	21-25 day
App. Rate:	
Submitter:	
n:	70
min:	0.02
max:	0.90
median:	0.14
average:	0.18

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.45 (0.60)	0.60 (0.70)	0.70 (--)
EU Method I Log Normal	0.60 (0.80)	1.0 (1.5)	1.9 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.70		
UPLMedian95th	0.70		
Approximate Shapiro-Francia Normality Test	0.9831 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Wheat straw

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Wheat Straw
PHI: 40-56 day SE
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.055	-2.90	-0.12
0.07	-2.66	0.34
0.053	-2.94	-0.23
0.052	-2.96	-0.41
0.032	-3.44	-1.05
0.036	-3.32	-0.94
0.158	-1.85	1.52
0.158	-1.85	1.64
0.036	-3.32	-0.88
0.039	-3.24	-0.74
0.076	-2.58	0.65
0.068	-2.69	0.26
0.084	-2.48	0.88
0.072	-2.63	0.53
0.061	-2.80	0.05
0.046	-3.08	-0.53
0.075	-2.59	0.61
0.069	-2.67	0.30
0.043	-3.15	-0.57
0.037	-3.30	-0.83
0.02	-3.91	-2.38
0.02	-3.91	-2.00
0.065	-2.73	0.19
0.073	-2.62	0.57
0.122	-2.10	1.18
0.164	-1.81	2.38
0.063	-2.76	0.12
0.082	-2.50	0.83
0.085	-2.47	0.94
0.078	-2.55	0.74
0.076	-2.58	0.69
0.07	-2.66	0.37
0.125	-2.08	1.25
0.162	-1.82	2.00
0.07	-2.66	0.41
0.059	-2.83	-0.02
0.039	-3.24	-0.69
0.03	-3.51	-1.18
0.054	-2.92	-0.19
0.052	-2.96	-0.37
0.059	-2.83	0.02
0.055	-2.90	-0.09
0.078	-2.55	0.78
0.052	-2.96	-0.34
0.061	-2.80	0.09
0.063	-2.76	0.16
0.109	-2.22	1.11
0.151	-1.89	1.33
0.052	-2.96	-0.30
0.052	-2.96	-0.26
0.054	-2.92	-0.16
0.051	-2.98	-0.45
0.057	-2.86	-0.05
0.071	-2.65	0.49
0.021	-3.86	-1.42
0.022	-3.82	-1.25
0.031	-3.47	-1.11
0.032	-3.44	-0.99
0.161	-1.83	1.79
0.157	-1.85	1.42
0.02	-3.91	-1.79
0.02	-3.91	-1.64
0.042	-3.17	-0.61
0.046	-3.08	-0.49
0.021	-3.86	-1.33
0.02	-3.91	-1.52
0.065	-2.73	0.23
0.07	-2.66	0.45
0.086	-2.45	1.05

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Wheat Straw
PHI:	40-56 day SE
App. Rate:	
Submitter:	
n:	72
min:	0.02
max:	0.16
median:	0.06
average:	0.07

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.15 (0.15)	0.20 (0.20)	0.20 (--)
EU Method I Log Normal	0.15 (0.20)	0.25 (0.30)	0.35 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.20		
UPLMedian95th	0.30		
Approximate Shapiro-Francia Normality Test	0.9632 0.05 >= p-value > 0.01 : Reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Barley hay

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Barley hay
PHI: 21-26 day EC
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.103	-2.27	0.44
0.137	-1.99	0.70
0.047	-3.06	-0.88
0.055	-2.90	-0.49
0.027	-3.61	-1.68
0.039	-3.24	-1.28
0.093	-2.38	0.25
0.144	-1.94	0.95
0.040	-3.22	-1.19
0.036	-3.32	-1.39
0.083	-2.49	0.20
0.096	-2.34	0.34
0.060	-2.81	-0.25
0.042	-3.17	-1.10
0.165	-1.80	1.10
0.122	-2.10	0.54
0.058	-2.85	-0.34
0.065	-2.73	-0.20
0.078	-2.55	0.07
0.076	-2.58	-0.02
0.052	-2.96	-0.70
0.056	-2.88	-0.39
0.054	-2.92	-0.59
0.055	-2.90	-0.44
0.108	-2.23	0.49
0.077	-2.56	0.02
0.071	-2.65	-0.07
0.053	-2.94	-0.64
0.049	-3.02	-0.82
0.054	-2.92	-0.54
0.020	-3.91	-2.29
0.021	-3.86	-1.90
0.078	-2.55	0.11
0.065	-2.73	-0.16
0.178	-1.73	1.52
0.183	-1.70	1.90
0.095	-2.35	0.29
0.065	-2.73	-0.11
0.030	-3.51	-1.52
0.043	-3.15	-1.02
0.125	-2.08	0.64
0.141	-1.96	0.82
0.043	-3.15	-0.95
0.050	-3.00	-0.76
0.171	-1.77	1.19
0.208	-1.57	2.29
0.171	-1.77	1.28
0.176	-1.74	1.39
0.160	-1.83	1.02
0.123	-2.10	0.59
0.082	-2.50	0.16
0.059	-2.83	-0.29
0.099	-2.31	0.39
0.138	-1.98	0.76
0.181	-1.71	1.68
0.142	-1.95	0.88

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Barley hay
PHI:	21-26 day EC
App. Rate:	
Submitter:	
n:	56
min:	0.02
max:	0.21
median;	0.08
average:	0.09

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.20 (0.20)	0.25 (0.25)	0.25 (--)
EU Method I Log Normal	0.25 (0.30)	0.35 (0.45)	0.50 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.25		
UPLMedian95th	0.40		
Approximate Shapiro-Francia Normality Test	0.9733 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Barley straw

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Barley straw
PHI: 35-45 day SE
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.093	-2.38	1.12
0.063	-2.76	0.80
0.035	-3.35	0.07
0.030	-3.51	-0.28
0.018	-4.02	-1.33
0.019	-3.96	-1.12
0.019	-3.96	-1.03
0.024	-3.73	-0.61
0.024	-3.73	-0.55
0.024	-3.73	-0.49
0.040	-3.22	0.23
0.038	-3.27	0.13
0.040	-3.22	0.28
0.041	-3.19	0.44
0.120	-2.12	1.46
0.115	-2.16	1.33
0.030	-3.51	-0.23
0.049	-3.02	0.61
0.040	-3.22	0.33
0.021	-3.86	-0.80
0.028	-3.58	-0.38
0.030	-3.51	-0.18
0.048	-3.04	0.55
0.034	-3.38	-0.02
0.030	-3.51	-0.13
0.029	-3.54	-0.33
0.034	-3.38	0.02
0.039	-3.24	0.18
0.010	-4.61	-1.85
0.009	-4.71	-2.24
0.040	-3.22	0.38
0.032	-3.44	-0.07
0.022	-3.82	-0.67
0.021	-3.86	-0.73
0.017	-4.07	-1.46
0.013	-4.34	-1.62
0.078	-2.55	0.95
0.090	-2.41	1.03
0.053	-2.94	0.67
0.047	-3.06	0.49
0.025	-3.69	-0.44
0.020	-3.91	-0.95
0.106	-2.24	1.22
0.251	-1.38	2.24
0.020	-3.91	-0.87
0.018	-4.02	-1.22
0.137	-1.99	1.85
0.128	-2.06	1.62
0.059	-2.83	0.73
0.070	-2.66	0.87

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Barley straw
PHI:	35-45 day SE
App. Rate:	
Submitter:	
n:	50
min:	0.01
max:	0.25
median;	0.03
average:	0.05

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.15 (0.15)	0.15 (0.20)	0.20 (--)
EU Method I Log Normal	0.15 (0.20)	0.20 (0.30)	0.35 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.20		
UPLMedian95th	0.20		
Approximate Shapiro-Francia Normality Test	0.9695 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Oat forage

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Oat forage
PHI: 21-26 day EC
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.012	-4.42	-0.58
0.012	-4.42	-0.52
0.019	-3.96	-0.03
0.029	-3.54	0.64
0.008	-4.83	-0.84
0.007	-4.96	-1.19
0.002	-6.21	-2.23
0.003	-5.81	-1.83
0.107	-2.23	2.23
0.097	-2.33	1.83
0.031	-3.47	0.84
0.028	-3.58	0.58
0.011	-4.51	-0.70
0.015	-4.20	-0.18
0.040	-3.22	1.19
0.030	-3.51	0.70
0.007	-4.96	-1.09
0.006	-5.12	-1.60
0.081	-2.51	1.60
0.080	-2.53	1.44
0.025	-3.69	0.34
0.026	-3.65	0.46
0.019	-3.96	0.03
0.025	-3.69	0.40
0.027	-3.61	0.52
0.024	-3.73	0.29
0.034	-3.38	1.00
0.022	-3.82	0.18
0.034	-3.38	1.09
0.041	-3.19	1.31
0.023	-3.77	0.24
0.020	-3.91	0.13
0.013	-4.34	-0.40
0.013	-4.34	-0.34
0.016	-4.14	-0.13
0.019	-3.96	0.08
0.016	-4.14	-0.08
0.013	-4.34	-0.29
0.012	-4.42	-0.46
0.013	-4.34	-0.24
0.006	-5.12	-1.44
0.006	-5.12	-1.31
0.011	-4.51	-0.64
0.007	-4.96	-1.00
0.030	-3.51	0.77
0.032	-3.44	0.92
0.010	-4.61	-0.77
0.007	-4.96	-0.92

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Oat forage
PHI:	21-26 day EC
App. Rate:	
Submitter:	
n:	48
min:	0.00
max:	0.11
median:	0.02
average:	0.02

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.07 (0.08)	0.08 (0.10)	0.10 (--)
EU Method I Log Normal	0.07 (0.10)	0.15 (0.20)	0.25 (--)
EU Method II Distribution-Free	#REF!		
California Method μ+3σ	0.10		
UPLMedian95th	0.10		
Approximate Shapiro-Francia Normality Test	0.9759 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Oat grain

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Oat grain
PHI: 35-50 day SE
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.006	-5.12	-0.02
0.006	-5.12	0.02
0.005	-5.30	-0.22
0.004	-5.52	-0.70
0.107	-2.23	1.86
0.111	-2.20	2.26
0.005	-5.30	-0.17
0.005	-5.30	-0.12
0.012	-4.42	0.70
0.010	-4.61	0.37
0.028	-3.58	1.48
0.003	-5.81	-1.14
0.014	-4.27	0.83
0.011	-4.51	0.47
0.027	-3.61	1.35
0.028	-3.58	1.64
0.002	-6.21	-2.26
0.003	-5.81	-1.05
0.025	-3.69	1.05
0.025	-3.69	1.14
0.003	-5.81	-0.97
0.004	-5.52	-0.64
0.026	-3.65	1.24
0.023	-3.77	0.90
0.009	-4.71	0.32
0.010	-4.61	0.42
0.004	-5.52	-0.58
0.003	-5.81	-0.90
0.004	-5.52	-0.53
0.005	-5.30	-0.07
0.004	-5.52	-0.47
0.004	-5.52	-0.42
0.002	-6.21	-1.86
0.002	-6.21	-1.64
0.004	-5.52	-0.37
0.004	-5.52	-0.32
0.002	-6.21	-1.48
0.002	-6.21	-1.35
0.004	-5.52	-0.27
0.002	-6.21	-1.24
0.003	-5.81	-0.83
0.003	-5.81	-0.76
0.012	-4.42	0.76
0.011	-4.51	0.53
0.011	-4.51	0.58
0.011	-4.51	0.64
0.006	-5.12	0.07
0.007	-4.96	0.12
0.008	-4.83	0.27
0.007	-4.96	0.17
0.007	-4.96	0.22
0.023	-3.77	0.97

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Oat grain
PHI:	35-50 day SE
App. Rate:	
Submitter:	
n:	52
min:	0.00
max:	0.11
median:	0.01
average:	0.01

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.05 (0.06)	0.07 (0.08)	0.08 (--)
EU Method I Log Normal	0.04 (0.06)	0.07 (0.15)	0.15 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.08		
UPLMedian95th	0.04		
Approximate Shapiro-Francia Normality Test	0.9239 p-value <= 0.01: Reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Oat hay
PHI:	21-26 day SE
App. Rate:	
Submitter:	
n:	60
min:	0.03
max:	0.51
median;	0.13
average:	0.15

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.35 (0.35)	0.40 (0.45)	0.45 (--)
EU Method I Log Normal	0.40 (0.50)	0.60 (0.80)	0.90 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.45		
UPLMedian95th	0.70		
Approximate Shapiro-Francia Normality Test	0.9792 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Oat straw

Regulator: EPA
Chemical: Pyrasulfotole
Crop: Oat straw
PHI: 35-50 day SE
App. Rate:
Submitter:

Residues	LN(Residues)	Z-scores
0.069	-2.67	0.61
0.076	-2.58	0.86
0.075	-2.59	0.79
0.069	-2.67	0.67
0.079	-2.54	0.93
0.086	-2.45	1.00
0.028	-3.58	-1.08
0.029	-3.54	-0.93
0.068	-2.69	0.56
0.052	-2.96	0.07
0.055	-2.90	0.21
0.051	-2.98	0.02
0.170	-1.77	2.27
0.142	-1.95	1.88
0.102	-2.28	1.26
0.102	-2.28	1.37
0.059	-2.83	0.35
0.098	-2.32	1.08
0.018	-4.02	-1.37
0.015	-4.20	-1.66
0.030	-3.51	-0.86
0.034	-3.38	-0.56
0.011	-4.51	-2.27
0.012	-4.42	-1.88
0.103	-2.27	1.50
0.127	-2.06	1.66
0.048	-3.04	-0.16
0.044	-3.12	-0.21
0.100	-2.30	1.16
0.072	-2.63	0.73
0.056	-2.88	0.30
0.052	-2.96	0.12
0.030	-3.51	-0.79
0.042	-3.17	-0.35
0.042	-3.17	-0.30
0.033	-3.41	-0.67
0.048	-3.04	-0.12
0.055	-2.90	0.26
0.048	-3.04	-0.07
0.028	-3.58	-1.00
0.054	-2.92	0.16
0.060	-2.81	0.40
0.018	-4.02	-1.26
0.016	-4.14	-1.50
0.061	-2.80	0.45
0.063	-2.76	0.51
0.042	-3.17	-0.26
0.033	-3.41	-0.61
0.050	-3.00	-0.02
0.041	-3.19	-0.40
0.026	-3.65	-1.16
0.030	-3.51	-0.73
0.035	-3.35	-0.51
0.038	-3.27	-0.45

US EPA ARCHIVE DOCUMENT

Regulator:	EPA
Chemical:	Pyrasulfotole
Crop:	Oat straw
PHI:	35-50 day SE
App. Rate:	
Submitter:	
n:	54
min:	0.01
max:	0.17
median;	0.05
average:	0.06

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	0.15 (0.15)	0.15 (0.15)	0.20 (--)
EU Method I Log Normal	0.15 (0.20)	0.20 (0.30)	0.35 (--)
EU Method II Distribution-Free	#REF!		
California Method $\mu + 3\sigma$	0.20		
UPLMedian95th	0.30		
Approximate Shapiro-Francia Normality Test	0.9829 p-value > 0.05 : Do not reject lognormality assumption		

US EPA ARCHIVE DOCUMENT

Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally Apl 14/2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R. Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801817 Robaugh, David A. 2006. PAM I Multiresidue Protocol Testing of AE 0317309 and its Metabolite: AE 1073910. Pyxant Laboratories Study No.: 1624, Unpublished Bayer CropScience Report No.: RAAIX016, 165 pages.

US EPA ARCHIVE DOCUMENT

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EXECUTIVE SUMMARY:

Pyrasulfotole (AE 0317309) and the metabolite pyrasulfotole-desmethyl (AE 1073910) were subjected to analysis by selected protocols of the United States Food and Drug Administration (FDA) Pesticide Analytical Manual, Volume I (PAM I), third edition. Pyrasulfotole and pyrasulfotole-desmethyl were tested according to Protocols A, B, and C of the FDA PAM I testing procedures.

Protocol A of the PAM I testing procedures is not suitable for the detection of either pyrasulfotole or pyrasulfotole-desmethyl because neither compound is an *N*-methyl carbamate, nor a compound that is naturally fluorescent. Protocol B of the PAM I testing procedures is not suitable for the detection of pyrasulfotole-desmethyl; however, pyrasulfotole is partially recovered through Protocol B. Protocol C module DG-17 can be used for the detection of pyrasulfotole. No other module in Protocol C can be reliably utilized for the detection of either pyrasulfotole or pyrasulfotole-desmethyl. Since pyrasulfotole and pyrasulfotole-desmethyl are not soluble in hexane, Protocols D, E, and F are not suitable for analysis and detection.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the multiresidue method data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

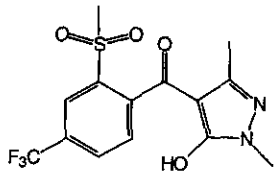
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (bidistilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. MATERIALS AND METHODS

Pyrasulfotole and pyrasulfotole-desmethyl were each injected at 1,000 ng and showed no response by natural fluorescence when analyzed according to the procedures outlined in Protocol A.

Pyrasulfotole and pyrasulfotole-desmethyl were subjected to Protocol C modules DG-1, DG-5, DG-13, DG-15, DG-17 and DG-18. Pyrasulfotole was chromatographed according to modules DG-1, DG-5, DG-17 and DG-18; however, pyrasulfotole produced multiple peaks for modules DG-1, DG-5, and DG-18. Pyrasulfotole-desmethyl was chromatographed according to modules DG-1, DG-17 and DG-18; however, pyrasulfotole-desmethyl produced multiple peaks for DG-18 and long, tailing peaks for DG-1 and DG-17, making these modules questionable for use in quantitative analysis. Of the Protocol C modules, only DG-17 for pyrasulfotole produces results that could be used for quantitative analysis.

Pyrasulfotole and pyrasulfotole-desmethyl were subjected to Protocol B utilizing module DG-1 from Protocol C. After calibrating the Florisil and gel permeation chromatography columns according to the procedures outlined in the PAM manual, methylated pyrasulfotole was analyzed at 0.149 and 1.49 ppm spiking level in the nonfatty matrix (pearl barley), and at 3.32 and 33.2 ppm in the fatty matrix (corn oil). This resulted in average recoveries of 62.5% and 47.1% at 0.149 ppm and 1.49 ppm, respectively, for pearl barley and 59.7% and 56.0% at 3.32 ppm and 33.2 ppm, respectively, for corn oil. Pyrasulfotole-desmethyl was not soluble in methylene chloride/hexane required for the gel permeation chromatography step, and therefore, could not be analyzed with the procedures of Protocol B.

Pyrasulfotole and pyrasulfotole-desmethyl were tested for solubility in hexane, which is necessary for Protocol D with cleanup and Protocols E and F. They were also tested for solubility in 10% acetone in hexane for use in Protocol D without cleanup. Although soluble in 10% acetone in hexane, pyrasulfotole could not be chromatographed successfully at the levels necessary for spiking of the test commodity at 0.05 ppm and 0.5 ppm, as per the procedures outlined in Protocol D without cleanup.

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C. RESULTS AND DISCUSSION

TABLE C.1.A. Results of Multiresidue methods Testing with Pyrasulfotole (AE 0317309).

PAM I Protocol	Results	Comments
A	Not effective	Not a *N*-methyl-carbamate or naturally fluorescent
B	Non-Fatty matrix (pearl barley) recoveries through complete method: 63% (0.149 ppm) and 47% (1.49 ppm) Fatty matrix (corn oil) recoveries through complete method 60%: (3.32 ppm) and 56% (33.2 ppm)	Partial recovery through protocol B
C	Chromatographable according to modules DG-1, DG-5, DG-17 and DG-18	Multiple peaks in all except module DG-17
D	Compounds insoluble in hexane and could not be tested	
E	Not tested	
F	Not tested	
G	Not tested	Not a substituted urea

TABLE C.1.B. Results of Multiresidue methods Testing with Pyrasulfotole-desmethyl (AE 1073910).

PAM I Protocol	Results	Comments
A	Not effective	Not a *N*-methyl-carbamate or naturally fluorescent
B	Not tested	Not amenable to gel-permeation clean-up step
C	Chromatographed using modules DG-1, DG-17 and DG-18	Multiple peaks in all modules
D	Compounds insoluble in hexane and could not be tested	
E	Not tested	
F	Not tested	
G	Not tested	Not a substituted urea

D. CONCLUSION

The results show that no multiresidue methods are suitable for the analysis of pyrasulfotole-desmethyl (AE 103910). Pyrasulfotole (AE 0317309) was partially recovered through Protocol B, but no other protocols were suitable for the analysis of this compound. Of the Protocol C modules, only DG-17 produces results that could be used for quantitative analysis.

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E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005

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APPENDIX 1

Reference Standards.

Pesticide analytical reference standards							
Description	**Master Logbook No.**	**Lot No.**	**Expiration Date**	**Purity (%)**	**Storage Conditions**	**Date Received**	**Manufacturer**
Carbofuran	15513755	3036X	02/05/10	99.9	Ambient	11/16/04	Sigma-Aldrich Co.
Chlorpyrifos	14542333	293-77A	12/01/06	99.5	2° C -8° C	04/21/03	Chem Service, Inc.
Endrin	15513700	3162X	06/11/08	99.1	Ambient	09/17/04	Chem Service, Inc.
Ethion PESTANAL®	15513698	4175X	06/23/10	97.9	2° C -8° C	09/17/04	Sigma-Aldrich Co.
Heptachlor Epoxide	15513792	311-95B	01/01/07	99.5	Ambient	12/22/04	Chem Service, Inc.
p,p'-DDT	15843897	341-50A	03/01/08	98	Ambient	05/04/05	Chem Service, Inc.
Pentachloroanisole	13832032	258-25A	01/01/07	98.2	2° C -8° C	05/08/01	Chem Service, Inc.
Pentachlorophenol	13832031	258-45B	02/01/06	99.1	2° C -8° C	05/08/01	Chem Service, Inc.

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Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally Apr 26/07 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R. Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801819 Coopersmith, H. 14 March 2006. Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

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EXECUTIVE SUMMARY:

This study was initiated to evaluate the freezer storage stability of pyrasulfotole (AE 0317309), pyrasulfotole-desmethyl (AE 1073910), and pyrasulfotole-benzoic acid (AE B197555) in soybean and wheat matrices.

Two gram samples of soybean grain, wheat grain, wheat forage, and wheat hay were spiked individually at 0.250 ppm each with pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid. Triplicate spiked samples of each matrix were analyzed immediately (0-Day). Stored soybean grain, wheat grain, wheat forage and wheat hay samples were analyzed for pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid at nominal intervals of 1, 3, 6, and 11 months (336 days). All spiked samples were stored at ≤-10°C during the course of the study. Sample analysis for pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid was performed using high-performance liquid chromatography-electrospray ionization with tandem mass spectrometry (HPLC-MS/MS; Method AI-001-P04-01).

Residues of pyrasulfotole, and pyrasulfotole-benzoic acid were stable in all crop matrices during 11 months (336 days) of frozen storage. Residues of pyrasulfotole-desmethyl were stable in soybean grain and wheat grain for up to 11 months (336 days) of frozen storage. However, residues of pyrasulfotole-desmethyl were found to decline in wheat forage and hay (ca. 0.12 % per day) in frozen storage.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the field trial residue data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

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A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

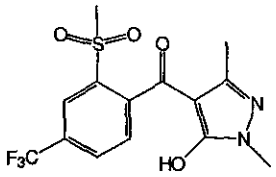
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Sample Handling and Preparation

Homogenates of the control matrices of soybean grain, wheat grain, wheat forage and wheat hay were obtained from Bayer CropScience. Individual 2.00 g samples of soybean grain, wheat grain, wheat forage and wheat hay were weighed into individual sealable 60 mL vials, each appropriately labeled. Stability samples were spiked with a 0.500 mL aliquot of the individual analyte standards to obtain a spiking level of 0.250 ppm for each analyte. Subsequent interval spiking was done with a 1.0 µg/mL mixed standard. Following the spiking procedure, the samples were left open at room temperature for approximately 10 minutes to allow the solvent to evaporate. With the exception of the 0-day samples, the vials were closed and placed in frozen storage (≤ -10°C).

B.2. Analytical Methodology

A 2.0 g aliquot of the crop matrix is weighed into a 60-mL vial and a mixture of acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) is added. The sample extract is heated to 60°C for at least 30 minutes. The samples are cooled and a mixture of isotopically labeled internal standards (IS) is added to the sample extract and mixed (0.100 ppm of each IS). A small aliquot (about 1.25 mL) is purified by C18 solid phase extraction (SPE). The solvent is removed from the sample and the residue is reconstituted for analysis by HPLC-MS/MS. HPLC separation was performed with a Phenomenex Gemini 50 x 2.0 mm column using aqueous 0.01 M NH_4OAc and methanol as mobile phases. The HPLC was interfaced to a ThermoFinnigan Quantum Ultra tandem mass spectrometer for analyte detection. The analytical method used in this study has a limit of quantitation (LOQ) of 0.01 ppm and limit of detection (LOD) of <0.003 ppm in all matrices (TABLE B.2). No interferences greater than the LOQ were observed in any of the control extracts from any matrix. All stored sample and concurrent recoveries were corrected for these minor interferences in corresponding controls.

TABLE B.2. Summary of LODs Calculated for Method AI-001-P04-01.

Matrix	Pyrasulfotole-benzoic acid (ppb)	Pyrasulfotole-desmethyl (ppb)	Pyrasulfotole (ppb)
Soybean grain	1.2	1.4	1.5
Corn grain	1.4	1.2	2.0
Corn stover	2.0	1.7	1.1
Wheat forage	0.9	0.8	1.0
Barley grain	1.9	0.8	0.9
Barley hay	2.9	0.8	0.9

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C. RESULTS AND DISCUSSION

Summaries of concurrent recoveries conducted as a part of this study are presented in TABLES C.1.A, C.1.B, C.1.C and C.1.D for soybean grain, wheat grain, wheat forage and wheat hay, respectively. Recoveries of pyrasulfotole (AE 0317309) spiked at 0.250 ppm in soybean grain ranged from 82% to 107%, in wheat grain ranged from 91% to 103%, in wheat forage ranged from 85% to 103%, and in wheat hay ranged from 91% to 103%. Recovery of pyrasulfotole-desmethyl in soybean grain ranged from 100% to 111%, in wheat grain ranged from 98% to 113%, in wheat forage ranged from 96% to 113%, and in wheat hay ranged from 96% to 111. Recovery of pyrasulfotole-benzoic acid in soybean grain ranged from 91% to 101%, in wheat grain ranged from 90% to 103%, in wheat forage ranged from 88% to 101%, and in wheat hay ranged from 89% to 101%.

Summaries of the percent recovered in stored samples are presented in TABLES C.2.A (soybean grain) C.2.B (wheat grain), C.2.C (wheat forage), and C.2.D and FIGURES C.2.A (soybean grain), C.2.B (wheat grain), C.2.C (wheat forage), and C.2.E (wheat hay). Linear regression analyses of pyrasulfotole-desmethyl recovery in wheat forage and hay are presented in FIGURES C.2.D and C.2.F, as well as APPENDIX 1. The residue of pyrasulfotole was stable in soybean grain, wheat grain, wheat forage and wheat hay with an overall 1%, 1.4%, 6.2% and 7.5% decline, respectively, at the final interval of 11 months (336 days). Residue of pyrasulfotole-benzoic acid (AE B197555) was stable with no decline at the final interval of 11 months (336 days). The residue of pyrasulfotole-desmethyl was stable in soybean and wheat grain with an overall 0% and 1.5% decline, respectively, at the final interval of 11 months (336 days). In contrast, the residue of pyrasulfotole-desmethyl was found to decline in wheat forage (ca. 0.1158 % per day) and in wheat hay (ca. 0.1212 % per day) during frozen storage.

TABLE C.1.A Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid from Soybean Grain.

Analyte	Spike Level (ppm)	Storage Interval (days)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Pyrasulfotole	0.250	0	3	91, 90, 89	90 ± 1.2
	0.250	29	2	90, 84	87
	0.250	89	2	82, 85	84
	0.250	180	2	102, 107	105
	0.250	336	2	97, 99	98
Pyrasulfotole-desmethyl	0.250	0	3	101, 102, 103	102 ± 1.0
	0.250	29	2	105, 100	103
	0.250	89	2	109, 106	108
	0.250	180	2	104, 110	107
	0.250	336	2	104, 111	106
Pyrasulfotole-benzoic acid	0.250	0	3	93, 91, 94	93 ± 1.6
	0.250	29	2	100, 93	97
	0.250	89	2	101, 99	100
	0.250	180	2	100, 101	101
	0.250	336	2	92, 95	94

Mean recovery = mathematical average of all recovery values.
The averages and standard deviations were calculated from the original raw data with Excel.

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TABLE C.1.B Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid from Wheat Grain.

Analyte	Spike Level (ppm)	Storage Interval (days)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Pyrasulfotole	0.250	0	3	94, 94, 92	93 ± 1.6
	0.250	29	2	91, 91	91
	0.250	89	2	95, 94	95
	0.250	180	2	100, 103	102
	0.250	336	2	93, 94	94
Pyrasulfotole-desmethyl	0.250	0	3	100, 98, 103	100 ± 2.4
	0.250	29	2	98, 98	98
	0.250	89	2	113, 113	113
	0.250	180	2	106, 107	107
	0.250	336	2	106, 107	107
Pyrasulfotole-benzoic acid	0.250	0	3	95, 99, 96	97 ± 2.1
	0.250	29	2	97, 94	96
	0.250	89	2	103, 102	103
	0.250	180	2	99, 100	100
	0.250	336	2	91, 90	91

Mean recovery = mathematical average of all recovery values.
The averages and standard deviations were calculated from the original raw data with Excel.

TABLE C.1.C Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid from Wheat Forage.

Analyte	Spike Level (ppm)	Storage Interval (days)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Pyrasulfotole	0.250	0	3	87, 88, 85	87 ± 1.4
	0.250	29	2	95, 92	94
	0.250	89	2	92, 92	92
	0.250	180	2	101, 103	102
	0.250	336	2	94, 90	92
Pyrasulfotole-desmethyl	0.250	0	3	96, 96, 97	96 ± 0.7
	0.250	29	2	104, 96	100
	0.250	89	2	113, 108	111
	0.250	180	2	100, 103	102
	0.250	336	2	102, 105	104
Pyrasulfotole-benzoic acid	0.250	0	3	91, 91, 92	91 ± 0.6
	0.250	29	2	96, 92	94
	0.250	89	2	100, 101	101
	0.250	180	2	95, 100	98
	0.250	336	2	89, 88	89

Mean recovery = mathematical average of all recovery values.
The averages and standard deviations were calculated from the original raw data with Excel.

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TABLE C.1.D Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid from Wheat Hay.

Analyte	Spike Level (ppm)	Storage Interval (days)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Pyrasulfotole	0.250	0	3	91, 91, 91	91 ± 0.2
	0.250	29	2	93, 94	94
	0.250	89	2	92, 94	93
	0.250	180	2	103, 96	100
	0.250	336	2	95, 92	94
Pyrasulfotole-desmethyl	0.250	0	3	99, 98, 97	98 ± 1.4
	0.250	29	2	96, 96	96
	0.250	89	2	110, 111	111
	0.250	180	2	104, 104	104
	0.250	336	2	103, 100	102
Pyrasulfotole-benzoic acid	0.250	0	3	96, 90, 90	92 ± 3.6
	0.250	29	2	90, 93	92
	0.250	89	2	100, 101	101
	0.250	180	2	99, 95	97
	0.250	336	2	89, 89	89

Mean recovery = mathematical average of all recovery values
The averages and standard deviations were calculated from the original raw data with Excel.

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TABLE C.2.A. Stability of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid Residues in Soybean Grain Following Frozen Storage at ≤-10 °C.

Analyte	Spike Level (ppm)	Storage Interval (days)	Recovered Residues (ppm)	% Recovery of Stored Samples	Average % Concurrent Recovery	Corrected[a] % Recovery	Average % Corrected Recovery	Percent[b] Decline
Pyrasulfotole	0.250	29	0.2206	88.2	87.2	101.1	100.0	0.0
			0.2159	86.3		98.9		
	0.250	89	0.2068	82.6	83.6	98.8	99.8	0.2
			0.2111	84.3		100.8		
	0.250	180	0.2818	111.7	104.8	111.7	109.2	0
			0.2693	106.7		106.7		
	0.250	336	0.2412	96.4	97.9	98.4	99.0	1.0
			0.2440	97.5		99.6		
Pyrasulfotole-desmethyl	0.250	29	0.2582	103.0	102.8	103.0	101.3	0
			0.2495	99.5		99.5		
	0.250	89	0.2623	104.4	107.5	104.4	106.8	0
			0.2741	109.1		109.1		
	0.250	180	0.2605	103.2	107.1	103.2	103.2	0
			0.2604	103.2		103.2		
	0.250	336	0.2684	107.0	107.3	107.0	106.4	0
			0.2652	105.8		105.8		
Pyrasulfotole-benzoic acid	0.250	29	0.2381	95.2	96.5	98.7	97.8	2.2
			0.2335	93.4		96.8		
	0.250	89	0.2532	101.3	100.2	101.3	101.3	0
			0.2530	101.2		101.2		
	0.250	180	0.2295	91.8	100.3	91.8	94.9	5.1
			0.2451	98.0		98.0		
	0.250	336	0.2453	98.1	93.8	104.6	105.0	0
			0.2471	98.8		105.4		

% recovery = [(residue found in sample – residue value of the control) ÷ spike level] X 100.
Corrected % recovery = (% recovery of stored sample ÷ average % concurrent recovery) X 100.
[a]: No adjustments were made if the average % concurrent recovery >100%.
Percent decline = (100% - average % corrected recovery).
[b]: No adjustments were made if the average % corrected recovery >100%.

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FIGURE C.2.A. Stability of Pyrasulfotole (AE 0319309), Pyrasulfotole-Desmethyl (AE 107910), and Pyrasulfotole-Benzoic Acid (AE 197555) Residues in Soybean Grain Following Frozen Storage at ≤ -10°C.

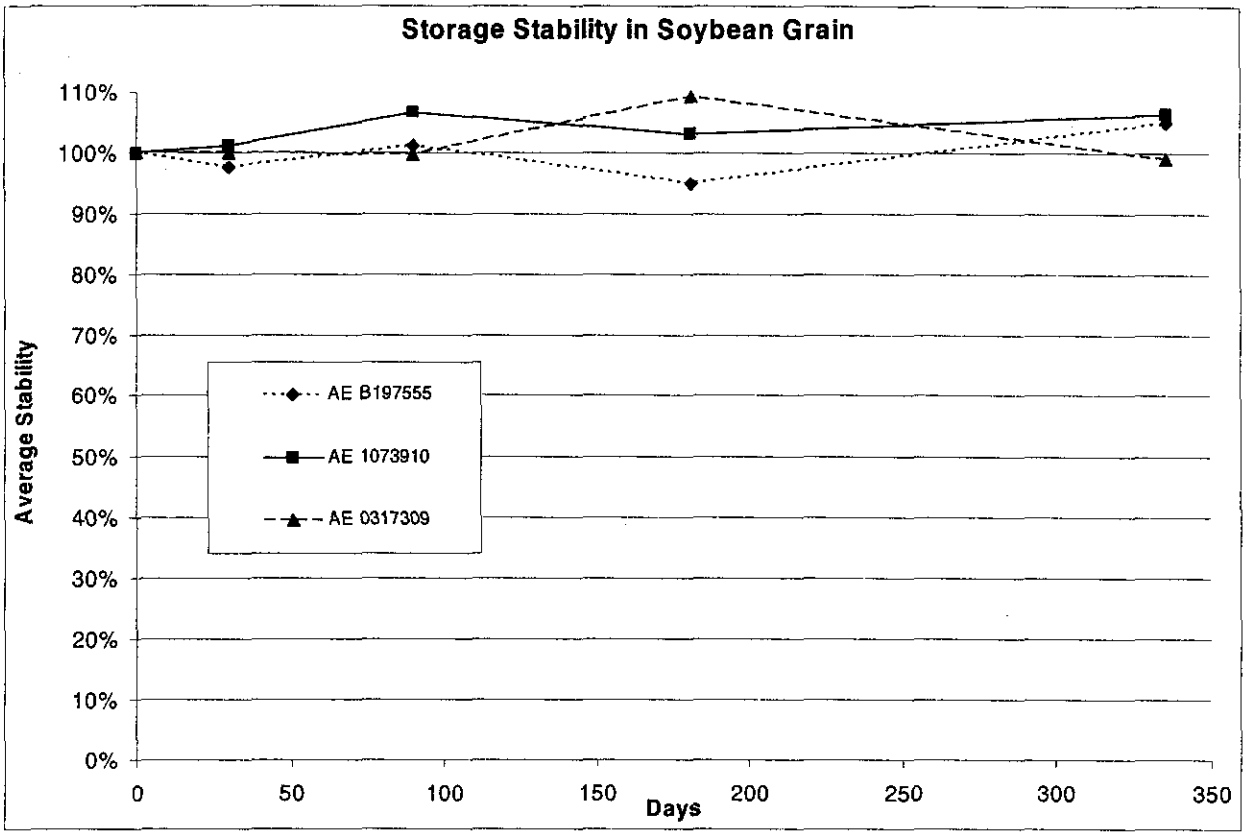

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TABLE C.2.B. Stability of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid Residues in Wheat Grain Following Frozen Storage at ≤ -10°C.

Analyte	Spike Level (ppm)	Storage Interval (days)	Recovered Residues (ppm)	% Recovery of Stored Samples	Average % Concurrent Recovery	Corrected[a] % Recovery	Average % Corrected Recovery	Percent[b] Decline
Pyrasulfotole	0.250	30	0.2381	95.0	91.0	104.4	102.7	0
			0.2301	91.8		100.9		
	0.250	90	0.2352	93.8	94.1	99.7	99.2	0.8
			0.2327	92.8		98.6		
	0.250	181	0.2506	99.7	101.3	99.7	97.9	2.1
			0.2414	96.0		96.0		
	0.250	336	0.2338	93.2	93.2	100.0	98.6	1.4
			0.2271	90.5		97.1		
Pyrasulfotole-desmethyl	0.250	30	0.2535	100.9	97.9	103.1	101.4	0
			0.2452	97.5		99.7		
	0.250	90	0.2720	108.2	112.5	108.2	109.4	0
			0.2780	110.6		110.6		
	0.250	181	0.2510	99.8	106.6	99.8	99.5	0.5
			0.2493	99.2		99.2		
	0.250	336	0.2463	98.1	106.6	98.1	98.5	1.5
			0.2485	98.9		98.9		
Pyrasulfotole-benzoic acid	0.250	30	0.2402	96.1	95.2	100.9	101.5	0
			0.2430	97.2		102.1		
	0.250	90	0.2490	99.6	102.2	99.6	100.2	0
			0.2520	100.8		100.8		
	0.250	181	0.2392	95.4	99.5	95.9	97.1	2.9
			0.2450	97.7		98.2		
	0.250	336	0.2417	96.7	90.5	106.8	104.0	0
			0.2289	91.6		101.1		

% recovery = [(residue found in sample – residue value of the control) ÷ spike level] X 100.
Corrected % recovery = (% recovery of stored sample ÷ average % concurrent recovery) X 100.
[a]: No adjustments were made if the average % concurrent recovery >100%.
Percent decline = (100% - average % corrected recovery).
[b]: No adjustments were made if the average % corrected recovery >100%.

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FIGURE C.2.B. Stability of Pyrasulfotole (AE 0319309), Pyrasulfotole-Desmethyl (AE 107910), and Pyrasulfotole-Benzoic Acid (AE 197555) Residues in Wheat Grain Following Frozen Storage at ≤ -10°C.

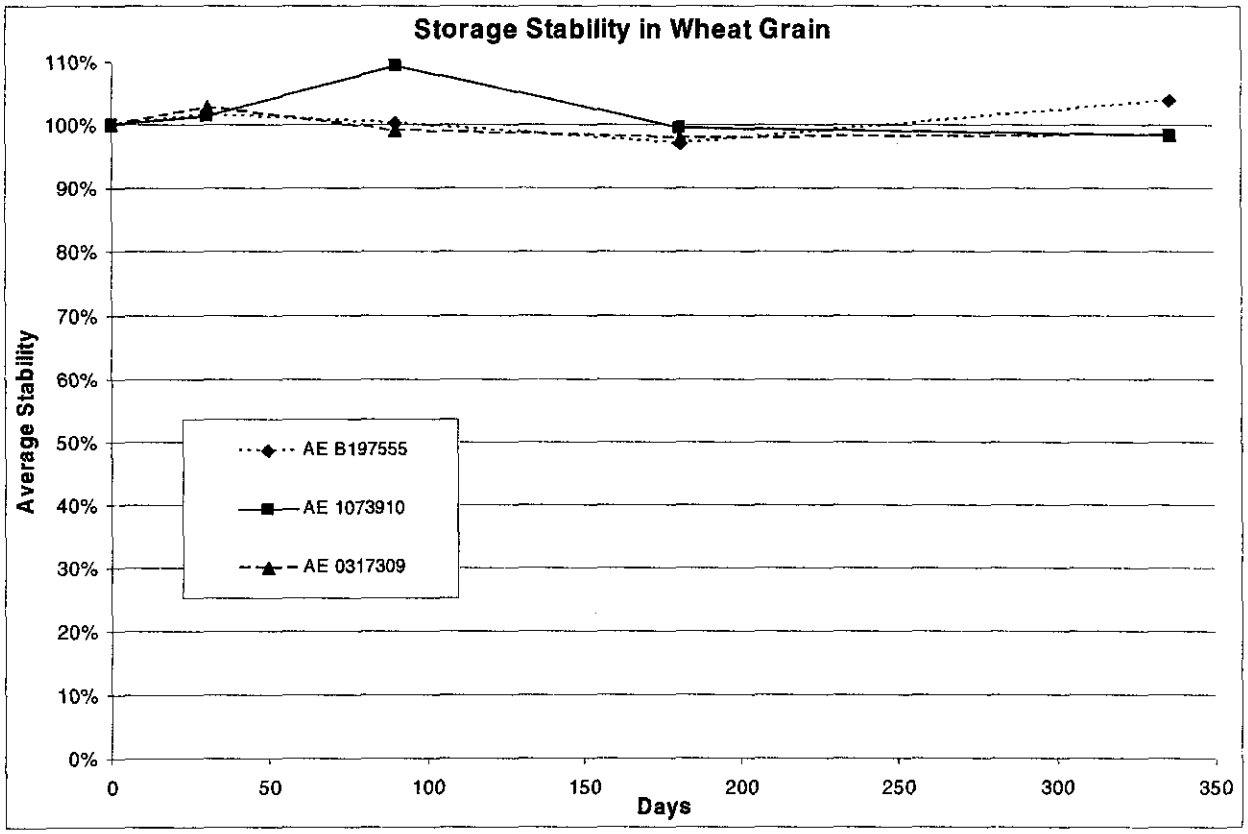

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TABLE C.2.C. Stability of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid Residues in Wheat Forage Following Frozen Storage at ≤ -10°C.

Analyte	Spike Level (ppm)	Storage Interval (days)	Recovered Residues (ppm)	% Recovery of Stored Samples	Average % Concurrent Recovery	Corrected[a] % Recovery	Average % Corrected Recovery	Percent[b] Decline
Pyrasulfotole	0.250	29	0.2276	90.9	93.3	97.5	98.3	1.7
			0.2312	92.4		99.0		
	0.250	89	0.2172	86.7	91.7	94.5	95.6	4.4
			0.2221	88.7		96.7		
	0.250	180	0.2516	100.4	102.0	100.4	98.3	1.7
			0.2409	96.2		96.2		
	0.250	336	0.2140	85.5	92.1	92.8	93.8	6.2
			0.2186	87.3		94.8		
Pyrasulfotole-desmethyl	0.250	29	0.1898	75.7	99.9	75.8	77.4	22.6
			0.1976	78.8		78.9		
	0.250	89	0.1894	75.3	110.7	75.3	74.5	25.5
			0.1852	73.6		73.6		
	0.250	180	0.1498	59.8	101.6	59.8	62.1	37.9
			0.1612	64.3		64.3		
	0.250	336	0.1383	55.1	103.3	55.1	53.7	46.3
			0.1313	52.3		52.3		
Pyrasulfotole-benzoic acid	0.250	29	0.2226	88.9	94.2	94.4	96.3	3.7
			0.2316	92.5		98.2		
	0.250	89	0.2325	92.9	100.4	92.9	94.4	5.6
			0.2402	95.9		95.9		
	0.250	180	0.2244	89.5	97.4	92.0	92.1	7.9
			0.2246	89.6		92.1		
	0.250	336	0.2210	88.3	88.2	100.0	102.8	0
			0.2331	93.1		105.5		

% recovery = [(residue found in sample – residue value of the control) ÷ spike level] X 100.
Corrected % recovery = (% recovery of stored sample ÷ average % concurrent recovery) X 100.
[a]: No adjustments were made if the average % concurrent recovery >100%.
Percent decline = (100% - average % corrected recovery).
[b]: No adjustments were made if the average % corrected recovery >100%.

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FIGURE C.2.C. Stability of Pyrasulfotole (AE 0319309), Pyrasulfotole-Desmethyl (AE 107910), and Pyrasulfotole-Benzoic Acid (AE 197555) Residues in Wheat Forage Following Frozen Storage at ≤ -10°C.

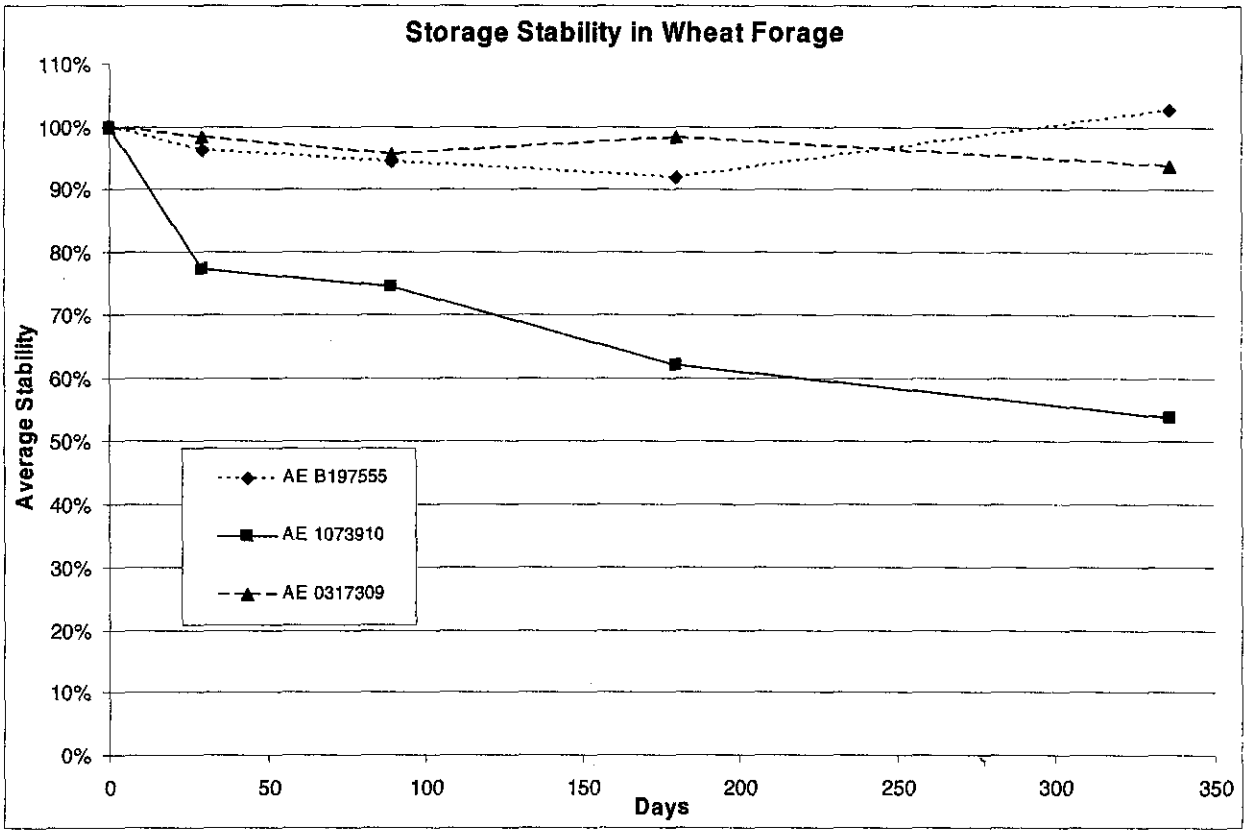

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FIGURE C.2.D. Linear Regression Analysis of Pyrasulfotole-Desmethyl Stability in Wheat Forage During Storage at ≤ -10°C.

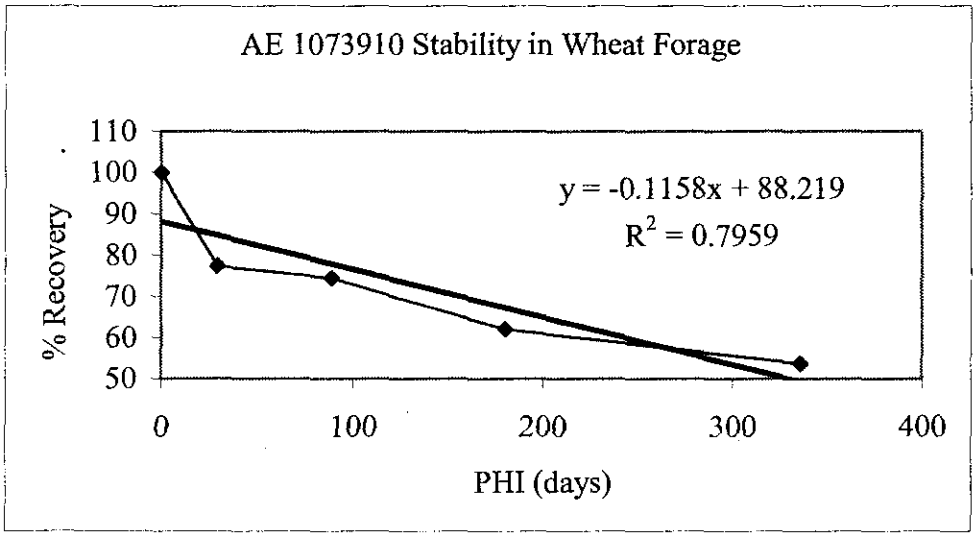

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TABLE C.2.D. Stability of Pyrasulfotole, Pyrasulfotole-Desmethyl, and Pyrasulfotole-Benzoic Acid Residues in Wheat Hay Following Frozen Storage at ≤ -10°C.

Analyte	Spike Level (ppm)	Storage Interval (days)	Recovered Residues (ppm)	% Recovery of Stored Samples	Average % Concurrent Recovery	Corrected[a] % Recovery	Average % Corrected Recovery	Percent[b] Decline
Pyrasulfotole	0.250	29	0.2302	92.0	93.4	98.5	98.4	1.6
			0.2298	91.8		98.3		
	0.250	89	0.2238	89.3	92.9	96.1	98.7	1.3
			0.2357	94.0		101.2		
	0.250	180	0.2507	99.9	99.5	100.4	101.0	0
			0.2538	101.2		101.6		
	0.250	336	0.2174	86.9	93.6	92.8	92.5	7.5
			0.2157	86.2		92.1		
Pyrasulfotole-desmethyl	0.250	29	0.1980	78.9	96.1	82.2	80.9	19.1
			0.1917	76.4		79.5		
	0.250	89	0.1898	75.2	110.6	75.2	75.3	24.7
			0.1900	75.3		75.3		
	0.250	180	0.1543	61.5	103.9	61.5	62.4	37.6
			0.1585	63.2		63.2		
	0.250	336	0.1385	55.1	104.1	55.1	53.5	46.5
			0.1303	51.8		51.8		
Pyrasulfotole-benzoic acid	0.250	29	0.2298	91.7	91.5	100.2	100.8	0
			0.2326	92.8		101.4		
	0.250	89	0.2526	99.6	100.6	99.6	97.7	2.3
			0.2430	95.8		95.8		
	0.250	180	0.2294	90.7	97.1	93.5	93.2	6.8
			0.2277	90.1		92.8		
	0.250	336	0.2400	95.9	90.3	106.2	104.0	0
			0.2300	91.9		101.8		

% recovery = [(residue found in sample – residue value of the control) ÷ spike level] X 100.
Corrected % recovery = (% recovery of stored sample ÷ average % concurrent recovery) X 100.
[a]: No adjustments were made if the average % concurrent recovery >100%.
Percent decline = (100% - average % corrected recovery).
[b]: No adjustments were made if the average % corrected recovery >100%.

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FIGURE C.2.E. Stability of Pyrasulfotole (AE 0319309), Pyrasulfotole-Desmethyl (AE 107910), and Pyrasulfotole-Benzoic Acid (AE 197555) Residues in Wheat Hay Following Frozen Storage at ≤ -10°C.

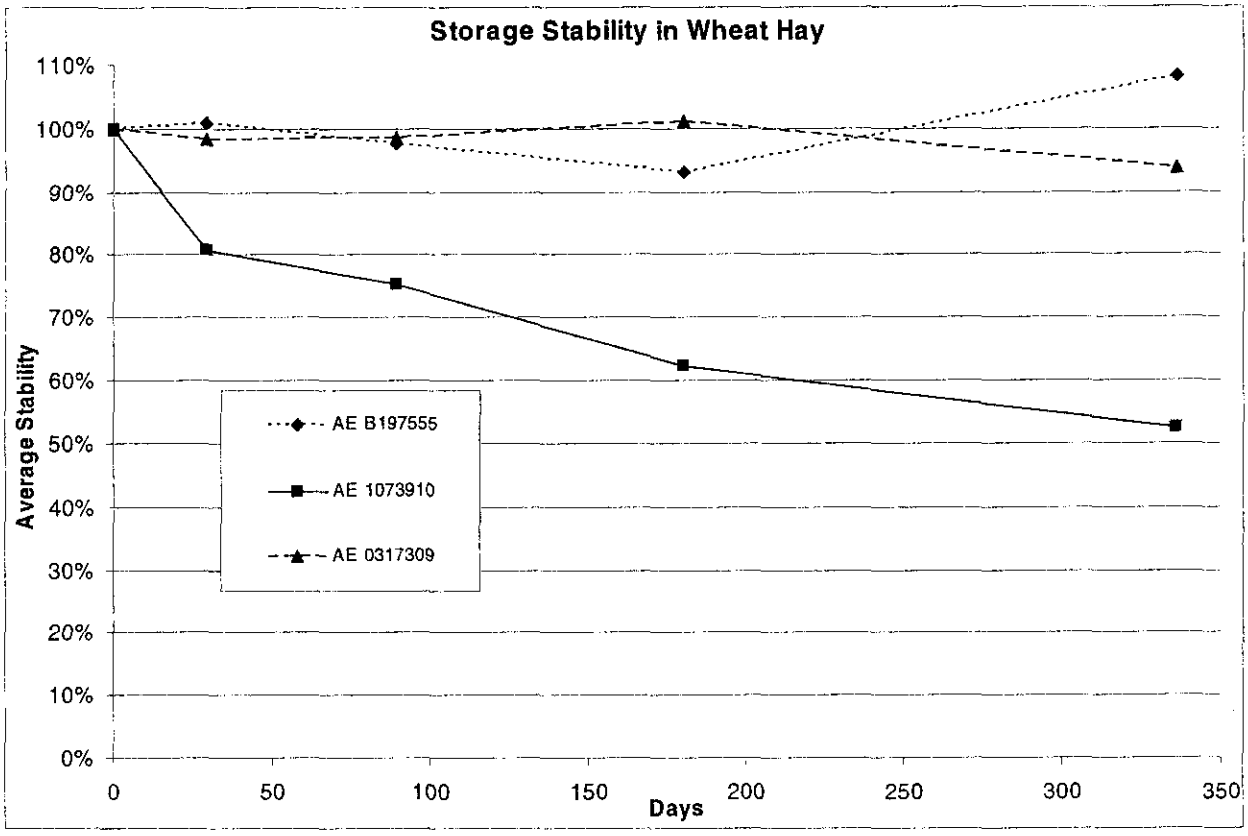

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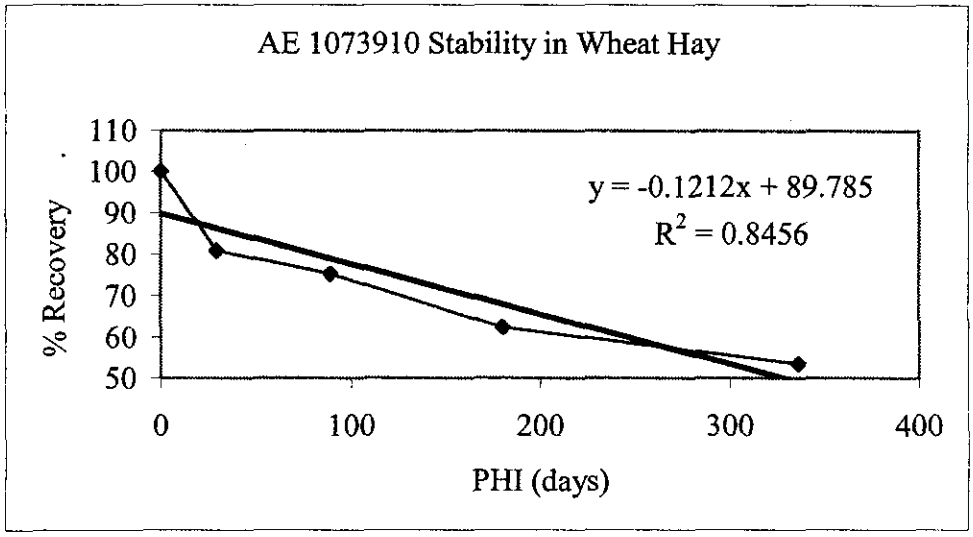
FIGURE C.2.F. Linear Regression Analysis of Pyrasulfotole-desmethyl Stability in Wheat Hay During Storage at ≤ -10°C.



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D. CONCLUSION

The residue of pyrasulfotole was stable in soybean grain, wheat grain, wheat forage and hay up to 336 days (11months) with less than 7.5% decline. The metabolite pyrasulfotole-desmethyl was stable in soybean grain, and wheat grain with less than 1.5% decline up to 336 days (11 months). The residue of pyrasulfotole-desmethyl was stable up to 157 days (5.2 months) and 163 days (5.4 months) in wheat forage, and hay, respectively with less than 30% decline. The residue of pyrasulfotole-benzoic acid in soybean grain, wheat grain, wheat forage and wheat hay was stable (<7.9% decline) during frozen storage for at least 336 days (11 months).

E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

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10. Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01 An Analytical Method for the Determination of Residues of AE 0317309, AE 1073910, and AE B197555 in Wheat, Corn, and Soybean Matrices Using LC/MS/MS.

11. Gould, T. J., Timberlake, B.C. and Brungardt, J.N. (2005). Validation of Bayer Method AI-001-P04-01; An Analytical Method for the Determination of Residues of AE 0317309, AE 1073910, and AE B197555 in Wheat, Corn, Barley, and Soybean Matrices Using LC/MS/MS. Bayer CropScience Report No. RAAIX005.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412
PC Code: 000692

Template Version June 2005.

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G. APPENDIX 1

Linear regression analysis on the stability of pyrasulfotole-desmethyl residues in wheat forage during frozen storage.

y = 88.219 - (0.116 * x)
N = 5.000
R = 0.892
Rsqr = 0.796
Adj Rsqr = 0.728
Standard Error of Estimate = 9.187

	Coefficient	Std. Error	t	P	
Constant	88.219	5.941	14.848	<0.001	
Col 1	-0.116	0.0338	-3.42	0.042	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	987.254	987.254	11.697	0.042
Residual	3	253.198	84.399		
Total	4	1240.452	310.113		

Normality Test: Passed (P = 0.375)
Constant Variance Test: Passed (P = 0.050)
Power of performed test with alpha = 0.050: 0.526
The power of the performed test (0.526) is below the desired power of 0.800.
You should interpret the negative findings cautiously.

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Linear regression analysis on the stability of pyrasulfotole-desmethyl residues in wheat hay during frozen storage.

Col 2 = 89.785 - (0.121 * Col 1)
N = 5.000
R = 0.920
Rsqr = 0.846
Adj Rsqr = 0.794
Standard Error of Estimate = 8.115

	Coefficient	Std. Error	t	P	
Constant	89.785	5.248	17.107	<0.001	
Col 1	-0.121	0.0299	-4.053	0.027	

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1081.655	1081.655	16.424	0.027
Residual	3	197.573	65.858		
Total	4	1279.228	319.807		

Normality Test: Passed (P = 0.235)
Constant Variance Test: Passed (P = 0.050)
Power of performed test with alpha = 0.050: 0.611
The power of the performed test (0.611) is below the desired power of 0.800.
You should interpret the negative findings cautiously.

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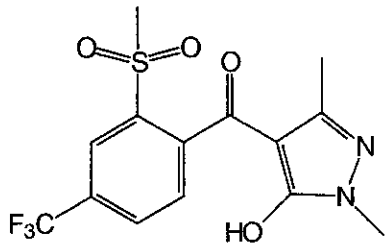
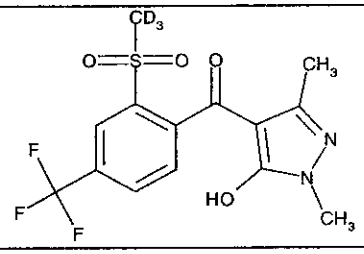
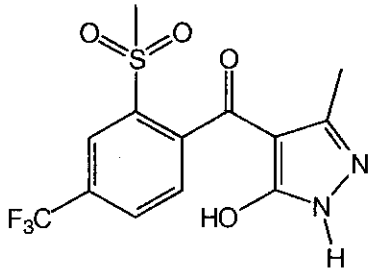
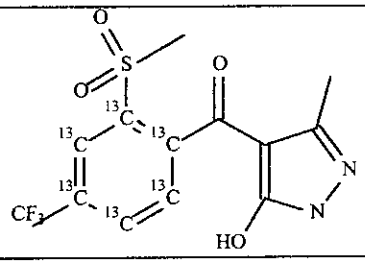
APPENDIX 2

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 107391 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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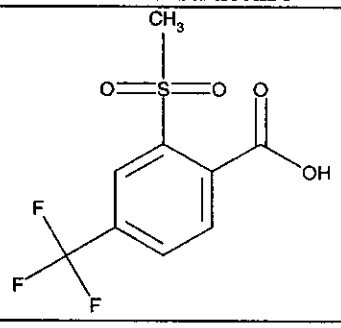
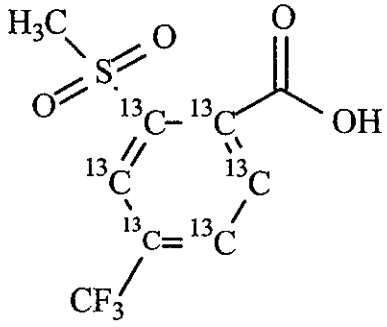
Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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Primary Evaluator	William S Mohan, PhD Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Peer Reviewer	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, PhD. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORT:

MRID 46801823 Mackie, S. J. W. (2006) AE V197555- Magnitude of the Residue in Laying Hens: Bayer CropScience Study Identification: RAAIP004. Unpublished Bayer CropScience Report Number: RAAIP004. March 13, (2006) 242 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience has submitted a hen feeding study for pyrasulfotole-benzoic acid, [(2-(methylsulfonyl)-4-(trifluoromethyl) benzoic acid)] (AE B197555), a metabolite present in poultry feeds from crops treated with pyrasulfotole (AE 0317309). Pyrasulfotole-benzoic acid was administered orally *via* gelatin capsule to forty laying hens for 29 days. There were three treatment groups with three sub-groups of four hens each and four control hens. Dosing was conducted at 0 (control), 0.4, 1.2, or 4.0 ppm/day in the feed (w/w).

Residue data for pyrasulfotole-benzoic acid in eggs and tissues were obtained using reverse phase high-performance liquid chromatography (HPLC), and HPLC with electrospray ionization and tandem mass spectrometry (HPLC-MS/MS) using isotope labeled internal standards. T he limit of quantitation (LOQ) was 0.010 ppm for all tissue and egg matrices. All egg and tissue samples were analyzed within 35 days of collection; therefore, no storage stability studies, or corrections, on egg or hen tissue are necessary.

Pyrasulfotole-benzoic acid residues were less than the LOQ in all egg samples analyzed from the 4-ppm dose group. Therefore, egg samples from the 1.2-ppm and 0.4-ppm dose groups were not analyzed and no depuration study was performed. In the 0.4- and 1.2-ppm dose groups, average pyrasulfotole-benzoic acid residues were less than the LOQ in all tissue matrices. In the 4-ppm dose group, the maximum pyrasulfotole-benzoic acid residues in liver, skin, fat, and muscle were 0.021, 0.022, <0.010, and <0.010 ppm, respectively. Therefore, at the highest dose examined (4.0 ppm), pyrasulfotole-benzoic acid residues accumulate in the liver and skin.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the hen feeding residue data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole-benzoic acid is the major metabolite present in poultry feed items (e.g., cereal grains) from crops treated with the herbicide and parent compound AE 0317309. AE 0317309 [(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone] (pyrasulfotole) is a postemergence dicot herbicide for use in cereal crops.

Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks prenylquinone biosynthesis in plants. The end-use products are applied to target weeds and act primarily through leaf uptake and translocation. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

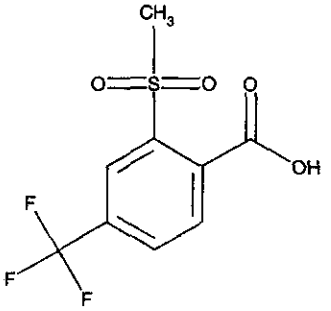
Compound:	Chemical Structure:
Pyrasulfotole benzoic acid	
Company Experimental Name	AE B197555
IUPAC Name:	2-Mesyl-4-trifluoromethylbenzoic acid
CAS Name:	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid
CAS Number:	142994-06-7
End Use Product:	Not applicable – degradation product of AE 0317309

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.[a]

Parameter	Value	Reference
Water solubility (mg/L at 20 °C)	8.64	1
Dissociation constant (pK_a)	1.77	1

[a] Pyrasulfotole-benzoic acid is not fully characterized as it is a metabolite of the active ingredient AE 0317309.

B. EXPERIMENTAL DESIGN

B.1. Livestock

Forty laying hens were divided into three groups, which were comprised of three treatment subgroups of four hens each and one control group of four hens.

TABLE B.1.1. General Test Animal Information.

Species	Breed	Age (weeks)	Weight at study initiation (kg)	Health Status	Description of housing/holding area
Gallus domesticus	White Leghorn	25	1.2-1.6*	Healthy and laying	2' x 4' x 4' cages Four birds/cage

* Bodyweights ranged 1.4 – 1.7 kg on day 29.

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TABLE B.1.2. Test Animal Dietary Regime.

Composition of Diet	Feed consumption (g/bird/day)	Water	Acclimation period	Predosing
GENISIS MID-WEST POULTRY I : For Laying Hens Guaranteed Analysis :* Grain products, including Crude Protein (min. 16%) Lysine (min. 0.9%) Methionine (min, 0.27%) Crude Fat (min 2.6%) Crude Fibre (max 4.0%) Calcium (3.7-4.7%) Phosphorus (min. 0.5%) Salt (0.2-0.4%)	119.7-125	*Ad libitum*	5 weeks	Day 0 was considered the pre-dosing day.

* Note that the guaranteed analysis values represent the minimum and/or maximum percentage content of each component in the feed and does not represent a material balance.

TABLE B.1.3. Dosing Regime.

Treatment Group	Treatment Type	Level administered (mg a.i./day)	Residue intake in diet (ppm)	Vehicle	Timing/ Duration
Control	Oral	0	0	Gelatin capsule	4 weeks
0.4 ppm	Oral	0.050	0.401	Gelatin capsule	week 1
0.4 ppm	Oral	0.050	0.320	Gelatin capsule	week 2
0.4 ppm	Oral	0.050	0.400	Gelatin capsule	week 3
0.4 ppm	Oral	0.051	0.449	Gelatin capsule	week 4
1.2 ppm	Oral	0.133	1.257	Gelatin capsule	week 1
1.2 ppm	Oral	0.143	1.166	Gelatin capsule	week 2
1.2 ppm	Oral	0.144	1.079	Gelatin capsule	week 3
1.2 ppm	Oral	0.154	1.241	Gelatin capsule	week 4
4 ppm	Oral	0.468	4.002	Gelatin capsule	week 1
4 ppm	Oral	0.459	3.904	Gelatin capsule	week 2
4 ppm	Oral	0.480	3.901	Gelatin capsule	week 3
4 ppm	Oral	0.522	4.011	Gelatin capsule	week 4

TABLE B.1.4. Sample Collection Information.

Matrix collected	Number of eggs produced during normal production.	Urine, feces and cage wash collected	Interval from last dose to sacrifice	Tissues harvested and analysed
Eggs	1-7 per day per subgroup	NA	3-5 hours	Liver Skin Fat Muscle

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B.2. Sampling, Handling and Preparation

Eggs:
On study days 0, 1, 3, 7, 10, 14, 17, 21, 24, 26, and 28, the eggs collected in the afternoon from each sub-group were combined with the eggs collected in the morning from the same sub-group. The white and yolks were composited (shells discarded) by sub-group into a labeled container and weighed. The contents were thoroughly mixed by vigorous shaking and then sub-divided into two approximately equal aliquots. The aliquots were stored frozen.

Tissues:
The hens were sacrificed within 5 hours of administration of the final dose (day 29). Representative samples of the following tissues were collected: liver (entire), skin (thigh and breast), fat (abdominal and subcutaneous), and muscle (thigh and breast). Tissue weights were recorded. Composite tissue samples from each sub-group were placed into labeled plastic storage bags, and immediately transferred to a freezer. The individual liver, skin, muscle, and fat samples were subsequently pulverized in the presence of dry ice and stored frozen (< -15°C).

B.3. Analytical Methodology

Egg and tissue samples were analyzed for AE B197555 by the HPLC-MS/MS method entitled "An Analytical Method for the Determination of Residues of AE B197555 in Poultry and Eggs using LC-MS/MS".[2] The method was validated before any samples from dosed animals were analyzed.[3] Briefly, pyrasulfotole-benzoic acid residues were extracted from tissue samples with acetonitrile: 2 M HCl (2:1 v/v). The sample extract was then heated to 60°C for 30 minutes. The supernatant was decanted after cooling and the sample was extracted again with acetonitrile: 2 M HCl. An isotopically labeled internal standard was added to the combined sample extracts and an aliquot of the extract was then purified by C18 solid-phase extraction (SPE). The eluate was concentrated to dryness, reconstituted with methanol and 10 mM ammonium acetate, and submitted to HPLC-MS/MS analysis.

Egg samples were extracted with acetonitrile and centrifuged. An isotopically labeled internal standard was added to the extract and then partitioned against hexane. An aliquot of the acetonitrile phase was concentrated to dryness, reconstituted with methanol and 10 mM ammonium acetate, and submitted to HPLC-MS/MS analysis.

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C. RESULTS AND DISCUSSION

Egg and tissue samples were analyzed for pyrasulfotole-benzoic acid which had been directly fed to hens at a rate of 0.4, 1.2 and 4 ppm/day. No adverse effects were observed on egg production or hen weight as a result of pyrasulfotole-benzoic acid consumption.

Method validation and concurrent recovery for pyrasulfotole-benzoic acid was performed using various spiking levels (TABLE C.1). Recoveries of pyrasulfotole-benzoic acid residue ranged from 86% to 116% ± 7% to 8% at the LOQ (0.010 ppm). The calculated LOD values were 0.0022 ppm in egg, 0.0010 ppm in liver, 0.0014 ppm in skin and fat, and 0.0018 ppm in muscle. The relative response of the detector in the HPLC-MS/MS chromatographic system to pyrasulfotole-benzoic acid was linear over the range of 0.005 ppm to 0.5 ppm for all tissues, with correlation coefficients all > 0.99. Chromatographs were symmetrical and free from interference at the reported LOD.

Tissue samples, as well as eggs from study days 7, 10, 14, 17, 21, 24, 26, and 28 were analyzed within 30 days of collection. In contrast, egg samples from study days 0, 1, and 3 were analyzed 32 to 35 days after collection (TABLE C.2). The slightly (5 days) longer storage interval for some eggs did not appear to have an effect on AE 0197555 dissipation. All extracts were analyzed within 3 days of extraction.

Pyrasulfotole-benzoic acid residue values are listed in TABLE C.3 and are summarized in TABLE C.4 and FIGURE C.1.

In eggs, pyrasulfotole-benzoic acid residues remained below the LOD (0.0022 ppm) in all samples from the 4-ppm dose group. Therefore, egg samples from the 0.4-ppm and 1.2-ppm dose groups were not analyzed and no depuration study was conducted.

In tissues, pyrasulfotole-benzoic acid residues were below the LOQ (0.010 ppm) in all samples except for liver and skin samples from the 4-ppm group. In the 4-ppm group, pyrasulfotole-benzoic acid residues were 0.011, 0.010, 0.021 ppm in the in liver and were 0.021, 0.020, 0.023 ppm in skin. Average pyrasulfotole-benzoic acid residues were 0.014 ppm ± 0.006 in liver and 0.021 ppm ± 0.001 in skin. Therefore, at the highest dose examined (4.0 ppm), pyrasulfotole-benzoic acid residues accumulate in the liver and skin.

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TABLE C.1. Summary of Concurrent Recoveries of Pyrasulfotole-Benzoic Acid (AE B197555) from Egg, Liver, Skin, Fat, and Muscle.

Matrix	Analyte	Spike level (ppm)	Sample size (n)	Recoveries (%)	Mean ± std dev (%)
Egg	AE B197555	0.010	7	99, 91, 97, 86, 105, 93, 102	96 ± 7
Egg	AE B197555	0.05	2	99, 94	97
Egg	AE B197555	0.20	2	95, 103	99
Liver	AE B197555	0.010	3	103, 109, 93	102 ± 8
Liver	AE B197555	0.05	2	107, 110	109
Liver	AE B197555	0.20	2	101, 98	100
Skin	AE B197555	0.010	2	104, 116	110
Skin	AE B197555	0.05	2	103, 108	106
Skin	AE B197555	0.20	2	110, 107	109
Fat	AE B197555	0.010	2	89, 101	95
Fat	AE B197555	0.05	2	102, 99	101
Fat	AE B197555	0.20	2	99, 99	99
Muscle	AE B197555	0.010	2	93, 94	94
Muscle	AE B197555	0.05	2	97, 103	100
Muscle	AE B197555	0.20	2	104, 101	103

TABLE C.2. Summary of Storage Conditions.

Matrix	Storage Temperature (°C)	Actual Sample Storage Duration (days)[a]	Limit of Demonstrated Storage Stability (days)
Egg	< -15	5 - 35	NA[b]
Liver	< -15	14	NA[c]
Skin	< -15	14	NA[c]
Fat	< -15	15	NA[c]
Muscle	< -15	14	NA[c]

[a] Actual study duration = time from sample collection through the last sample analysis

[b] Freezer storage stability should not be required since the majority of egg samples were stored less than 30 days prior to analysis. Egg samples from the 0, 1, and 7 day collection were stored 32-35 days prior to analysis. However, since all egg samples had residues of pyrasulfotole-benzoic acid below the LOQ, the additional 2-5 days in frozen storage had no negative effect on the study results.

[c] Freezer storage stability should not be required since all samples were stored less than 30 days prior to analysis.

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TABLE C.3. Residue Data from a Laying Hen Feeding Study with Pyrasulfotole-Benzoic Acid (AE B197555).

Hen Sub-group ID	Matrix	Collection Time (Study Day)	Feeding Level (ppm)	Residues (ppm)
UTC	Egg	0 - 28	NA	<LOD
UTC	Liver	29	NA	<LOD
UTC	Skin	29	NA	<LOD
UTC	Fat	29	NA	<LOD
UTC	Muscle	29	NA	<LOD
0.4 ppm A	Egg	0 - 28	0.4	NA
0.4 ppm A	Liver	29	0.4	0.0015
0.4 ppm A	Skin	29	0.4	0.0017
0.4 ppm A	Fat	29	0.4	<LOD
0.4 ppm A	Muscle	29	0.4	<LOD
0.4 ppm B	Egg	0 - 28	0.4	NA
0.4 ppm B	Liver	29	0.4	<LOD
0.4 ppm B	Skin	29	0.4	0.0014
0.4 ppm B	Fat	29	0.4	<LOD
0.4 ppm B	Muscle	29	0.4	<LOD
0.4 ppm C	Egg	0 - 28	0.4	NA
0.4 ppm C	Liver	29	0.4	0.0016
0.4 ppm C	Skin	29	0.4	0.0030
0.4 ppm C	Fat	29	0.4	<LOD
0.4 ppm C	Muscle	29	0.4	<LOD
1.2 ppm A	Egg	0 - 28	1.2	NA
1.2 ppm A	Liver	29	1.2	0.0031
1.2 ppm A	Skin	29	1.2	0.0073
1.2 ppm A	Fat	29	1.2	0.0085
1.2 ppm A	Muscle	29	1.2	<LOD
1.2 ppm B	Egg	0 - 28	1.2	NA
1.2 ppm B	Liver	29	1.2	0.0034
1.2 ppm B	Skin	29	1.2	0.0042
1.2 ppm B	Fat	29	1.2	0.0017
1.2 ppm B	Muscle	29	1.2	<LOD
1.2 ppm C	Egg	0 - 28	1.2	0.0024
1.2 ppm C	Liver	29	1.2	NA
1.2 ppm C	Skin	29	1.2	0.0040
1.2 ppm C	Fat	29	1.2	<LOD
1.2 ppm C	Muscle	29	1.2	<LOD
4.0 ppm A	Egg	0 - 28	4.0	<LOD
4.0 ppm A	Liver	29	4.0	0.0105
4.0 ppm A	Skin	29	4.0	0.0207
4.0 ppm A	Fat	29	4.0	0.0057
4.0 ppm A	Muscle	29	4.0	0.0036
4.0 ppm B	Egg	0 - 28	4.0	<LOD
4.0 ppm B	Liver	29	4.0	0.0102
4.0 ppm B	Skin	29	4.0	0.0203
4.0 ppm B	Fat	29	4.0	0.0052
4.0 ppm B	Muscle	29	4.0	0.0038
4.0 ppm C	Egg	0 - 28	4.0	<LOD
4.0 ppm C	Liver	29	4.0	0.0209
4.0 ppm C	Skin	29	4.0	0.0226
4.0 ppm C	Fat	29	4.0	0.0025
4.0 ppm C	Muscle	29	4.0	0.0023

UTC = untreated control.

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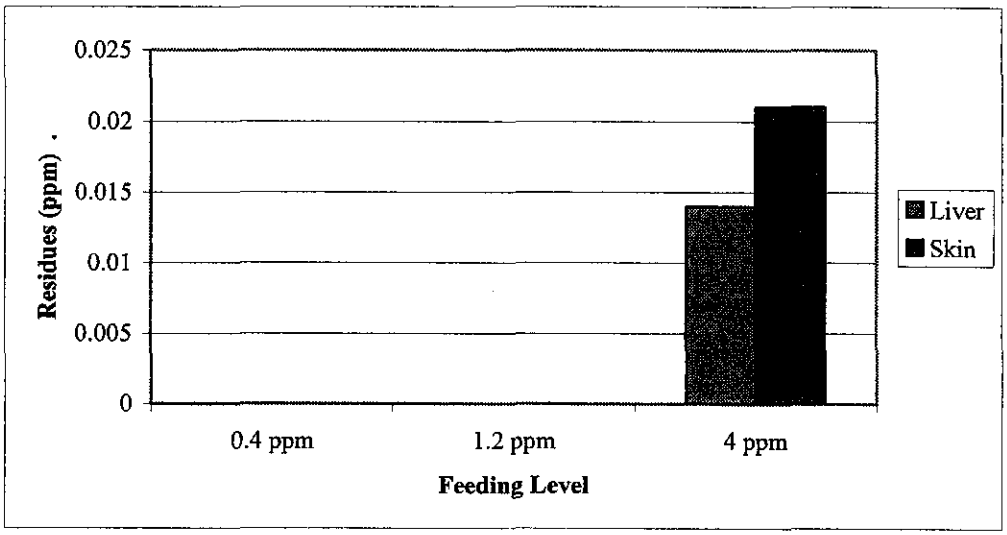
TABLE C.4. Summary of Egg and Tissues Residue Data from Pyrasulfotole-Benzoic Acid (AE B197555) Fed Poultry.

Matrix	Feeding Level	Residue Levels (ppm)						
		n	LOD	Min	Max	Median	Mean	Standard Deviation
Egg	4.0 ppm [a]	30	0.0022	<LOD	<LOD	—	—	—
Fat	0.4 ppm	3	0.0014	<LOD	<LOD	—	—	—
	1.2 ppm	3		<LOD	0.0085	—	—	—
	4.0 ppm	3		0.0025	0.0057	0.0052	0.0045	0.0018
Liver	0.4 ppm	3	0.0010	<LOD	0.0016	—	—	—
	1.2 ppm	3		0.0024	0.0035	0.0031	0.0029	0.0008
	4.0 ppm	3		0.0102	0.0209	0.0105	0.0139	0.0061
Muscle	0.4 ppm	3	0.0018	<LOD	<LOD	—	—	—
	1.2 ppm	3		<LOD	<LOD	—	—	—
	4.0 ppm	3		0.0023	0.0038	0.0036	0.0032	0.0008
Skin	0.4 ppm	3	0.0014	0.0014	0.0030	0.0017	0.0021	0.0009
	1.2 ppm	3		0.0040	0.0073	0.0042	0.0052	0.0019
	4.0 ppm	3		0.0203	0.0226	0.0207	0.0212	0.0013

[a] For egg samples at 4.0 ppm dosing level, samples from Day 0 were excluded in the statistical analysis since dosing was not started until Day 1 (i.e., Day 0 was pre-dosing day).

FIGURE C.1. Residues of AEB107555 in Liver and Skin from Hens Fed at 0.4, 1.2 and 4 ppm/day.



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D. CONCLUSION

No pyrasulfotole-benzoic acid residues were detected above the LOQ (0.01 ppm) in any matrix when laying hens were dosed at 0.4 ppm or 1.2 ppm. At 4 ppm, the maximum amounts of pyrasulfotole-benzoic acid residue detected in liver, skin, fat, muscle and eggs were 0.021, 0.022, <0.01, <0.01,and <0.01 ppm, respectively. Therefore, pyrasulfotole-benzoic acid residues accumulated only in the liver and skin of hens treated at the highest dose examined (4.0 ppm).

E. REFERENCES

1. Mills, E. A. M. (2003). AE B197555: The Determination of the pKa for the Isoxaflutole Metabolite RPA203328. Bayer CropScience. Report Number C036496.

2. Lam, C. K. and Qadri, S. S. (2005). An Analytical Method for the Determination of residues of AE B197555 in poultry and eggs using HPLC-MS/MS. Bayer CropScience Method No. AI-005-A05-01. Bayer CropScience Report No. RAAIP012, Appendix 5.

3. Lam, C. K. and Qadri, S. S. (2006). Validation of Bayer CropScience Method No. AI-005-A05-01. Bayer CropScience Report No. RAAIP012.

4. Milo, J. and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 031709 03 EC23 A8 -Magnitude of the Residue in/on Wheat. Bayer CropScience Report Number RAAIM002.

5. Milo, J. and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 031709 03 EC23 A8 -Magnitude of the Residue in/on Barley. Bayer CropScience Report Number RAAIM004.

6. Milo, J. and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 031709 03 EC23 A8 -Magnitude of the Residue in/on Oats. Bayer CropScience Report Number RAAIM006.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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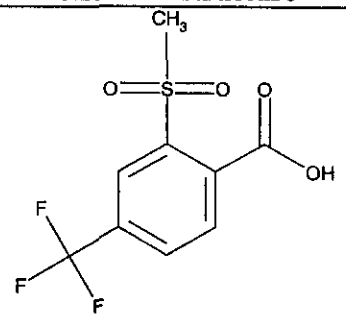
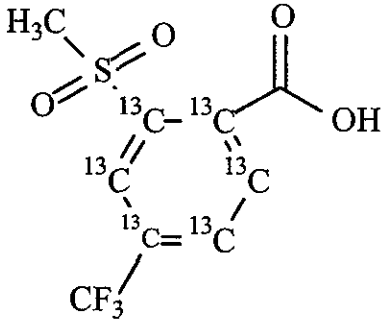
APPENDIX 1

Reference Standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	April 17/2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORT:

MRID No. 46801824 Mackie, S. J. W. (2006) AE 0317309 – Magnitude of the Residue in Lactating Cows. Bayer CropScience Study Number RAAIX017. Unpublished Bayer CropScience Report Number: RAAIX017. 6 March 2006. 303 pages.

US EPA ARCHIVE DOCUMENT

EXECUTIVE SUMMARY:

Bayer CropScience conducted a dairy cattle feeding study for the herbicide, pyrasulfotole (AE 0317309), [(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoro-methyl)phenyl]-methanone]. Pyrasulfotole was administered orally via gelatin capsule to 10 lactating Holstein cows (*Bos taurus*) for 29 consecutive days. There were 3 animals per treatment group and a single control animal. Dosing was conducted at 0 (control), 3, 9, or 30 ppm/day in the feed (dry weight basis). This study did not include a depuration phase.

Residue data for pyrasulfotole in milk and tissues were obtained using high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS). The limit of quantitation (LOQ) for pyrasulfotole was 0.005 ppm (milk, cream), and 0.010 ppm (tissues).

The tissue and milk samples in this study were analyzed within 26 days of collection. Pyrasulfotole residues in the milk samples from the 30-ppm feeding level reached a plateau by the third day of dosing (max = 0.013 ppm) and remained relatively constant for the rest of the study (mean = 0.010 ± 0.002, n = 30). Since the pyrasulfotole residue in the milk samples from the 9-ppm feeding level were all below the LOQ (0.005 ppm), milk samples from the 3-ppm dose group were not analyzed. There was no tendency for pyrasulfotole residues to concentrate in the skim milk or milk fat (concentration factors <1).

Pyrasulfotole residue was observed in significant amounts in the kidney and liver from all animals in all dose groups. Pyrasulfotole residue ranged from 0.123 ppm to 0.424 ppm in the kidney and from 0.692 ppm to 1.939 ppm in the liver. Pyrasulfotole residue was observed above the LOQ (0.014 ppm) in only one of the 30-ppm animal fat tissue sample. No pyrasulfotole residue above the LOQ (0.010 ppm) was observed in any of the muscle tissue samples from any animal in any dose group.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the livestock feeding data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

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BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

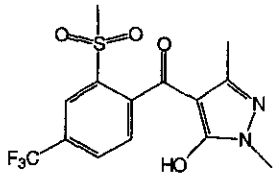
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Livestock

Ten dairy cows were divided into three treatment subgroups of three cows each and one control cow.

TABLE B.1.1. General Test Animal Information.

Species	Breed	Age (years)	Weight at study initiation (kg)	Health Status	Description of housing/holding area
Bos taurus	Holstein Dairy Cows	3-7	493-711	All animals were healthy and lactating prior to the start of the study. During the study, the control animal developed mastitis. A cow from the 30 ppm group exhibited bleeding from erosion of lung abscesses. Neither condition was considered related to the test chemical. No other health problems or clinical abnormalities were noted.	Individual stanchions in a dairy barn.

TABLE B.1.2. Test Animal Dietary Regime.

Composition of Diet (Nominal fresh wgt)	Feed consumption (kg/day) (individual animals)	Water	Acclimation period	Pre-dosing
Dairy ration, 8 kg Alfalfa cubes, 8 kg Baled hay, 2 kg	20.7 – 22.9 kg fresh weight or 17.9 – 22.6 kg dry weight.	*Ad libitum* (fresh potable well water)	8-11 days	4 days

TABLE B.1.3. Dosing Regime.

Treatment Group	Treatment Type	Level of pyrasulfotole (AE 0317309) administered (mg a.i./dose)	Residue intake in diet (ppm feed)	Vehicle	Timing/Duration (days)
Control	Oral (AE 0317309 was weighed directly into gelatin capsules. Capsules were administered using a balling gun, once per day after the morning milking.)	0	0	Gelatin Capsule	---
3 ppm		62.1 – 64.9	3.1 – 3.2	Gelatin Capsule	29
9 ppm		188.4 – 201.6	8.4 – 9.0	Gelatin Capsule	29
30 ppm		649.3 – 675.0	28.8 – 31.4	Gelatin Capsule	29

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TABLE B.1.4. Sample Collection.

Milk Collected	Amount of milk produced during normal production	Urine, feces and cage wash collected	Interval from last dose to sacrifice (days)	Tissues harvested and analyzed
Milk collected twice daily from all cows (am and pm milking). Milk collected on day 26 separated into skim milk and cream.	12.3 – 33.5 kg* milk/cow/day. Output consistent per individual cow, low producers and high producers.	Not collected.	Animals were sacrificed on day 29 of the study, within 8 hours after the last dose. There was no depuration phase in the study.	Approximately 500 g of each of the following were collected: Liver (portions of each lobe) Kidney (center and ends) Fat (composite of available omental, renal, and subcutaneous) Skeletal muscle (composite of loin, round and flank).

* Range of the daily milk production for individual cows throughout the study. Animals were not at similar stages of lactation hence large range of daily milk yield.

B.2 Sample Handling Information

Milk, Cream, and Skim Milk:

Milk was collected from all cows twice daily. The milk samples, collected during the 24 hours following each daily dose (PM and the AM milking for the following day), were composited and sub-sampled. On study day 26, additional sub-samples of milk from each cow were separated into cream (milk fat) and skim milk using a centrifugal cream separator. The milk, cream, and skim milk samples were held and shipped frozen until analysis.

The milk, skim milk, and cream samples remained in frozen (<-15°C) storage at all times except during analysis. Milk, milk fat and skim milk samples were kept in frozen storage for up to 9 days prior to analysis.

Dairy Cattle Tissues:

The cows were sacrificed within eight hours after the final dose on day 29. Following the termination, each animal was examined macroscopically and representative samples totaling approximately 500 g were taken of liver (portions of each lobe), kidney (center and ends), fat (composite of available omental, renal, and subcutaneous), and skeletal muscle (composite of loin, round and shank).

After sample collection and weighing, the liver, kidney, and muscle samples were cubed and immediately transferred into a freezer (<-15°C). Fat samples were frozen then cubed. The tissue samples remained in frozen (<-15°C) storage at all times except during analysis. Samples of muscle, fat, liver and kidney were kept in frozen storage for up to 26 days prior to analysis.

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The frozen tissue samples were homogenized in the presence of dry ice using a commercial food processor. The homogenized samples were placed in a freezer, and the dry ice was allowed to sublime. Tissue samples remained in frozen (<-15°C) storage at all times except during analysis.

B.3. Analytical Methodology

The method quantitates AE 0317039 residues using an isotopically labeled internal standard. [10, 11] Reference substance information including structures is given in TABLE B.3.

Tissue samples were extracted with a mixture of acetonitrile:water (2:1 v/v) at 60°C for 30 minutes and cooled. The sample extract is centrifuged, the supernatant is decanted and isotopically labeled standard is added to the supernatant. An aliquot is purified by C-18 solid phase extraction (SPE), concentrated then reconstituted in methanol:1% acetic acid (1:9 v/v) prior to quantitation by LC-MS/MS.

Whole and skim milk samples were diluted with water. The isotopically labeled internal standard was added to the diluted sample which was filtered and analysed by LC-MS/MS.

Cream (milk fat) was extracted with acetonitrile and centrifuged. The isotopically labeled internal standard was added to the supernatant and then partitioned with hexane. An aliquot of the acetonitrile extract was concentrated then reconstituted in methanol:1% acetic acid (1:9 v/v) for analysis by LC-MS/MS.

The chromatographic analysis of pyrasulfotole involved gradient elution from a reverse-phase column with aqueous 10 mM ammonium bicarbonate solution and methanol as the mobile phase components. An electrospray interface in the positive mode was used to introduce the sample into the MS.

Details of data processing including chromatogram integration, calculation of calibration curves, and a sample calculation of residues were adequately reported.

The LOQ for pyrasulfotole was 0.005 ppm for milk and cream, and 0.010 ppm for tissues. In this study, the limit of detection (LOD) of the method was defined as the concentration that can be determined to be statistically different than a blank. The LOD was calculated as 0.0015 ppm in milk, 0.0002 ppm in skim milk, 0.0003 ppm in cream, 0.0007 ppm in fat, 0.0004 ppm in kidney, 0.0006 ppm in muscle and 0.0005 ppm in liver.

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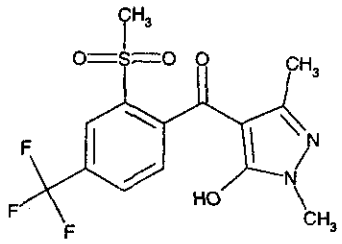
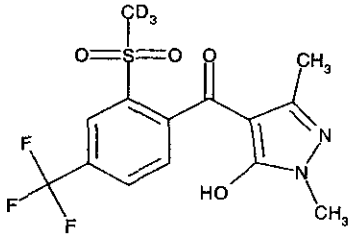
TABLE B.3. Reference Substance Information.

Common Name Code Number IUPAC Name CAS Name Molecular Wt. CAS Reg. No. Reference No. % Purity Expiration	Pyrasulfotole AE 0317309 5-Hydroxy-1,3-dimethylpyrazol-4-yl 2-mesyl-4-(trifluoromethyl)phenyl ketone (5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone 362.32 365400-11-9 K-1394 (Lot # 0324200303) 99.5 October 26, 2008	
Common Name Code Number IUPAC Name CAS Name Molecular Wt. CAS Reg. No. Reference No. % Purity Expiration	d_3-Pyrasulfotole d_3-AE 0317309 Unavailable (5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone 365.34 Unavailable K-1409 (Lot # 1221200413) 98.3 December 20, 2006	

C. RESULTS AND DISCUSSION

The analytical method was validated for the analysis of residues of pyrasulfotole in milk, milk fat (cream), skim milk, fat, kidney, liver, and muscle prior to analyses of the treated samples. Recoveries of pyrasulfotole were also measured concurrently with each set of samples to verify method performance. The method validation and concurrent recovery data are summarized in TABLE C.1. All the recovery data were within the acceptable limits of 70 to 120%. The validation of the methodology for the determination of pyrasulfotole demonstrated that it can be accurately determined at an LOQ of 0.005 ppm in milk matrices (including cream) and 0.010 ppm in tissue matrices (fat, kidney, liver and muscle). Chromatographs were symmetrical and free from interference for residue values as low as LOD.

Milk and tissue samples in this study were analyzed within 9 and 26 days of collection, respectively; therefore, freezer storage stability studies on ruminant tissue and milk matrices were not provided and are not required. No corrections for any possible decomposition during frozen storage have been made to the results reported. A summary of the storage intervals and storage conditions incurred by the samples in this study are provided in TABLE C.2. All extracts were analyzed within 1 day of extraction.

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No residues of pyrasulfotole were detected in any of the untreated milk samples except for one milk sample (day 3) in which a residue below the LOQ was detected. In the control fat and control kidney samples, residues of pyrasulfotole were detected (<0.002 ppm), but were below the limit of quantitation.

Residues of pyrasulfotole in the milk samples from the 9-ppm feeding level were all below the LOQ (0.005 ppm), therefore, milk samples from the 3-ppm feeding level were not analyzed (TABLE C.3.1).

Residues of pyrasulfotole in the milk samples from the 30-ppm feeding level reached a plateau by day 3 of dosing (max = 0.0134 ppm; mean = 0.0096 ppm; n = 30) and remained relatively constant throughout the study period (FIGURE C.1).

Milk from the 26-day sampling from the 30-ppm cows had a mean residue of pyrasulfotole of 0.0098 ppm (0.0080, 0.0100, 0.0114 ppm). When the milk samples taken on day 26 from the 30-ppm dose group were separated into skim milk and milk fat (cream), the mean residue in skim milk was 0.0094 ppm (0.0086, 0.0090, 0.0105 ppm) and in milk fat was 0.0073 ppm (0.0061, 0.0074, 0.0085 ppm). This indicated that there is no tendency for pyrasulfotole residues to concentrate in the skim milk or milk fat.

Residues of pyrasulfotole found in the tissue samples from individual animals in each of the 3, 9, and 30-ppm dose groups are presented in TABLE C.3.2 and are summarized in TABLE C.3.3. Residues of pyrasulfotole in muscle were less than the LOQ of 0.010 ppm in all animals, for all dose groups.

Pyrasulfotole residues in fat were less than the LOQ of 0.010 ppm in all animals, with the exception of one animal in the 30-ppm dose group (animal 15), which had residues of 0.0143 ppm.

The residues of pyrasulfotole in the kidney from the 30-ppm dose group were 0.3811, 0.4144 and 0.378 ppm, with a mean of 0.391 ppm. For the animals in the 9-ppm dose group, the pyrasulfotole residues in kidney tissue were 0.242, 0.123 and 0.424 ppm, with a mean of 0.263 ppm. For the animals in the 3-ppm dose group, the pyrasulfotole residues in kidneys were 0.222, 0.175 and 0.197 ppm, with a mean of 0.198 ppm.

The residues of pyrasulfotole in the liver from the 30-ppm dose group were 1.642, 1.940 and 1.795 ppm, with a mean of 1.792 ppm. For the animals in the 9-ppm dose group, the residues of pyrasulfotole were 0.692, 1.578, 1.594 ppm, with a mean of 1.287 ppm. For the animals in the 3-ppm dose group, the residues were 1.187, 1.019, 1.230 ppm, with a mean of 1.145 ppm. A graphical presentation of dose level versus residues found in kidney and liver is presented in FIGURE C.2.

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TABLE C.1. Summary of Recoveries of Pyrasulfotole (AE 0317309) from Bovine Milk and Tissues.

Matrix	Analyte	Spike level (ppm)	Sample size (n)	Recoveries (%)	Mean ± std dev
Milk	AE 0317309	0.005	18	76 – 100	89 ± 7
		0.025	2	96 – 97	97
		0.050	2	94 – 96	95
Cream (milk fat)	AE 0317309	0.005	4	82 – 88	84 ± 3
		0.025	2	86 – 87	87
		0.050	2	85 – 87	86
Skim Milk	AE 0317309	0.005	5	81 – 100	90 ± 10
		0.025	2	96 – 98	97
		0.050	2	96 – 97	97
Fat	AE 0317309	0.010	3	87 – 93	91 ± 3
		0.050	3	96 – 99	98 ± 2
		0.100	2	95 – 96	96
Kidney	AE 0317309	0.010	4	83 – 92	88 ± 4
		0.050	2	97 – 100	99
		0.100	3	79 – 96	90 ± 10
		1.000	2	105 – 106	106
Muscle	AE 0317309	0.010	3	77 - 89	82 ± 7
		0.050	3	92 – 96	94 ± 2
		0.200	2	110 – 112	111
Liver	AE 0317309	0.010	2	87 – 91	89
		0.050	2	94 – 94	94
		0.100	2	91 – 95	93
		1.000	1	105	105
		2.500	2	112 - 113	113

TABLE C.2. Summary of Sample Storage Conditions.

Matrix (RAC)	Storage Temperature (°C)	Sample Storage Duration (days)[a]	Limit of Demonstrated Storage Stability (days)
Milk	< -15	9	NA[b]
Milk Fat	< -15	3	NA
Whey	< -15	3	NA
Fat	< -15	19	NA
Kidney	< -15	26	NA
Muscle	< -15	15	NA
Liver	< -15	20	NA

[a]Actual study duration = time from sample collection through the last sample analysis.

[b]Freezer storage stability should not be required since all samples were stored less than 30 days prior to analysis.

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TABLE C.3.1. Residue Data in Milk, Milk Fat (Cream) and Whey (Skim Milk) from Dairy Cow Feeding Study with Pyrasulfotole (AE 0317309).

Feeding Level (ppm dry feed)	Matrix	Study Day	Residues of AE 0317309 (ppm)			
Animal Number:			3	10	15	Mean
30	Milk	0	<LOD	<LOD	<LOD	<LOD
30	Milk	1	0.0061	0.0107	0.0042	0.0070
30	Milk	3	0.0077	0.0127	0.0134	0.0113
30	Milk	7	0.0079	0.0110	0.0112	0.0100
30	Milk	10	0.0070	0.0121	0.0113	0.0101
30	Milk	14	0.0070	0.0090	0.0114	0.0091
30	Milk	17	0.0060	0.0120	0.0088	0.0089
30	Milk	21	0.0081	0.0116	0.0119	0.0105
30	Milk	24	0.0061	0.0101	0.0105	0.0089
30	Milk	26	0.0080	0.0100	0.0114	0.0098
30	Milk Fat	26	0.0061	0.0074	0.0085	0.0073
30	Whey	26	0.0086	0.0090	0.0105	0.0094
30	Milk	28	0.0080	0.0109	0.0125	0.0105
Animal Number:			2	13	14	
9	Milk	1	0.0031	0.0022	0.0023	0.0025
9	Milk	3	0.0030	0.0025	0.0023	0.0026
9	Milk	7	0.0025	0.0033	0.0024	0.0027
9	Milk	10	0.0021	0.0030	0.0028	0.0026
9	Milk	14	0.0024	0.0026	0.0025	0.0025
9	Milk	17	0.0020	0.0019	0.0022	0.0020
9	Milk	21	0.0026	0.0029	0.0026	0.0027
9	Milk	24	<LOD	0.0017	<LOD	—
9	Milk	26	0.0016	0.0023	0.0015	0.0018
9	Milk	28	<LOD	0.0026	<LOD	—

TABLE C.3.2. Residue Data in Tissues from Dairy Cow Feeding Study with Pyrasulfotole (AE 0317309).

Dose Level (ppm dry feed)	Matrix	Study Day	AE 0317309 Residues (ppm)			
Animal Number:			4	7	12	Mean
3	Fat	29	0.0062	0.0040	0.0017	0.0040
3	Kidney	29	0.2224	0.1748	0.1973	0.1982
3	Muscle	29	<LOD	0.0008	0.0010	—
3	Liver	29	1.230	1.019	1.187	1.145
Animal Number:			2	13	14	Mean
9	Fat	29	0.0007	0.0033	<LOD	—
9	Kidney	29	0.2420	0.1232	0.4240 [a]	0.2631
9	Muscle	29	0.0007	<LOD	<LOD	—
9	Liver	29	1.594	0.6922	1.577	1.287
Animal Number:			3	10	15	Mean
30	Fat	29	0.0046	0.0143	0.0024	0.0071
30	Kidney	29	0.3811	0.4144	0.3778	0.3911
30	Muscle	29	0.0025	0.0039	0.0013	0.0026
30	Liver	29	1.642	1.795	1.940	1.792

[a] Mean of duplicate analyses.

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TABLE C.3.3. Summary of Residue Data from Dairy Cow Feeding Study with Pyrasulfotole (AE 0317309).

Matrix	Feeding Level (ppm/day)	Residue Levels (ppm)						
		n	LOD	Min	Max	Median	Mean	Standard Deviation
Milk	30[a]	30	0.0015	0.0042	0.0134	0.0103	0.0096	0.0024
Milk	9	30		<LOD	0.0033	0.0024	0.0022	0.0007
Milk Fat	30	3	0.0003	0.0061	0.0085	0.0074	0.0073	0.0012
Milk Skim	30	3	0.0002	0.0086	0.0105	0.0090	0.0094	0.0010
Fat	3	3	0.0007	0.0017	0.0062	0.0040	0.0040	0.0022
	9	3		<LOD	0.0033	—	—	—
	30	3		0.0024	0.0143	0.0046	0.0071	0.0064
Kidney	3	3	0.0004	0.1748	0.2224	0.1973	0.1982	0.0238
	9	4		0.1232	0.4240	0.2420	0.2631	0.1515
	30	3		0.3778	0.4144	0.3811	0.3911	0.0202
Liver	3	3		1.019	1.230	1.187	1.145	0.1113
	9	3	0.0005	0.6922	1.594	1.577	1.288	0.5159
	30	3		1.642	1.939	1.795	1.792	0.1488
Muscle	3	3	0.0006	<LOD	0.0010	—	—	—
	9	3		<LOD	0.0007	—	—	—
	30	3		0.0013	0.0039	0.0025	0.0026	0.0013

[a] For milk samples at the 30 ppm level Day 0 were excluded from the statistical analysis because dosing was not started until Day 1 (*i.e.* Day 0 was predosing).

FIGURE C.1. Mean pyrasulfotole Residues in Whole Milk as a Function of Time.

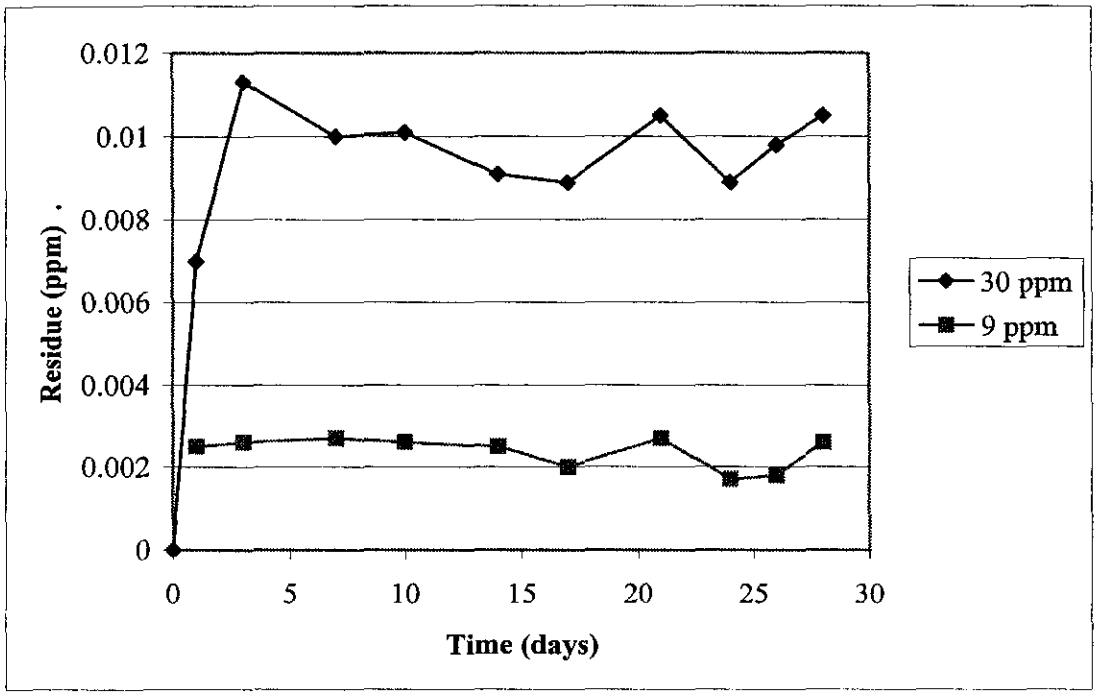

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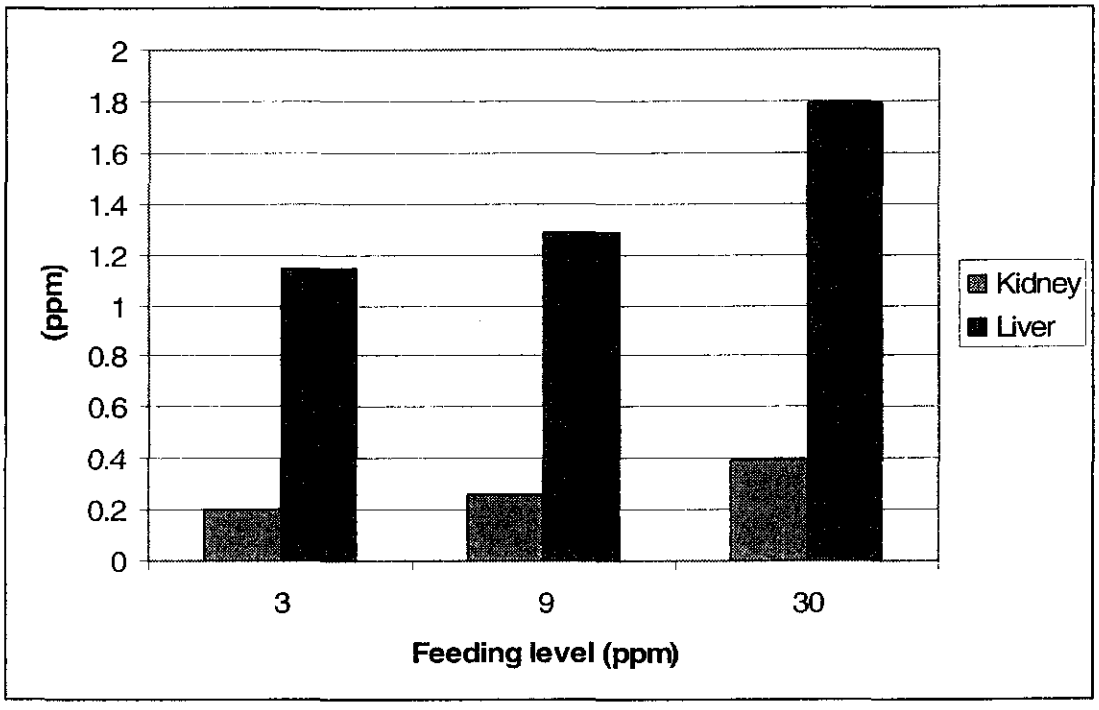
FIGURE C.2. Residues of Pyrasulfotole in Liver and Kidney Fed at 3, 9 and 30 ppm/day.



D. CONCLUSION

Dairy cows were fed pyrasulfotole at 0, 3, 9, or 30 ppm/day (dry weight basis) for 29 consecutive days. At the 30-ppm feeding level, residues of pyrasulfotole appeared to plateau in milk by day 3 (ca. 0.013 ppm). Residues did not concentrate in milk fat (cream) or skim milk. No residues of pyrasulfotole were observed above the LOQ in muscle samples. Only one composite sample of fat (0.014 ppm) had detectable residues above the LOQ. In contrast, there was evidence of an increased tissue load of pyrasulfotole in kidney and liver with increasing levels of administered pyrasulfotole. Residues ranged from 0.123 to 0.424 ppm (kidney) and from 0.692 to 1.940 ppm (liver).

E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. Müehlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

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4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Muhlberger, B. 2003. AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A. and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS). and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. Lam, C. K. and Qadri, S. S. (2005). An Analytical method for the determination of residues of AE 0317309 in animal tissues and milk using LC-MS/MS. Bayer CropScience Method Number AI-004-A05-01.

11. Lam, C. K. and. Qadri, S. S. (2005). Validation of Bayer CropScience Method AI-004-A05-01. Bayer CropScience Report Number RAAIX006.

F. DOCUMENT TRACKING

RDI: Raj Bhula; (August 25th); RDI: Louise G Croteau (3 November 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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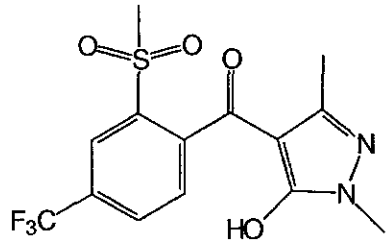
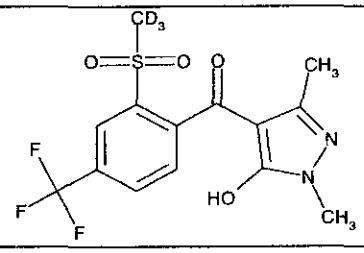
EPA's Records Disposition Schedule PEST 361 Scientific Data Reviews HED Records Center - File R153474 - Page 119 of 428

APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	

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Primary Evaluator	William S Mohan, Ph.D. Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Peer Reviewer	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801834 Milo, J., and A. M. Harbin. (2006). AE 0317309: Magnitude of the Residue in Corn and Soybeans Planted as Rotational Crops Following Treatment of Wheat with AE 0317309 02 SE06 A1 (120-Day Plant-back Interval). Lab Project Number: RAAIM012. Unpublished study prepared by Bayer CropScience, Inc. 220 p.

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EXECUTIVE SUMMARY:

AE 0317309 02 SE06 A1 (SE06), a suspo-emulsion containing the active ingredient (a.i.) pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone) (5% a.i.) and mefenpyr-diethyl (1.25% safener), was applied to wheat planted in silty loam soil at a nominal rate of 0.050 kg a.i./ha (0.044 lb a.i./A) with one application at three sites (NAFTA Regions 4 and 5) in 2004. The wheat crop was harvested and/or destroyed to allow planting of corn and soybeans with plant-back intervals (PBIs) of 114 to 123 days following the application to wheat.

The harvested samples were analyzed for residues of pyrasulfotole (AE 0317309) and the metabolites pyrasulfotole-benzoic acid (AE B197555) and pyrasulfotole-desmethyl (AE 1073910) by using high-performance liquid chromatography-electrospray ionization with tandem mass spectrometry (HPLC-MS/MS) and stable isotope labelled internal standards. The limit of quantitation (LOQ) for each analyte was 0.010 ppm in/on all matrices.

Samples in this study were stored for 134 days (4.5 months) in frozen storage (<-15°C). This falls within the predicted storage stability intervals for pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid in all corn and soybean raw agricultural commodities (RACs).

Maximum residues levels in 114-to 123-day PBI samples were less than the respective limits of detection (LODs) for pyrasulfotole and pyrasulfotole-desmethyl in all corn and soybean RACs. Maximum residues levels for pyrasulfotole-benzoic acid were 0.0018 ppm in corn forage, 0.0027 ppm in soybean forage, 0.0126 ppm in soybean hay and <LOD in corn grain, corn stover and soybean grain.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the field accumulation data in rotational crops are classified as scientifically acceptable. The number and location of limited field trials were in accordance with OPPTS Guideline 860.1500 or Directive 98-02; Section 9.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

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A. BACKGROUND INFORMATION

Pyrasulfotole is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

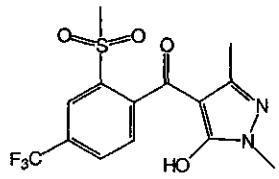
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol *n*-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol–water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 (nm) in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Study Site Information

TABLE B.1.1. Trial site conditions for corn and soybeans planted after application of AE 0317309 02 SE06 A1 to a target crop of wheat.

Study Location (City, State)	Trial Number	Plot [b]	Study Period	Soil Characteristics				Meteorological Data [a]	
				Type	% OM	pH	CEC	Total Rainfall in (cm)	Temp. Range °F (°C)
Leland, MS	AI089-04RA	TRTCO	03/04–10/04	Silt Loam	0.6	6.26	7.6	34.5 (87.6)	34–97 (1–31)
Leland, MS	AI089-04RB	TRTSY	03/04–09/04	Silt Loam	0.6	6.26	7.6	28.9 (73.4)	34–97 (-2–23)
Stilwell, KS	AI090-04RA	TRTCO	02/04–11/04	Silt Loam	1.6	6.0	12	39.2 (99.6)	25–96 (4–38)
Stilwell, KS	AI090-04RB	TRTSY	02/04–11/04	Silt Loam	1.6	6.0	12	39.2 (99.6)	25–96 (4–38)
Seymour, IL	AI091-04RA	TRTCO	02/04–10/04	Silt Loam	3.4	6.2	17	27.9 (70.9)	17–91 (-2–22)
Seymour, IL	AI091-04RB	TRTSY	02/04–10/04	Silt Loam	3.4	6.2	17	30.2 (76.7)	17–91 (-1–25)

[a] The data is for the interval from planting of the rotatational crop to the last sampling.
[b] Plot identification as follows:
TRTCO = Field corn grown as a rotational crop; TRTSY = Soybeans grown as a rotational crop.
The application of AE 0317309 02 SE06 A1 was made to winter wheat.

Actual and historical temperatures and rainfall data were provided. During the course of the study actual recordings were comparable to historical values, with the exception of trial AI089-04R where the total rainfall during the study period was twice the historical average (TABLE B.1.1.) As a result, soybean grain samples in both the control and treated plots were harvested outside the normal percent dry matter ranges, however this did not appear to substantially affect residue levels.

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TABLE B.1.2. Study Use Pattern.

Study Location (City, State)	Trial Number	Year	Application Details						Tank Mix/ Adjuvants
			Method Timing	Plot	Volume GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI (days)	Total Rate lb a.i./A (kg a.i./ha)	
Leland, MS Region 4	AI089-04RA	2004	Foliar	TRTCO	17 (154)	0.044 (0.050)	NA	0.011 (0.012)	No
Leland, MS Region 4	AI089-04RB	2004	Foliar	TRTSY	17 (155)	0.044 (0.050)	NA	0.011 (0.012)	No
Stilwell, KS Region 5	AI090-04RA	2004	Foliar	TRTCO	13 (122)	0.044 (0.049)	NA	0.011 (0.012)	No
Stilwell, KS Region 5	AI090-04RB	2004	Foliar	TRTSY	13 (123)	0.044 (0.049)	NA	0.011 (0.012)	No
Seymour, IL Region 5	AI091-04RA	2004	Foliar	TRTCO	16 (152)	0.045 (0.051)	NA	0.011 (0.013)	No
Seymour, IL Region 5	AI091-04RB	2004	Foliar	TRTSY	16 (152)	0.045 (0.051)	NA	0.011 (0.013)	No

EP = End-use Product.
GPA = Gallons per acre, L/ha
TRTCO = Field corn grown as a rotational crop; TRTSY = Soybeans grown as a rotational crop.
RTI = Retreatment Interval.

B.2. Sample Handling and Preparation

The RACs of corn and soybeans were harvested at normal commercial maturity. Corn forage was collected at dough/early dent (BBCH 85 to 87) and grain and fodder (stover) were collected at commercial harvest (BBCH 89). For soybeans, forage was collected at late flowering to the end of flowering (BBCH 67 to 69), hay was collected at late flowering to 50% pods have reached final length (BCH 67 to 75), and grain was collected at normal to late harvest (BBCH 89 to 96). The only exception to this was field trial AI089-04RB, where the soybean seed from both the control and treated plots did not reach maturity due to cold and wet weather; for this trial only forage and hay were collected.

Duplicate composite samples (two separate runs through the plot) were collected from each treated plot and a single sample from each control plot. Corn forage consisted of the entire aerial portion of the plant, and stover was considered the mature dried stalks from which ears (cob and grain) had been removed. For corn stover, a minimum of 12 stalks were divided into three equal lengths, and four groups of top, middle, and bottom portions were sampled. For all other RAC matrices a minimum of 1 kg sample was collected from at least 12 separate areas of the plot.

All samples were frozen within 2 hours of collection. Corn and soybean RACs were homogenized by grinding in a chopper (Robot Coupe, Jackson, MS) in the presence of dry ice then returned immediately to frozen storage. The samples remained in frozen storage at all times except during subsampling for analyses.

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B.3. Analytical Methodology

Residue data for corn and soybean RACs were obtained using the analytical method AI-001-P04-01 for determining total pyrasulfotole (pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl) residues in plant matrices.[10, 11] In this method, HPLC-MS/MS is used to quantify residues of pyrasulfotole, pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl from a single sample using isotope labelled internal standards and a nine-level calibration curve.[10] Briefly, residues are extracted from homogenized wheat samples with acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) at 60°C for at least 30 minutes. After cooling, a mixture of isotope labelled internal standards is added to the sample extract and mixed. A small aliquot (about 1.25 mL) is purified by C18 solid-phase extraction (SPE), followed by chromatographic analysis involving gradient elution from a Gemini C-18 (50 x 2.0 mm) with aqueous 10 mM NH_4HCO_3 solution and methanol as the mobile phase components. An electrospray interface in the negative ion mode is used to introduce the sample into the MS.

All reference standards were corrected for purity and prepared in pyrasulfotole molar equivalents during initial standard solution preparation; therefore, all residues are reported in pyrasulfotole equivalents.

In the present study, detector response was linear over the range of 0.005 ppm to 2.5 ppm for all analytes with associated correlation coefficients of >0.998. The analytical standards for pyrasulfotole and the metabolites were >96.7% pure.

C. RESULTS AND DISCUSSION

The samples in this study were frozen for a maximum of 134 days (4.5 months) prior to analysis for pyrasulfotole and the metabolites (TABLE C.2.). Storage stability data were not provided for corn and soybean RACs, however wheat storage stability data were translated to corn and soybean RACs.[12, 13] The data suggest that residues of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid were stable in all corn and soybean matrices for the duration of storage (FIGURE C.1.).

Method validation for pyrasulfotole and the metabolites was performed using various spiking levels on wheat RACs (TABLE C.1.). At the respective LOQ for the various wheat matrices, the concurrent recoveries for pyrasulfotole and the metabolites ranged form 80% to 110%. Therefore, the method is deemed suitable for data gathering. The LOQ for all analytes was 0.010 ppm in both corn and soybean.

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The determination of certain LODs values were previously performed during method development[14] in various cereal matrices such as soybean grain, corn grain, corn stover, wheat forage, barley grain, and barley hay. The previously established LODs in soybean grain were 0.0015 ppm for pyrasulfotole, 0.0012 ppm for pyrasulfotole-benzoic acid and 0.0014 ppm for pyrasulfotole-desmethyl. The calculated LODs in corn grain were 0.0020 ppm for pyrasulfotole, 0.0014 ppm for pyrasulfotole-benzoic acid and 0.0012 ppm for pyrasulfotole-desmethyl. The calculated LODs in corn stover were 0.0011 ppm for pyrasulfotole, 0.0020 ppm for pyrasulfotole-benzoic acid and 0.0017 ppm for pyrasulfotole-desmethyl. In those cases where the LOD had not been previously determined, the LOD was translated from the appropriate RAC.[10,11] Therefore, the LOD established for wheat forage was translated to corn forage and soybean forage. The LOD established for barley hay was translated to soybean hay. Therefore, the calculated LODs in corn forage and soybean forage were 0.0010 ppm for pyrasulfotole, 0.0009 ppm for pyrasulfotole-benzoic acid and 0.0008 ppm for pyrasulfotole-desmethyl. The calculated LODs in soybean hay were 0.0009 ppm for pyrasulfotole, 0.0029 ppm for pyrasulfotole-benzoic acid and 0.0008 ppm for pyrasulfotole-desmethyl. Any analyte residue value that was below the LOD was reported as "<LOD."

Uncorrected residue values are listed in TABLE C.3. Maximum residues levels in 114- to 123-day PBI samples were <LOD for pyrasulfotole and pyrasulfotole-desmethyl in all corn and soybean RACs. Maximum residues levels of pyrasulfotole-benzoic acid in 114- to 123-day PBI samples were 0.0018 ppm in corn forage, 0.0027 in soybean forage, 0.0126 in soybean hay and <LOD in corn grain, corn stover and soybean grain (TABLE C.4.).

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TABLE C.1. Summary of Concurrent Recoveries in Corn and Soybean Matrices.

Matrix	Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Corn Forage	AE B197555	0.01	3	98, 94, 90	94 ± 4
		0.25	3	97, 97, 98	97 ± 0.6
	pyrasulfotole-desmethyl	0.01	3	94, 93, 89	92 ± 2.1
		0.25	3	102, 100, 104	102 ± 2.1
	pyrasulfotole	0.01	3	92, 91, 86	90 ± 3.6
		0.25	3	98, 96, 96	97 ± 1.3
Corn Grain	pyrasulfotole-benzoic acid	0.01	3	92, 97, 93	94 ± 2.5
		0.25	3	97, 99, 101	99 ± 2.1
	pyrasulfotole-desmethyl	0.01	3	96, 97, 94	95 ± 1.6
		0.25	3	104, 103, 104	104 ± 0.5
	pyrasulfotole	0.01	3	90, 95, 86	91 ± 4.4
		0.25	3	96, 96, 99	97 ± 1.6
Corn Stover	pyrasulfotole-benzoic acid	0.01	3	97, 92, 96	95 ± 2.5
		0.25	3	94, 95, 94	94 ± 0.3
	pyrasulfotole-desmethyl	0.01	3	94, 88, 88	90 ± 3.5
		0.25	3	95, 101, 99	98 ± 3.1
	pyrasulfotole	0.01	3	93, 87, 84	88 ± 4.9
		0.25	3	94, 97, 98	96 ± 2.1
Soybean Forage	pyrasulfotole-benzoic acid	0.01	4	90, 90, 90, 88	89 ± 0.9
		0.25	3	97, 97, 97	97 ± 0.2
	pyrasulfotole-desmethyl	0.01	4	86, 85, 86, 94	88 ± 4.1
		0.25	3	102, 99, 104	102 ± 2.3
	pyrasulfotole	0.01	4	82, 86, 84, 84	84 ± 1.8
		0.25	3	99, 99, 100	99 ± 0.5
Soybean Hay	pyrasulfotole-benzoic acid	0.01	4	92, 95, 110, 92	97 ± 8.7
		0.25	3	93, 96, 94	95 ± 1.3
	pyrasulfotole-desmethyl	0.01	4	94, 90, 88, 93	91 ± 3
		0.25	3	100, 100, 99	100 ± 0.6
	pyrasulfotole	0.01	4	86, 90, 80, 84	85 ± 4.3
		0.25	3	96, 95, 95	95 ± 0.7
Soybean Grain	pyrasulfotole-benzoic acid	0.01	3	91, 88, 95	92 ± 3.5
		0.25	3	102, 98, 99	100 ± 1.8
	pyrasulfotole-desmethyl	0.01	3	97, 95, 96	96 ± 1.1
		0.25	3	103, 104, 101	103 ± 1.4
	pyrasulfotole	0.01	3	89, 88, 93	90 ± 2.4
		0.25	3	96, 99, 95	97 ± 2.1

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TABLE C.2. Summary of Storage Conditions for Corn and Soybean RACs.

Residue Component(s)	RAC	Storage Temperature (°C)[a]	Actual Sample Storage Duration (days)[b]	Interval of demonstrated storage stability (days)[c]
pyrasulfotole	Corn Forage	≤ -15	122	180 [d]
pyrasulfotole-benzoic acid		≤ -15	122	180 [d]
pyrasulfotole-desmethyl		≤ -15	122	180 [d]
pyrasulfotole	Corn Grain	≤ -15	70	180 [e]
pyrasulfotole-benzoic acid		≤ -15	70	180 [e]
pyrasulfotole-desmethyl		≤ -15	70	180 [e]
pyrasulfotole	Corn Fodder	≤ -15	70	180 [f]
pyrasulfotole-benzoic acid		≤ -15	70	180 [f]
pyrasulfotole-desmethyl		≤ -15	70	180 [f]
pyrasulfotole	Soybean Forage	≤ -15	134	180 [d]
pyrasulfotole-benzoic acid		≤ -15	134	180 [d]
pyrasulfotole-desmethyl		≤ -15	134	180 [d]
pyrasulfotole	Soybean Hay	≤ -15	134	180 [f]
pyrasulfotole-benzoic acid		≤ -15	134	180 [f]
pyrasulfotole-desmethyl		≤ -15	134	180 [f]
pyrasulfotole	Soybean Grain	≤ -15	80	180
pyrasulfotole-benzoic acid		≤ -15	80	180
pyrasulfotole-desmethyl		≤ -15	80	180

[a] Storage temperature from receipt at the Bayer Research Park through last sample extraction.
[b] Field sampling date through the last sample extraction date.
[c] See Bayer CropScience Report No. RAAEX009.
[d] Stability in wheat forage is representative of the stability to be expected in corn forage and soybean forage.
[e] Stability in wheat grain and soybean grain are representative of the stability to be expected in corn grain.
[f] Stability in wheat hay is representative of the stability to be expected in corn fodder and soybean hay.

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TABLE C.3. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City State	Trial ID	Year	Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PBI[1] (days)	Harvest DAP[2] (days)	Individual Analyte Residue (ppm)		
									pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl	pyrasulfotole
Leland MS	AI089-04R	2004	4	G-90	Corn forage	0.044 (0.050)	118	71	0.0017	<LOD	<LOD
									0.0018	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Asgrow 8888	Corn forage	0.044 (0.049)	123	71	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P39A30	Corn forage	0.045 (0.051)	114	106	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Leland MS	AI089-04R	2004	4	G-90	Corn Grain	0.044 (0.050)	118	108	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Asgrow 8888	Corn Grain	0.044 (0.049)	123	139	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P39A30	Corn Grain	0.045 (0.051)	114	127	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Leland MS	AI089-04R	2004	4	G-90	Corn Stover	0.044 (0.050)	118	108	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Asgrow 8888	Corn Stover	0.044 (0.049)	123	139	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P39A30	Corn Stover	0.045 (0.051)	114	127	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Leland MS	AI089-04R	2004	4	AG5903	Soybean Forage	0.044 (0.050)	118	54	0.0027	<LOD	<LOD
									0.0026	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Fontanelle	Soybean Forage	0.044 (0.049)	123	71	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P93B09	Soybean Forage	0.045 (0.051)	114	59	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Leland MS	AI089-04R	2004	4	AG5903	Soybean Hay	0.044 (0.050)	118	57	0.0126	<LOD	<LOD
									0.0121	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Fontanelle	Soybean Hay	0.044 (0.049)	123	71	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P93B09	Soybean Hay	0.045 (0.051)	114	59	<LOD	<LOD	<LOD
									0.0030	<LOD	<LOD
Stilwell KS	AI090-04R	2004	5	Fontanelle	Soybean Grain	0.044 (0.049)	123	139	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD
Seymour IL	AI091-04R	2004	5	P93B09	Soybean Grain	0.045 (0.051)	114	113	<LOD	<LOD	<LOD
									<LOD	<LOD	<LOD

[1] DAP = Days After Planting.
[2] PBI = Plant Back Interval.

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TABLE C.4. Summary of Residue Data in Rotational Crops Following Primary Treatment with AE 0317309 02 SE06 A1.

Commodity	Applic. Rate lb a.i./A (kg a.i./ha)	PBI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
pyrasulfotole-benzoic acid									
Corn forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	0.0018	0.0018	<LOD	<LOD	<LOD
Corn Grain	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Corn Stover	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	0.0027	0.0026	<LOD	<LOD	<LOD
Soybean Grain	0.044–0.045 (0.049–0.051)	114-123	4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Hay	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	0.0126	0.0124	<LOD	0.0053	0.0055
pyrasulfotole-desmethyl									
Corn forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Corn Grain	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Corn Stover	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Grain	0.044–0.045 (0.049–0.051)	114-123	4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Hay	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
pyrasulfotole									
Corn forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Corn Grain	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Corn Stover	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Forage	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Grain	0.044–0.045 (0.049–0.051)	114-123	4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Soybean Hay	0.044–0.045 (0.049–0.051)	114-123	6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

HAFT = Highest Average Field Trial.
PBI = Plant Back Interval.

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D. CONCLUSION

With one exception, the maximum residue levels in 114- to 123- day PBI samples were <0.01 ppm for pyrasulfotole, pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl in corn forage, corn grain, corn stover, soybean forage, soybean grain and soybean hay. The only exception was in soybean hay, an animal feedstuff and not a commodity for human consumption, where pyrasulfotole-benzoic acid residue levels are not expected to exceed 0.0126 ppm.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of pyrasulfotole: substance, pure code: pyrasulfotole 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of pyrasulfotole. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). Pyrasulfotole - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of pyrasulfotole at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). pyrasulfotole: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). Pyrasulfotole: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). Pyrasulfotole: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. MRID No. 46801806 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01. An analytical method for the determination of residues of

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pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using LC-MS/MS.

11. MRID No. 46801808 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Extraction efficiency of Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using lc/ms/ms. Bayer CropScience Report No. RAAIX011.

12. MRID No. 46801819 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Storage stability of pyrasulfotole, AE1073910, and AE B197555 in soybean grain, wheat grain, wheat forage, and wheat hay. Bayer CropScience Study No. RAAIX009.

13. MRID No. 46801819 Coopersmith, H. (2006). Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (6 December 2006); George Kramer (6 December 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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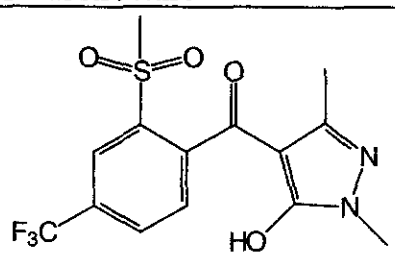
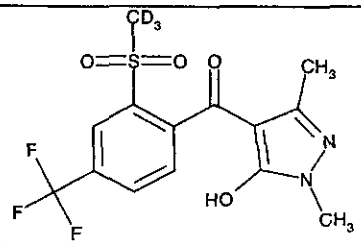
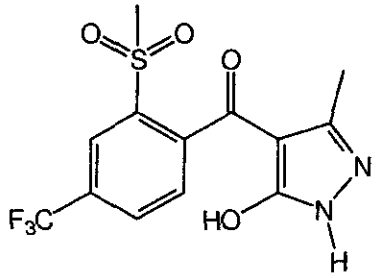
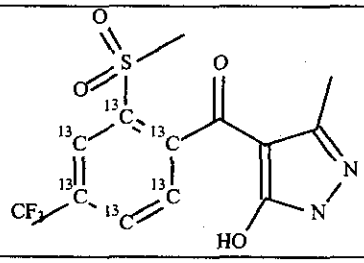
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 107391 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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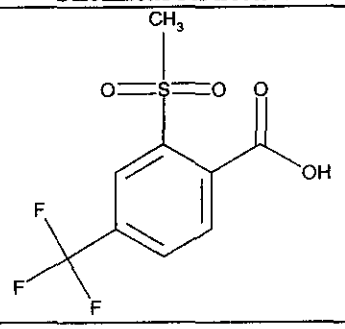
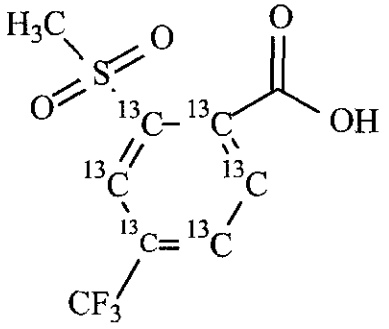
Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801833 Beedle, Ellen C. (8 February 2006). The Accumulation of [Phenyl-UL-^{14}C] and [Pyrazole-3-^{14}C] AE 0317309 in Confined Rotational Crops: Bayer CropScience Study Identification Numbers: A9051601/MEAIX002 and A9051602/MEAIM001. Unpublished Bayer CropScience Report Number: 201152. 115 pages.

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0.001 ppm) for the [phenyl-U-^{14}C]-label study. Pyrasulfotole was the only identified component in the 120-DAT wheat hay and straw samples (3-9% of the TRR; <0.001-0.002 ppm) for the [pyrazole-3-^{14}C]-label study. Multiple components were characterized as ACN/H2O soluble or remaining solid phase extraction fractions in wheat matrices for the [phenyl-U-^{14}C]-label (3.9-47.2% of the TRR; 0.001-0.025 ppm) and the [pyrazole-3-^{14}C]-label (37-50% of the TRR; 0.003-0.013 ppm).

For the 120-DAT and 301-DAT wheat samples, remaining solids ranged from 3.1 to 12.6% of the TRR (0.001-0.008 ppm), and 4.1 to 29.0% of the TRR (0.001-0.005 ppm) for the [phenyl-U-^{14}C]-label study, respectively. Unextractable residues were 40 to 47% of the TRR (0.006-0.008 ppm) in wheat hay and straw for the [pyrazole-3-^{14}C]-label study.

The metabolic breakdown of pyrasulfotole involved the cleavage of the complete pyrazole moiety yielding the benzoic acid metabolite (AE B1975555).

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the confined rotational crop metabolism data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practive (GLP), Quality Assurance, and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

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TABLE A.1. Test Compound Nomenclature.

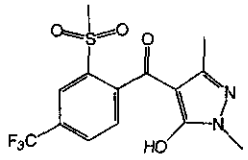
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; suspo-emulsion AE 0317309 02 SE06 A1

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point/range	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Test Site and Crop Information

TABLE B.1.1. Test Site Information.

Testing Environment and location	Soil characteristics						
	Type	% Sand	% Silt	% Clay	%OM	pH	CEC
[Phenyl-UL-^{14}C] and [Pyrazole-3-^{14}C] Test system 1: Oval tub with 2.03 m^2 surface area moved between greenhouse and patio as needed.	Sandy Loam	62	22	16	2.4	7.4	9.3
[Phenyl-UL-^{14}C] and [Pyrazole-3-^{14}C] Test system 2: Oval tub with 1.85 m^2 surface area moved between greenhouse and patio as needed.	Sandy Loam	62	24	14	4.2	7.1	10.2

TABLE B.1.2. Crop Information.

Crop/crop group	Variety	Plant-back Interval (days)	Growth stage at harvest	Harvested RAC	Harvesting procedure
Wheat/small grain	Butte 86 HRSW	120	Beginning of stem elongation	Forage	Manual-cut approx. 2.5 cm inch above soil surface
Wheat/small grain	Butte 86 HRSW	120	Heading	Hay	Manual-cut approx. 2.5 cm above soil surface, dried in greenhouse
Wheat/small grain [pyrazole-3-^{14}C] AE 0317309 study	Butte 86 HRSW	120	Dough (ripening)[a]	Straw and grain	Manual-cut stalks at damage point[a]; head separated from straw; grain separated from heads by hand
Wheat/small grain [phenyl-UL-^{14}C] AE 0317309 study	Butte 86 HRSW	120	Maturity	Straw and grain	Manual-cut stalks approx. 2.5 cm above soil surface; head separated from straw; grain separated from heads by hand or food mill
Wheat/small grain	Arapahoe HRWW	301	Leaf development	Forage	Manual-cut approx. 2.5 cm above soil surface
Wheat/small grain	Arapahoe HRWW	301	Heading/flowering	Hay	Manual-cut approx. 2.5 cm above soil surface, dried in greenhouse
Wheat/small grain	Arapahoe HRWW	301	Maturity	Straw and grain	Manual-cut stalks approx. 2.5 cm above soil surface; head separated from straw; grain separated from heads by hand or food mill
Swiss Chard/leafy vegetable	Luccullus	122	Maturity	Leaves	Manual-cut just above soil surface
Turnips/root crop	Purple Top	122	Maturity	Roots and tops	Manual-removed from soil, rinsed gently, tops cut from roots

[a] Due to some damage to the crop caused by storms (wind) and fungus, broken stalks were collected during ripening at milk to dough stage. An additional harvest was conducted 13 days later, however these grain and straw samples were inadvertently contaminated. Therefore, the first harvest of grain and straw samples for the [pyrazole-3-^{14}C] study were used for the 120-DAT analysis.

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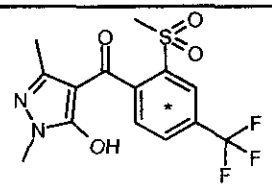
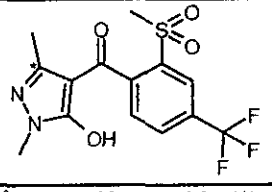
B.2. Test Materials

TABLE B.2.1. Test Material Characteristics.

Chemical structure				
Radiolabel position	Phenyl-UL, Denoted by asterisks (*)		Pyrazole-3[a], Denoted by asterisks (*)	
	System 1	System 2	System 1	System 2
Lot No.	Vial C-929	Vial C-980A	Vial C-930	Vial C-979A
Purity	100%	97.5%	100	96.9
Specific activity (Bq)[a]	1159 MBq/mmol 3.20 MBq/mg		1160 MBq/mmol 3.20 MBq/mg	1157 MBq/mmol 3.19 MBq/mg
Specific activity (dpm)[b]	192,000 dpm/µg		192,000 dpm/µg	191,000 dpm/µg
Specific activity (mCi)	31.33 mCi/mmole		31.35 mCi/mmole	31.28 mCi/mmole

[a] Bq = disintegrations per second
[b] dpm = disintegrations per minute

B.3. Study Use Pattern

TABLE B.3.1. Use Pattern Information.

Chemical name	Methanone, (5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]
Application method	Spray application to bare soil
Application rate	82 g a.i./ha
Number of applications	1
Timing of applications	Approximately 120 and 301 days prior to planting crops
PHI (days)	PHI is not relevant to the confined rotational crop study. The PBI (plant back interval) for this study was 120 days and 301 days.

B.4. Identification/Characterization of Residues

B.4.1. Sample Preparation

Wheat grain was homogenized using a model SD-45 Tissumizer® in the presence of liquid nitrogen. Other matrices were homogenized using a model RSI BS6 Blixer® in the presence of dry ice. The homogenized samples (RACs) were poured into double plastic bags and stored open in the freezer to allow the dry ice or nitrogen to evaporate. The plastic bags were sealed and the frozen samples were stored in the freezer except during sub-sampling for analysis. Aliquots (0.14 g to 0.31 g) the homogenized crops were oxidized to determine the TRR levels.

Specific details related to the extraction of radioactive residues from each RAC are given below and in FIGURES B.4.1.2.4.1- B.4.1.2.4.3. Aliquots (20 to 82 g) of each RAC with a TRR greater than 0.010 ppm were extracted using the same general procedure described below. Samples were blended with ACN/H_2O (4:1), and if necessary, refluxed with MeOH followed by an acid (1*N* HCl) and a base (1*N* NaOH) reflux.

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An aliquot of the RAC was weighed into one or more centrifuge jars. Each jar was blended with 100 to 150-mL of ACN/H_2O (4:1) using an Ultra-Turrax or equivalent for about 3 minutes. The samples were centrifuged, and the supernatants were decanted from the solids into a graduated mixing cylinder. For the contents of each centrifuge jar, the extraction and centrifugation were repeated two times. The combined ACN/H_2O extract was radioassayed. The ACN/H_2O extract was concentrated using a Büchi rotary evaporator at 25 to 35°C.

Each extract was purified with solid phase extraction cartridges. A general procedure is described here. The details of and minor variations from this procedure are shown in the RAC flow diagrams. Each concentrated extract was dissolved in either ACN/H_2O (1:1) or ACN/H_2O (1:9) with 0.1% trifluoroacetic acid (TFA) and loaded onto 10-g C-18 SPE cartridges (2 to 8 cartridges) previously conditioned with ACN followed by the solvent mixture of the dissolved extract. The initial effluent from the cartridges was collected, the cartridges were rinsed with solvent mixture of the dissolved extract, and the cartridges were eluted with ACN/H_2O (1:1), ACN/H_2O (4:1), and/or ACN, if needed. Each eluate was collected separately and radioassayed. Appropriate eluates were combined and concentrated to near dryness using the Büchi rotary evaporator, and 1:9 ACN/H_2O with 0.1% TFA was added. The sample was radioassayed and analyzed by HPLC. The solids were dried under a gentle stream of nitrogen.

The ACN/H_2O extracted solids were suspended in 400 mL of MeOH. The mixture was refluxed for approximately 4 hours, and was cooled overnight. The sample was centrifuged, and the supernatant was decanted from the solids and filtered through a Whatman filter supported on a Buchner funnel. The solids were rinsed with MeOH, and the centrifugation and filtration were repeated. The combined extract was radioassayed. The solids were dried under a gentle stream of nitrogen.

The MeOH extracted solids were suspended in 400 mL of 1 *N* HCl. The mixture was refluxed for approximately 4 hours, and was cooled overnight. The sample was centrifuged, and the supernatant was decanted from the solids and filtered through two Whatman filters supported on a Buchner funnel. The solids were rinsed with H_2O, and the combined extract was neutralized and radioassayed. The solids were dried under a gentle stream of nitrogen.

The base extracted solids were suspended in 400 mL of 1 *N* NaOH. The mixture was refluxed for approximately 4 hours, and was cooled overnight. The sample was centrifuged, and the supernatant was decanted from the solids and filtered through two Whatman filters supported on a Buchner funnel. The solids were rinsed with H_2O, and the combined extract was neutralized and radioassayed. The solids were dried under a gentle stream of nitrogen and radioassayed.

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B.4.1.2.4. Flow Diagrams of the Extraction and Analysis Schemes

FIGURE B.4.1.2.4.1. Extraction and analysis scheme for wheat forage and wheat grain.

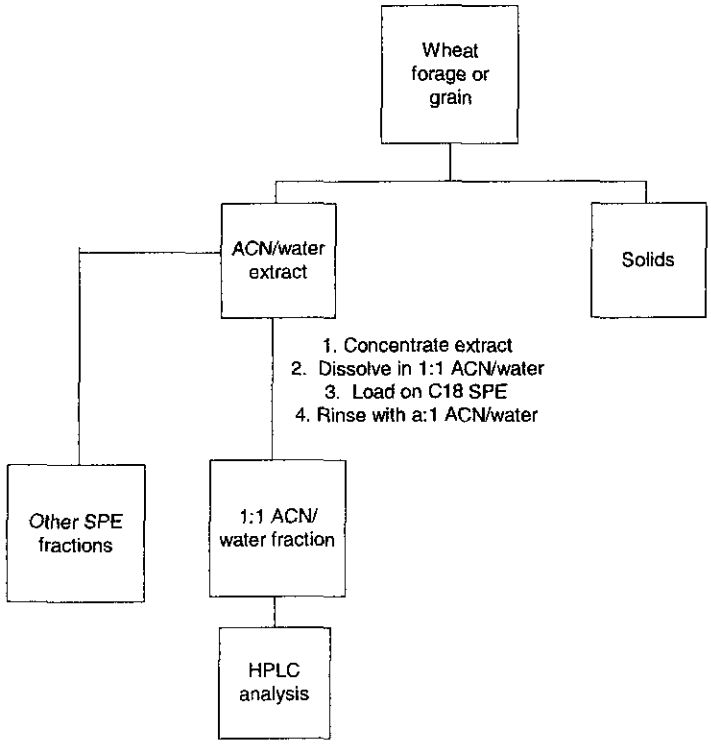

FIGURE B.4.1.2.4.2. Extraction and analysis scheme for wheat hay.

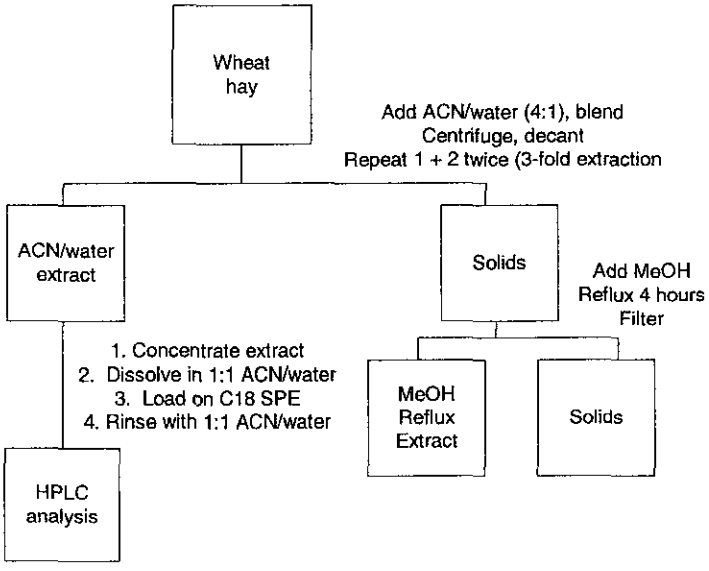

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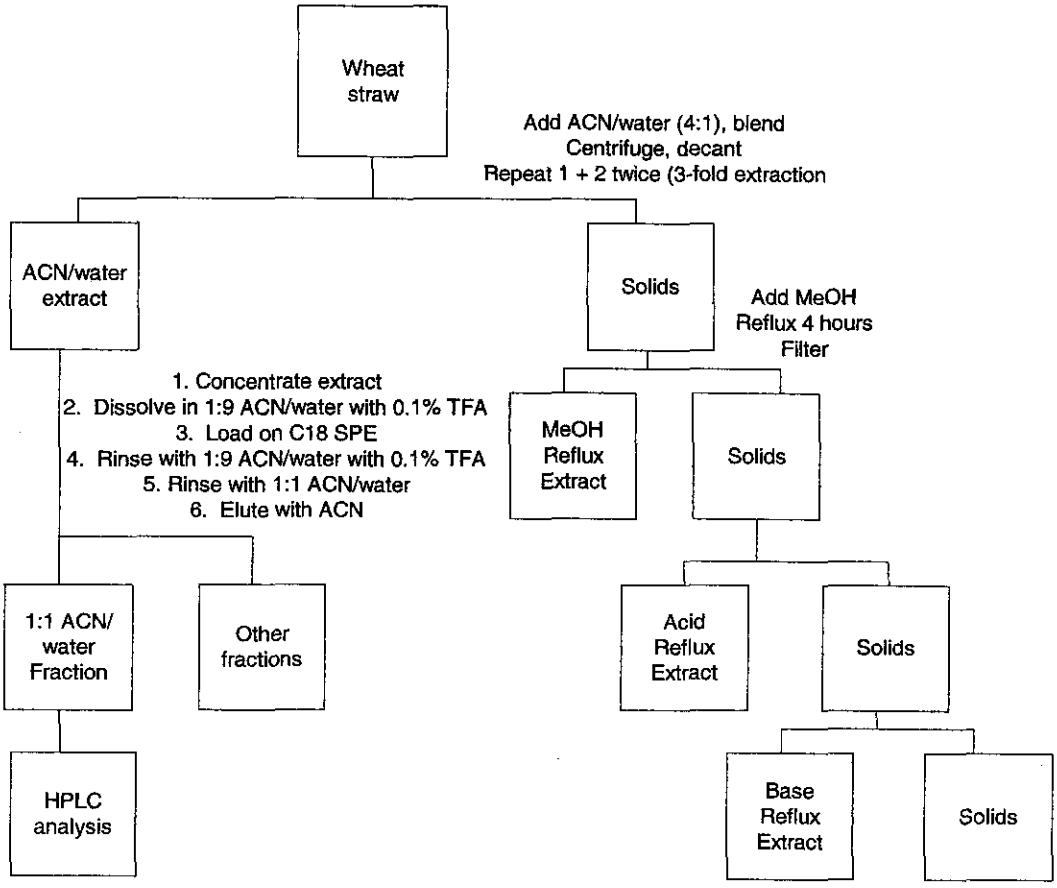
FIGURE B.4.1.2.4.3. Extraction and analysis scheme for wheat straw.



B.4.2. Analytical Methodology

B.4.2.1. Measurement of Radioactivity

Liquid samples (0.010 to 5.0 mL) were mixed with 6 to 18 mL of Ultima Gold scintillation fluid and radioassayed in a Beckman Model LS 6000 LL liquid scintillation counter (LSC). Data were processed with Beckman data reduction software.

Aliquots (0.14 to 0.32 g) of solid samples were oxidized, and radioassayed.

B.4.2.2. High Performance Liquid Chromatography (HPLC)

HPLC analysis of the treatment solution for [phenyl-UL-^{14}C] and [pyrazole-3-^{14}C] test system 1 studies was performed with a Beckman System Gold Chromatographic system consisting of a Beckman Model 128 solvent module and a Beckman Model 166 variable wavelength detector. The chromatographic system was connected to a radioactivity detector. Data were collected and analyzed by a Beckman Gold Nouveau Chromatography Workstation.

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All other HPLC analyses were performed on a Hewlett Packard Model 1100 gradient HPLC system, which included an HP 1100 series binary pump, a variable wavelength detector, and a manual injector. The chromatographic system was connected to a radioactivity detector.

TABLE B.4.2. Limits of Detection and Quantitation.

Study	Background	Counting Efficiency		Specific Activity	Sample Volume	Aliquot Size	LSC LOQ	Combustion LOQ	HPLC LOD
		Combustion	LSC	dpm/µg	mL	g	µg/mL	µg/g	µg
Phenyl-label	25 dpm	82%	90%	192,000	1	0.1	0.0003	0.0016	0.0012
Pyrazole-label	25 dpm	82%	90%	192,000	1	0.1	0.0003	0.0016	0.0013

B.4.2.3. Mass Spectrometry

Mass spectral analyses of treatment solutions were performed with either a TSQ 7000 or TSQ Quantum mass spectrometer. Each spectrometer was connected to an HPLC system consisting of a ThermoFinnegan quaternary solvent pump, an autosampler, and either a Phenomenex Luna 5µ C8(2), 250 mm x 4.6 mm reverse phase column or a Zorbax 5µ Rx C8, 250 mm x 4.6 mm reverse phase column.

The negative ion electrospray LC-MS analyses used solvent A (0.1% formic acid) and solvent B (MeOH) in combination as the mobile phase at a flow rate of 0.8 mL/min. The flow from the column was split to deliver 0.2 mL/min to the electrospray interface and 0.6 mL/min to a radiodetector. The HPLC program consisted of an initial isocratic hold at 5% solvent B for 1 minute followed by a linear ramp from 5 to 100% solvent B over 11 minutes and an isocratic hold at 100% B for 3 minutes.

Daughter ion spectra were produced by liquid chromatography/mass spectrometry-mass spectrometry (LC-MS/MS). The first quadrapole of the TSQ 7000 was used to isolate a precursor ion, and the second stage of the instrument was used to induce fragmentation of the precursor ion by collision with argon gas at approximately 1.5 to 2.3 mTorr and collision energy of about 20 eV. The second quadrapole of the instrument was used to measure the mass spectra of the resultant molecular fragments.

C. RESULTS AND DISCUSSION

TRR in rotational crops are reported in TABLE C.2.1. The distribution of radioactivity in rotational crops is reported in TABLE C.2.2.a, TABLE C.2.2.b and TABLE C.2.2.c. Characterization and identification of radioactive residues is summarized in TABLE C.2.3.a, TABLE C.2.3.b and TABLE C.2.3.c.

Distribution of total radioactive residues:

After application of [phenyl-UL-^{14}C]-pyrasulfotole, the TRR for the 120-DAT wheat forage, hay, straw, and grain samples were 0.027 ppm, 0.061 ppm, 0.023 ppm, and 0.031 ppm,

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respectively. The TRR in the 122-DAT Swiss chard, turnip tops, and turnip roots were 0.007 ppm, 0.008 ppm, and 0.002 ppm, respectively. The TRR in the 301-DAT wheat forage, hay, straw, and grain were 0.085 ppm, 0.036 ppm, 0.016 ppm, and 0.011 ppm, respectively. The TRR reported for the [pyrazole-3-^{14}C] study at 120-day plant back interval in wheat forage, hay, straw, and grain were 0.004 ppm, 0.012 ppm, 0.021 ppm, and 0.003 ppm, respectively. At the 122-day plant back interval, Swiss Chard, turnip tops and roots samples, TRR were 0.003 ppm, 0.005 ppm, and 0.001 ppm, respectively. At the 301-day plant back interval, residue levels in wheat forage, hay, straw, and grain were 0.005 ppm, 0.008 ppm, 0.005 ppm, and 0.005 ppm, respectively. After application of [phenyl-UL-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole, Swiss chard and turnips were not included in the 10-month PBI planting because residues were less than 0.01 ppm.

Characterization and identification of total radioactive residues:

The major component of the combined ACN/H2O extracts was isolated by preparative HPLC and subjected to mass spectrometry. Pyrasulfotole was confirmed by negative ion LC-MS with a parent ion at m/z 361 $(M-1)^+$. The negative ion LC-MS/MS daughter ion spectrum of the m/z 361 and HPLC retention time were both identical to an authentic pyrasulfotole standard (MW=362). The pyrasulfotole-benzoic acid metabolite was identified based on its HPLC retention time relative to an authentic standard of AE B197555. Also, the negative ion LC-MS was compared with the negative ion LC-MS of the [^{14}C]-AE B197555 standard (pyrasulfotole-benzoic acid). Both spectra showed a parent ion at m/z 267. The LC-MS/MS daughter ion spectra of the m/z 267-precursor ion showed a fragment at m/z 223, arising from the loss of –COOH. The retention time corresponded to that of the standard.

120-DAT and 301-DAT Wheat Forage

Extraction of 120-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat forage samples with ACN/H_2O (4:1) released 94.1% of the TRR (0.025 ppm). The HPLC profile of the ACN/H_2O extract showed three components (ph-1, ph-3 and ph-5). The remaining solids contained 6% of the TRR (0.002 ppm). The 120-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat forage sample was not extracted because the TRR was <0.01 ppm.

Component ph-5 (90.2% of the TRR; 0.024 ppm) was positively identified as pyrasulfotole-benzoic acid (AE B197555). Components ph-1 (1.4% of the TRR; <0.001 ppm) and ph-3 (2.5% of the TRR; 0.001 ppm) were characterized as ACN/H_2O soluble.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 120-DAT wheat forage sample was 90.2% (0.024 ppm), and an additional 4% (0.001 ppm) of the TRR was characterized. All radioactive residues greater than 0.01 ppm were identified.

Extraction of the 301-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat forage samples with ACN/H_2O (4:1) released 95.9% of the TRR (0.082 ppm). The HPLC profile of the ACN/H_2O extract showed four components (ph-1, ph-2, ph-3 and ph-5). The remaining solids contained 4% of the

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TRR (0.004 ppm). The 301-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat forage sample was not extracted because the TRR was <0.01 ppm.

Component ph-5 (91% of the TRR; 0.078 ppm) was identified as pyrasulfotole-benzoic acid (AE B197555). Components ph-1 (1.3% of the TRR; 0.001 ppm), ph-2 (1.5% of the TRR; 0.001 ppm), and ph-3 (1.8% of the TRR; 0.002 ppm) were characterized as ACN/H_2O soluble.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 301-DAT wheat forage samples was 91.3% (0.078 ppm), and an additional 4.6% (0.004 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.002 ppm were identified.

120-DAT and 301-DAT Wheat Hay

Extraction of 120-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat hay samples with ACN/H_2O (4:1) released 80.2% of the TRR (0.049 ppm). Further extraction with refluxing MeOH released an additional 7.2% of the TRR (0.004 ppm). The HPLC profile of the ACN/H_2O extract showed one component (ph-5). The remaining solids contained 12.6% of the TRR (0.008 ppm). Component ph-5 (80% of the TRR; 0.049 ppm) was positively identified as AE B197555.

Extraction of 120-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat hay with ACN/H_2O (4:1) released 53.4% of the TRR (0.007 ppm). The HPLC profile of the ACN/H_2O extract showed nine components (py-1 to py-9). The remaining solids contained 46.6% of the TRR (0.006 ppm). Component py-6 (3% of the TRR; <0.001 ppm) was identified as pyrasulfotole. Components py-1 to py-5 and py-7 to py-9 (largest component was 13% of the TRR, 0.002 ppm) were characterized as ACN/H_2O soluble.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 120-DAT wheat hay samples was 80.2% (0.049 ppm) as AE B197555, and an additional 7.2% (0.004 ppm) of the TRR was characterized as MeOH soluble. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.008 ppm were identified. Three percent of the [pyrazole-3-^{14}C]-pyrasulfotole radioactive residue was identified as pyrasulfotole. An additional 50% of the TRR (0.006 ppm) was characterized with each individual residue comprising 0.002 ppm (13% of the TRR) or less, and 0.006 ppm (46.6% of the TRR) remained in the solids.

Extraction of 301-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat hay samples with ACN/H_2O (4:1) released 81.0% of the TRR (0.029 ppm). Further extraction with refluxing MeOH released an additional 5.6% of the TRR (0.002 ppm). The HPLC profile of the ACN/H_2O extract showed four components (ph-1, ph-2, ph-4, and ph-5). The remaining solids contained 13.4% of the TRR (0.005 ppm). The 301-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat hay sample was not extracted because the TRR was <0.01 ppm.

Component ph-5 (58.3% of the TRR; 0.021 ppm) was positively identified as AE B197555.

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Component ph-4 (2% of the TRR; 0.001 ppm) was identified as pyrasulfotole. Components ph-1 (14.2% of the TRR; 0.005 ppm) and ph-2 (6.4% of the TRR; 0.002 ppm) were characterized as ACN/H_2O soluble.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 301-DAT wheat hay was 58.3% (0.021 ppm), and an additional 26.2% (0.010 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.005 ppm were identified.

120-DAT and 301-DAT Wheat Straw

Extraction of the 120-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat straw samples with ACN/H_2O (4:1) released 68.9% of the TRR (0.016 ppm). Further extraction with refluxing MeOH, refluxing acid (1 *N* HCl) and refluxing base (1 *N* NaOH) released an additional 4.5% of the TRR (0.001 ppm), 8.4% of the TRR (0.002 ppm), and 15.1% of the TRR (0.004 ppm), respectively. The HPLC profile of the ACN/H_2O extract showed four components (ph-1, ph-2, ph-3, and ph-5). The remaining solids contained 3.1% of the TRR (0.001 ppm).

Component ph-5 (49.7% of the TRR; 0.012 ppm) was positively identified as AE B197555. Components ph-1 (7.4% of the TRR; 0.002 ppm), ph-2 (3.1% of the TRR; 0.001 ppm), and ph-3 (2.1% of the TRR; <0.001 ppm) were characterized as ACN/H_2O soluble.

Extraction of the 120-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat straw samples with ACN/H_2O (4:1) released 60% of the TRR (0.013 ppm). The HPLC profile of the ACN/H_2O extract showed eight components (py-1 to py-4, and py-6 to py-9). The remaining solids contained 40% of the TRR (0.008 ppm). Component py-6 (9% of the TRR; 0.002 ppm) was tentatively identified as AE 0317309 based on a retention time of 48 min compared to the retention time of 45.6 min for AE 0317309. Components py-1 to py-4 and py-7 to py-9 (largest component was 0.006 ppm) were characterized as ACN/H_2O soluble.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 120-DAT wheat straw was 49.7% (0.012 ppm), and an additional 47.2% (0.012 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C] AE 0317309 radioactive residues greater than 0.004 ppm were identified. Nine percent of the [pyrazole-3-^{14}C]-pyrasulfotole radioactive residue (0.002 ppm) was identified, an additional 50% of the TRR (0.011 ppm) was characterized, with each individual residue comprising less than or equal to 0.006 ppm of the TRR, and 0.008 ppm (40% of the TRR) remained in the solids.

Extraction of the 301-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat straw samples with ACN/H_2O (4:1) released 71% of the TRR (0.011 ppm) identified/characterized as ph-1, ph-2, and ph-5. Component ph-5 of the phenyl-label study (27% of the TRR; 0.004 ppm) was identified as pyrasulfotole-benzoic acid (AE B197555). Components ph-1 (19.4% of the TRR; 0.003 ppm) and ph-2 (15.3% of the TRR; 0.002 ppm) were characterized as ACN/H_2O soluble. The remaining solids contained 29% of the TRR (0.005 ppm). The 301-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat straw sample was not extracted because the TRR was <0.01 ppm.

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Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 301-DAT wheat straw samples was 27% (0.004 ppm), and an additional 43.9% (0.007 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.005 ppm were identified.

120-DAT and 301-DAT Wheat Grain

Extraction of the120-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat grain samples with ACN/H_2O (4:1) released 91.3% of the TRR (0.029 ppm). The HPLC profile of the ACN/H_2O extract showed two components (ph-4 and ph-5). The remaining solids contained 8.7% of the TRR (0.003 ppm). The 120-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat grain sample was not extracted because the TRR was <0.01 ppm.

Component ph-5 (89.4% of the TRR; 0.028 ppm) was positively identified as pyrasulfotole-benzoic acid (AE B197555). Component ph-4 (0.9% of the TRR; <0.001 ppm) was tentatively identified as pyrasulfotole.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 120-DAT wheat grain samples was 91.2% (0.028 ppm), and an additional 0.9% (<0.001 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.003 ppm were identified.

Extraction of the 301-DAT [phenyl-UL-^{14}C]-pyrasulfotole wheat grain samples with ACN/H_2O (4:1) released 87.1% of the TRR (0.010 ppm) identified/characterized as ph-1, ph-2, and ph-5. Component ph-5 (77% of the TRR; 0.008 ppm) was identified as pyrasulfotole-benzoic acid (AE B197555). Ph-1 and ph-2 were characterized as ACN/H_2O soluble. The remaining solids contained 12.9% of the TRR (0.001 ppm). The 301-DAT [pyrazole-3-^{14}C]-pyrasulfotole wheat grain sample was not extracted because the TRR was <0.01 ppm.

Total identification of the [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues in the 301-DAT wheat grain samples was 77% (0.008 ppm), and an additional 10.2% (0.001 ppm) of the TRR was characterized. All [phenyl-UL-^{14}C]-pyrasulfotole radioactive residues greater than 0.001 ppm were identified.

120-DAT Swiss Chard and Turnips

The 120-DAT [phenyl-UL-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole Swiss chard, and turnip samples were not extracted because the TRR were <0.01 ppm.

C.1. Storage Stability

All RACs were initially processed and analyzed within 30 days of harvest, except for the [pyrazole-3-^{14}C] 120-DAT wheat straw and wheat grain samples, which were analyzed within 50 days of harvest. Specific storage temperatures and durations are listed in TABLE C.1.

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TABLE C.1. Summary of Storage Conditions.

Matrix	Plant-back interval (days)	Storage Temp. (°C)	Actual Storage Duration (days)	Interval of demonstrated Storage Stability (days)
[Phenyl-UL-^{14}C] AE 0317309				
Wheat Forage RAC	120	<-22	12	Not required [a]
Wheat Hay RAC	120	<-10	13	Not required
Wheat Straw RAC	120	<-18	15	Not required
Wheat Grain RAC	120	<-18	14	Not required
Swiss Chard RAC	122	<-22	9	Not required
Turnip Tops RAC	122	<-22	11	Not required
Turnip Roots RAC	122	<-22	14	Not required
Wheat Forage RAC	301	<-17	9	Not required
Wheat Hay RAC	301	<-20	20	Not required
Wheat Straw RAC	301	<-17	22	Not required
Wheat Grain RAC	301	<-17	27	Not required
Wheat Forage Extract	120	<-10	1	Not required
Wheat Hay Extract	120	<-10	5	Not required
Wheat Straw Extract	120	<-9.8	12	Not required
Wheat Grain Extract	120	<-11	1	Not required
Wheat Forage Extract	301	<-10	1	Not required
Wheat Hay Extract	301	<-10	6	Not required
Wheat Straw Extract	301	<-10	5	Not required
Wheat Grain Extract	301	<-10	2	Not required
[Pyrazole-3-^{14}C] AE 0317309				
Wheat Forage RAC	120	<-22	3[b]	Not required
Wheat Hay RAC	120	<-10	20	Not required
Wheat Straw RAC	120	<-17	48	Not required
Wheat Grain RAC	120	<-17	47[b]	Not required
Swiss Chard RAC	122	<-22	9[b]	Not required
Turnip Tops RAC	122	<-22	14[b]	Not required
Turnip Roots RAC	122	<-22	14[b]	Not required
Wheat Forage RAC	301	<-17	8[b]	Not required
Wheat Hay RAC	301	<-20	5[b]	Not required
Wheat Straw RAC	301	<-17	20[b]	Not required
Wheat Grain RAC	301	<-17	20[b]	Not required
Wheat Hay Extract	120	<-9.6	8	Not required
Wheat Straw Extract	120	<-11	2	Not required

[a] Storage stability data should not normally be required for samples analyzed within 4 to 6 months of collection.[10]

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TABLE C.2.1. Total Radioactive Residues (TRR) in Confined Rotational Crops.

Matrix	Plant-back interval (days)	[Phenyl-UL-^{14}C] AE 0317309	[Pyrazole-3-^{14}C] AE 0317309
		ppm	ppm
Wheat Forage	120	0.027	0.004
Wheat Hay	120	0.061	0.012
Wheat Straw	120	0.023	0.021
Wheat Grain	120	0.031	0.003
Swiss Chard	122	0.007	0.003
Turnip Tops	122	0.008	0.005
Turnip Roots	122	0.002	0.001
Wheat Forage	301	0.085	0.005
Wheat Hay	301	0.036	0.008
Wheat Straw	301	0.016	0.005
Wheat Grain	301	0.011	0.005

TABLE C.2.2.a. Distribution of the Parent and the Metabolites in 120-DAT Rotational Crop Matrices when Dosed with [phenyl-UL-^{14}C]-AE 0317309.

Metabolite Fraction	120-DAT Wheat Forage		120-DAT Wheat Hay		120-DAT Wheat Straw		120-DAT Wheat Grain	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm
Room Temperature Extract 4:1 ACN/H_2O	94.1	0.025	80.2	0.049	68.9	0.016	91.3	0.029
SPE fractions not continued to HPLC	NA	NA	NA	NA	6.6	0.002	0.9	<0.001
1:1 ACN/H_2O Fraction								
AE 0317309 (ph-4)	n. d.	n. d.	n. d.	n. d.	n. d.	n. d.	0.9	<0.001
AE B197555 (ph-5)	90.2	0.024	80.2	0.049	49.7	0.012	89.4	0.028
ph-1	1.4	<0.001	n. d.	n. d.	7.4	0.002	n. d.	n. d.
ph-2	n. d.	n. d.	n. d.	n. d.	3.1	0.001	n. d.	n. d.
ph-3	2.5	0.001	n. d.	n. d.	2.1	<0.001	n. d.	n. d.
MeOH Reflux Extract	NA	NA	7.2	0.004	4.5	0.001	NA	NA
Acid Reflux Extract	NA	NA	NA	NA	8.4	0.002	NA	NA
Base Reflux Extract	NA	NA	NA	NA	15.1	0.004	NA	NA
Extracted Solids	6	0.002	12.6	0.008	3.1	0.001	8.7	0.003

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TABLE C.2.2.b. Distribution of the Parent and the Metabolites in 301-DAT Rotational Crop Matrices when Dosed with [phenyl-UL-^{14}C]-AE 0317309.

Metabolite Fraction	301-DAT Wheat Forage		301-DAT Wheat Hay		301-DAT Wheat Straw		301-DAT Wheat Grain	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm
Room Temperature Extract 4:1 ACN/H_2O	95.9	0.082	81.0	0.029	71.0	0.011	87.1	0.010
SPE fractions not continued to HPLC	NA	NA	NA	NA	9.2	0.001	7.1	0.001
1:1 ACN/H_2O Fraction								
AE 0317309 (ph-4)	n. d.	n. d.	2	0.001	n. d.	n. d.	n. d.	n. d.
AE B197555 (ph-5)	91.3	0.078	58.3	0.021	27.0	0.004	77.0	0.008
ph-1	1.3	0.001	14.2	0.005	19.4	0.003	2.0	<0.001
ph-2	1.5	0.001	6.4	0.002	15.3	0.002	1.1	<0.001
ph-3	1.8	0.002	n. d.	n. d.	n. d.	n. d.	n. d.	n. d.
MeOH Reflux Extract	NA	NA	5.6	0.002	NA	NA	NA	NA
Acid Reflux Extract	NA	NA	NA	NA	NA	NA	NA	NA
Base Reflux Extract	NA	NA	NA	NA	NA	NA	NA	NA
Extracted Solids	4.1	0.004	13.4	0.005	29.0	0.005	12.9	0.001

n.d. = not detected

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TABLE C.2.2.c. Distribution of the Parent and the Metabolites in 120-DAT Rotational Crop Matrices when Dosed with [pyrazole-3-^{14}C]-AE 0317309.

Metabolite Fraction	120-DAT Wheat Hay		120-DAT Wheat Straw	
	% TRR	ppm	% TRR	ppm
Room Temperature Extract 4:1 ACN/H_2O	53.4	0.007	60.4	0.013
SPE fractions not continued to HPLC	13.5	0.002	2.4	<0.001
AE 0317309 (py-6)	3	<0.001	8.9	0.002
py-1	2	<0.001	6.3	0.001
py-2	1	<0.001	2.6	0.001
py-3	2	<0.001	3.7	0.001
py-4	13	0.002	28.7	0.006
py-5	12	0.001	n.d.	n.d.
py-7	2	<0.001	4.3	0.001
py-8	2	<0.001	2.5	0.001
py-9	3	<0.001	1.0	<0.001
Extracted Solids	46.6	0.006	39.6	0.008

n.d. = not detected

TABLE C.2.3.a. Summary of the Characterization and Identification of Radioactive Residues in 120-DAT Rotational Crop Matrices following Application of [phenyl-UL-^{14}C]-AE 0317309 at 83 ga.i./ha.

Metabolite Fraction	120-DAT Wheat Forage TRR = 0.027 ppm		120-DAT Wheat Hay TRR = 0.061 ppm		120-DAT Wheat Straw TRR = 0.023 ppm		120-DAT Wheat Grain TRR = 0.031 ppm	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm
AE 0317309 (ph-4)	n. d.	n. d.	n. d.	n. d.	n. d.	n. d.	0.9	<0.001
AE B197555 (ph-5)	90.2	0.024	80.2	0.049	49.7	0.012	89.4	0.028
Total identified	90.2	0.024	80.2	0.049	49.7	0.012	90.3	0.028
Total characterized	3.9	0.025	7.2	0.004	47.2	0.012	0.9	<0.001
Total extractable	94.1	0.025	87.2	0.053	96.9	0.024	91.2	0.028
Unextracted	6.0	0.002	13	0.008	3.1	0.001	9.0	0.003
Accountability[a]	100%		100%		109%		100%	

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TABLE C.2.3.b. Summary of the Characterization and Identification of Radioactive Residues in 301-DAT Rotational Crop Matrices following Application of [phenyl-UL-^{14}C]-AE 0317309 at 83 g a.i./ha.

Metabolite Fraction	301-DAT Wheat Forage TRR = 0.058 ppm		301-DAT Wheat Hay TRR = 0.036 ppm		301-DAT Wheat Straw TRR = 0.016 ppm		301-DAT Wheat Grain TRR = 0.011 ppm	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm
AE 0317309 (ph-4)	n. d.	n. d.	2	0.001	n. d.	n. d.	n. d.	n. d.
AE B197555 (ph-5)	91.3	0.078	58.3	0.021	27.0	0.004	77.0	0.008
Total identified	91.3	0.078	58.3	0.021	27.0	0.004	77.0	0.008
Total characterized	4.6	0.004	26.2	0.009	43.9	0.006	10.2	0.001
Total extractable	95.9	0.082	84.5	0.030	71.0	0.010	87.2	0.009
Unextracted	4.1	0.004	13.4	0.005	29.0	0.005	13	0.001
Accountability[a]	101%		97.2%		94%		91%	

n. d. = not detected.
[a] Accountability = [(Total dpm extracted + Total dpm in residual solids)/(TRR from combustion analysis) x 100].

TABLE C.2.3.c. Summary of the Characterization and Identification of Radioactive Residues in Rotational Crop Matrices following Application of [pyrazole-3-^{14}C]-AE 317309 at 82 g a.i./ha.

Metabolite Fraction	120-DAT Wheat Hay TRR = 0.012 ppm		120-DAT Wheat Straw TRR = 0.021 ppm	
	% TRR	ppm	% TRR	ppm
AE 0317309 (py-6)	3	<0.001	9	0.002
Total identified	3	<0.001	9	0.002
Total characterized	37	0.003	50	0.013
Total extractable	53	0.004	60	0.013
Unextractable	47	0.006	40	0.008
Accountability[a]	108.3%		100%	

[a] [(Total dpm extracted + Total dpm in residual solids)/(TRR from combustion analysis; see Table C.2.1) x 100].

C.3. Proposed Metabolic Profile

The proposed metabolic pathway is shown in FIGURE C.3.1. Pyrasulfotole was metabolized to one major component, AE B197555 (pyrasulfotole-benzoic acid). Pyrasulfotole was observed in some matrices in small quantities.

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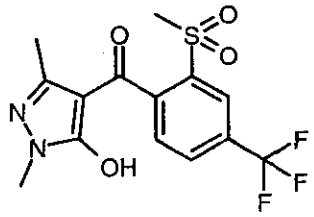
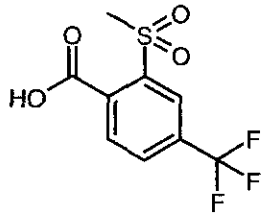
FIGURE C.3.1. Proposed Metabolic Pathway for AE 0317309 in Confined Rotational Crops.

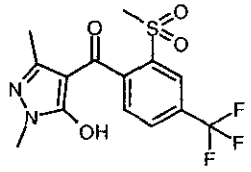
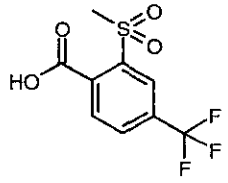


AE 0317309



AE B197555

TABLE C.3.1. Identification of Compounds from the Confined Rotational Crop Study.

Common name/code Figure C.3.1 ID No.	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-Hydroxy-1,3-dimethylpyrazol-4-yl)(2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	

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D. CONCLUSION

Pyrasulfotole was not extensively metabolized in rotational crops. The predominant residue is the pyrasulfotole-benzoic acid metabolite. Total residues amounting to 27.0 to 91.3% of the TRR were identified in rotational crop matrices following application of [phenyl-UL-^{14}C]-pyrasulfotole. Total identified residues were 3 to 9% of the TRR (<0.001-0.002 ppm) following application of [pyrazole-3-^{14}C]-pyrasulfotole. A number of components were characterized as ACN/H2O soluble. Nonextractable residues following extraction procedures accounted for 3.1 to 29% of the TRR (0.001-0.008 ppm) in phenyl-label samples, and 40 to 47% of the TRR (0.006-0.008 ppm) in pyrazole-label samples.

E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. (2004)0374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number (2004)0374.02.

7. Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

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10. Zager, E. and Edwards, D. (1992). EPA Memorandum: Additional guidance for conducting plant and livestock metabolism studies. Pesticide registration rejection rate analysis for residue chemistry.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (26 September 2006); RAB1 Chemists (15 November 2006); George Kramer (15 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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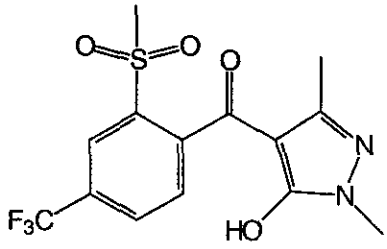
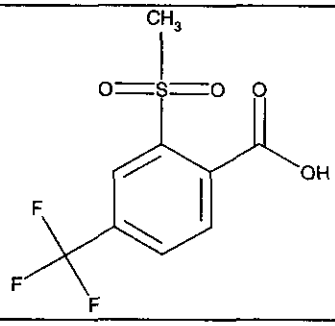
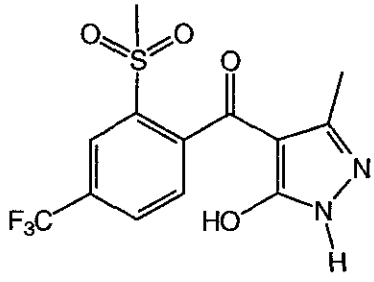
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	

US EPA ARCHIVE DOCUMENT

Primary Evaluator	William S Mohan, Ph.D. Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Peer Reviewer	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801830 Milo, J., and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 0317309 EC23 A8: Magnitude of the Residue in/on Barley. Lab Project Number: RAAIM004. Unpublished study prepared by Bayer CropScience, Inc. 848 p.

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EXECUTIVE SUMMARY:

Bayer CropScience conducted a total of 35 field trials (33 harvest and 2 decline) to measure the magnitude of the residue for the herbicide pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone) in/on barley hay, grain, and straw following application of the end-use products AE 0317309 02 SE06 A1 (SE06) or AE 0317309 03 EC23 A8 (EC23) on barley. AE 0317309 02 SE06 A1 is a suspo-emulsion containing 50 g pyrasulfotole/L and 12.5 g mefenpyr-diethyl/L safener. AE 0317309 03 EC23 A8 is an emulsifiable concentrate containing 37.5 g pyrasulfotole/L, 210 g bromoxynil/L, and 9.38 g mefenpyr-diethyl/L.

Trials for both formulations occurred in Regions 2 (GA; 1 trial), 5 (NE, MN, ON, WI; 4 trials), 5B (ON, QC; 1 trial), 7 (ND, NE, SK; 4 trials), 9 (ID; 1 trials), 10 (CA; 1 trial), 11 (OR, WA; 2 trials), and 14 (SK, AB, MB; 10 trials). At each trial location, SE06 (5% a.i.) or EC23 (3.75 % a.i.) was applied once to pre-emergent barley as a foliar broadcast spray at a rate of 0.043 to 0.048 lb a.i./A (0.048 to 0.054 kg a.i./ha) or 0.032 to 0.036 lb a.i./A (0.035 to 0.041 kg a.i./ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 24 (forage) BBCH 37 to 51 (hay, grain, and straw). All trials used ammonium sulphate as an adjuvant.

Preharvest intervals (PHIs) for barley raw agricultural commodities (RACs) were 21 to 25 days for hay and 35 to 45 days for grain and straw. In the decline trials, hay samples were collected at five intervals (± 2 days) corresponding to PHIs of 0, 15, 25, 30 and 35 days. Grain and straw samples were collected at five intervals (± 2 days) corresponding to PHIs of 35, 45, 50, 60 and 70 days.

Residues of pyrasulfotole (AE 0317309) and the metabolites pyrasulfotole-benzoic acid (AE B197555) and pyrasulfotole-desmethyl (AE 1073910) were quantified by high-performance liquid chromatography-electrospray ionization with tandem mass spectrometry (LC-MS/MS) using stable isotope labelled analytes as internal standards. The limit of quantitation (LOQ) for each analyte was 0.010 ppm in barley hay, grain, and straw.

All barley samples were frozen a maximum of 9 months prior to analysis. Data from an 11-month storage stability study suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all barley matrices. Residues of pyrasulfotole-desmethyl are also expected to be stable in barley grain, but decline in barley forage and hay (ca. 0.12 % per day).

The amount of each analyte detected in/on barley RACs appeared to be higher following SE06 application, with the highest residue levels observed in/on barley hay and the lowest levels observed in/on barley grain. The maximum pyrasulfotole-benzoic acid residue levels observed were 0.631 ppm (hay), 0.116 ppm (grain) and 0.451 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.185 ppm (hay), 0.008 ppm (grain) and 0.220 ppm (straw); and the maximum pyrasulfotole residue levels observed were 0.050 ppm (hay), 0.005 ppm (grain) and 0.031 ppm (straw). In decline trials, the amount of all analytes decreased with time in/on barley hay and straw, but did not change significantly in/on barley grain.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the field trial residue data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

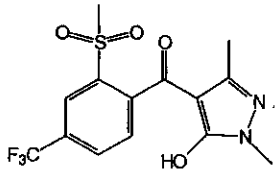
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7×10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0pH 7.0pH 9.0	8
UV/visible absorption spectrum	λ_{max}= *264, 241, 216 nm in water, 0.1M HCl, 0.1M* NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

TABLE B.1.1 Trial Site Conditions.

Study Location (City, State)	*Trial Number*	*Year*	Soil Characteristics				Meteorological Data	
			Type	% OM	pH	CEC meq/g	Total Rainfall in. (cm)	Temp. Range °F (°C)
Athens, GA	AI035-04H	2005	Clay	1.1	6.6	8.1	2.62 (6.65)	35–90 (2–32)
Springfield, NE	AI036-04D	2005	Silt Loam	2.9	6.2	14.1	5.38 (13.67	42–100 (6–38)
Sabin, MN	AI037-04H	2004	Silt	3.5	7.9	25	7.05 (17.91)	44–91 (7–33)
Guelph, ON	AI038-04H	2004	Loam	4.5	7.8	14.8	3.7 (9.40)	45–86 (7–30)
Carrington, ND	AI039-04HA	2004	Loam	3.3	8.2	34.1	2.63 (6.68)	42–92 (6–33)
Grand Island, NE	AI040-04H	2005	Clay Loam	2.7	6.6	21.8	5.56 (14.12)	49–99 (9–37)
Dundurn, SK	AI041-04H	2004	Sandy Loam	4.214	6.7	21.2	3.57 (9.07)	34–90 (1–32)
Windthorst, SK	AI042-04DA	2005	Sandy Loam	3.1	8.1	NA	4.62 (11.73)	30–93 (-1–34)
Jerome, ID	AI043-04H	2004	Loam	1.4	7.4	21.6	0.26 (0.66)	44–102 (7–39)
Fresno, CA	AI044-04H	2005	Sandy Loam	0.5	7.3	3.8	1.82 (4.62)	39–81 (4–27)
Madras, OR	AI045-04H	2004	Sandy Loam	1.3	7.1	23	1.72 (4.37)	45–101 (7–38)
Ephrata, WA	AI046-04H	2004	Sandy Loam	1.7	7.8	12.8	0.69 (1.75)	45–102 (7–39)
Winchester, ON	AI047-04H	2004	Clay	6.06	6.4	16.4	3.59 (9.12)	43–86 (6–30)

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TABLE B.1.1 Trial Site Conditions.

Study Location (City, State)	Trial Number	Year	Soil Characteristics				Meteorological Data	
			Type	% OM	pH	CEC meq/g	Total Rainfall in. (cm)	Temp. Range °F (°C)
Fort SK, AB	AI048-04H	2004	Silty Clay Loam	>7	6.3	37	7.31 (18.57)	34–86 (1–30)
Fort SK, AB	AI048-04HA	2005	Silty Clay Loam	10.2	5.8	37	2.9 (7.37)	40–85 (4–29)
Mundare, AB	AI049-04H	2004	Loam	5.25	6.6	40	4.03 (10.24)	36–86 (2–30)
Innisfail, AB	AI050-04HB	2005	Clay Loam	7.6	6.2	13.0	3.38 (8.59)	38–88 (3–31)
Blaine Lake, SK	AI051-04H	2004	Loam	4.76	7.2	26.6	5.11 (12.98)	30–82 (-1–28)
Wakaw, SK	AI052-04H	2004	Silt Loam	8.0	7.2	28	0.86 (2.18)	29–84 (-2–29)
Cudworth, SK	AI052-04HB	2005	Silt Loam	4.0	7.0	27.4	3.04 (7.72)	37–89 (3–32)
Wakaw, SK	AI053-04H	2004	Loam	7.0	7.2	27.4	3.03 (7.70)	29–84 (-2–29)
Cudworth/ SK,	AI053-04HB	2005	Silty Clay Loam	5.02	7.5	30.7	1.87 (4.75)	37–87 (3–31)
Indian Head, SK	AI054-04H	2004	Clay Loam	2.6	7.9	NA	3.2 (8.13)	30–84 (-1–29)
Regina, SK	AI054-04HA	2005	Clay Loam	2.6	7.9	NA	2.2 (5.59)	36–91 (2–33)
Ituna, SK	AI055-04H	2004	Sandy Loam	5.5	7.5	NA	3.69 (9.37)	31–87 (-1–31)
Fort Qu'Appelle, SK	AI055-04HA	2005	Loam	4.8	7.9	NA	1.57 (3.99)	35–96 (2–36)
Fort Qu'Appelle, SK	AI056-04H	2004	Loam	4.8	7.9	NA	3.33 (8.46)	28–84 (-2–29)
Yorktown, SK	AI057-04H	2004	NA	NA	NA	NA	2.93 (7.44)	31–87 (-1–31)
Brookdale, MB	AI058-04H	2004	Loam	5.1	6.3	23.3	0.83 (2.11)	36–88 (2–31)
Brookdale, MB	AI058-04HA	2005	Loam	5.1	6.3	23.3	3.61 (9.17)	37–88 (3–31)
Clanwilliam, MB	AI059-04H	2004	Loam	6.98	8.4	38.2	4.68 (11.89)	36–82 (2–28)
Clanwilliam, MB	AI059-04HA	2005	Loam	6.98	8.4	38.2	1.42 (3.61)	43–90 (6–32)
Arkansaw, WI	AI185-04H	2005	Sandy Loam	2.6	6.4	13.6	3.7 (9.40)	48–95 (9–35)
Mundare, AB	AI186-05H	2005	Loam	5.25	6.2	40	3.45 (8.76)	41–82 (5–28)
Saint-Cesaire, QB	AI191-05H	2005	Clay Loam	2.47	6.1	30.02	7.82 (19.86)	45–92 (7–33)

NA = not available

Temperatures and rainfall data were provided, and in some cases were above or below normal. Specifically, due to a cold wet fall in 2004, grain and straw commodities in Region 14 did not reach commercial harvest growth stages within the protocol-defined PHI intervals. For this reason many of the 2004 Region 14 trials were reinitiated in 2005. Although growing conditions in 2005 were more favourable, grain and straw samples in some trials did not reach commercial maturity when harvested at the desired PHI, and as a result were harvested outside the normal percent dry matter ranges. The early harvests in these trials did not appear to affect residue levels compared to those observed in other regions.

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TABLE B.1.2. Study Use Pattern.

Location City, State/ Trial ID Year; Region	Application					Tank Mix/ Adjuvants
	EP[1]	Method/Timing	Volume[2] GPA L/ha	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	
Athens, GA AI035-04H 2005; Region 2	SE06	1 Appl: Flag leaf sheath opening	10 (94)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	1 Appl: Flag leaf sheath opening	10 (94)	0.033 (0.037)	0.033 (0.037)	Yes
Springfield, NE AI036-04D 2005; Region 5	SE06	1 Appl: Flag leaf stage	14 (128)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	14 (129)	0.033 (0.038)	0.033 (0.038)	Yes
Sabin, MN AI037-04H 2004; Region 5	SE06	1 Appl: Flag leaf stage	12 (115)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	12 (109)	0.032 (0.035)	0.032 (0.035)	Yes
Guelph, ON AI038-04H 2004; Region 5	SE06	1 Appl: Flag leaf sheath opening	11 (101)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf sheath opening	11 (104)	0.035 (0.039)	0.035 (0.039)	Yes
Carrington, ND AI039-04HA 2004; Region 7	SE06	1 Appl: Flag leaf just visible still rolled	16 (145)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	15 (141)	0.034 (0.038)	0.034 (0.038)	Yes
Grand Island, NE AI040-04H 2005; Region 7	SE06	1 Appl: Flag leaf stage	19 (182)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	19 (181)	0.034 (0.038)	0.034 (0.038)	Yes
Dundurn, SK AI041-04H 2004; Region 7	SE06	1 Appl: Flag leaf just visible still rolled	12 (112)	0.046 (0.052)	0.046 (0.052)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (112)	0.035 (0.039)	0.035 (0.039)	Yes
Windthorst, SK AI042-04DA 2005; Region 7	SE06	1 Appl: Flag leaf stage	12 (108)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	12 (108)	0.034 (0.038)	0.034 (0.038)	Yes
Jerome, ID AI043-04H 2004; Region 9	SE06	1 Appl: Early boot stage: flag leaf sheath extending	20 (184)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Early boot stage: flag leaf sheath extending	20 (183)	0.034 (0.038)	0.034 (0.038)	Yes
Fresno, CA AI044-04H 2005; Region 10	SE06	1 Appl: Flag leaf stage	19 (176)	0.043 (0.048)	0.043 (0.048)	Yes
	EC23	1 Appl: Flag leaf stage	19 (180)	0.033 (0.037)	0.033 (0.037)	Yes
Madras, OR AI045-04H 2004; Region 11	SE06	1 Appl: Late boot stage: flag leaf swollen	13 (117)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	1 Appl: Late boot stage: flag leaf swollen	14 (130)	0.037 (0.041)	0.037 (0.041)	Yes

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TABLE B.1.2. Study Use Pattern.

Location City, State/ Trial ID Year; Region	Application					Tank Mix/ Adjuvants
	EP[1]	Method/Timing	Volume[2] GPA L/ha	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	
Ephrata, WA AI046-04H 2004; Region 11	SE06	1 Appl: Late boot stage: flag leaf swollen	15 (143)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Late boot stage: flag leaf swollen	15 (143)	0.034 (0.038)	0.034 (0.038)	Yes
Winchester, ON AI047-04H 2004; Region 5B	SE06	1 Appl: Flag leaf just visible still rolled	12 (108)	0.048 (0.054)	0.048 (0.054)	Yes
Fort Saskatchewan AB AI048-04H 2004; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	11 (100)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	11 (99)	0.033 (0.037)	0.033 (0.037)	Yes
Fort Saskatchewan AB AI048-04HA 2005; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (111)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (111)	0.034 (0.038)	0.034 (0.038)	Yes
Mundare, AB AI049-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	16 (147)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf stage	16 (148)	0.034 (0.038)	0.034 (0.038)	Yes
Innisfail, AB AI050-04HB 2005; Region 14	EC23	1 Appl: Flag leaf stage	11 (101)	0.034 (0.038)	0.034 (0.038)	Yes
Blaine Lake, SK AI051-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (110)	0.044 (0.050)	0.044 (0.050)	Yes
Wakaw, SK AI052-04H 2004; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (109)	0.044 (0.050)	0.044 (0.050)	Yes
Cudworth, SK AI052-04HB 2005; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (114)	0.046 (0.052)	0.046 (0.052)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (113)	0.035 (0.039)	0.035 (0.039)	Yes
Wakaw, SK AI053-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (111)	0.046 (0.052)	0.046 (0.052)	Yes
Cudworth, SK AI053-04HB 2005; Region 14	SE06	1 Appl: Flag leaf stage	12 (112)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	1 Appl: Flag leaf stage	12 (112)	0.034 (0.039)	0.034 (0.039)	Yes
Indian Head, SK AI054-04H 2004; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (112)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (111)	0.034 (0.038)	0.034 (0.038)	Yes
Regina, SK AI054-04HA 2005; Region 14	SE06	1 Appl: Flag leaf stage	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	12 (110)	0.034 (0.038)	0.034 (0.038)	Yes

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TABLE B.1.2. Study Use Pattern.

Location City, State/ Trial ID Year; Region	Application					Tank Mix/ Adjuvants
	EP[1]	Method/Timing	Volume[2] GPA L/ha	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	
Ituna, SK AI055-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	12 (109)	0.033 (0.037)	0.033 (0.037)	Yes
Fort Qu'Appelle, SK AI055-04HA 2005; Region 14	SE06	1 Appl: Flag leaf stage	12 (113)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf stage	12 (111)	0.034 (0.038)	0.034 (0.038)	Yes
Fort Qu'Appelle, SK AI056-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (111)	0.045 (0.050)	0.045 (0.050)	Yes
Yorktown, SK AI057-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (109)	0.044 (0.049)	0.044 (0.049)	Yes
Brookdale, Manitoba AI058-04H 2004; Region 14	SE06	1 Appl: Flag leaf stage	12 (113)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf stage	12 (114)	0.034 (0.038)	0.034 (0.038)	Yes
Brookdale, MB AI058-04HA 2005; Region 14	SE06	1 Appl: Flag leaf stage	12 (112)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	11 (107)	0.032 (0.036)	0.032 (0.036)	Yes
Clanwilliam, MB AI059-04H 2004; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (117)	0.046 (0.052)	0.046 (0.052)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (116)	0.035 (0.039)	0.035 (0.039)	Yes
Clanwilliam, MB AI059-04HA 2005; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (111)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (111)	0.033 (0.037)	0.033 (0.037)	Yes
Arkansaw, WI AI185-04H 2005; Region 5	SE06	1 Appl: Flag leaf stage	19 (175)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	19 (174)	0.033 (0.037)	0.033 (0.037)	Yes
Mundare, AB AI186-05H 2005; Region 14	SE06	1 Appl: Flag leaf just visible still rolled	12 (109)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	12 (109)	0.033 (0.037)	0.033 (0.037)	Yes
Saint-Cesaire, QB AI191-05H 2005; Region 5B	EC23	1 Appl: Flag leaf stage	19 (173)	0.035 (0.040)	0.035 (0.040)	Yes

Tank mix adjuvant = ammonium sulphate at a nominal rate of 0.45 lb a.i./acre (500 g a.i./ha).
[1]EP = End-use Product.
[2] GPA = Gallons per acre.

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TABLE B.1.3. Trial Numbers and Geographical Locations.

NAFTA Growing Region	SE06 Formulation		EC23 Formulation	
	Submitted	NAFTA[a]	Submitted	NAFTA[a]
1				
1A				
2	1	1	1	1
3				
4				
5	4	3	4	3
5A				
5B	1	1	1	1
6				
7	4	4	4	4
7A				
8				
9	1	1	1	1
10	1	1	1	1
11	2	2	2	2
12				
13				
14	10 (14[b])	12	10	12
Total	24 (28[c])	25	24	25

[a] NAFTA registration requirements for barley request a total of 33 trials distributed as indicated.
[b] A total of 14 hay trials and 10 grain and straw trials were successfully completed in region 14 for the SE06 formulation.
[c] A total of 28 hay trials and 24 grain and straw trials were successfully completed for the SE06 formulation.

B.2. Sample Handling and Preparation

Composite samples for all matrices were collected and placed into labelled cloth bags for storage. Control and treated samples were a composite from at least 12 areas of the plot and weighed a minimum of 1 kg for forage and grain and 0.5 kg for hay and straw. Treated samples were frozen within 7 hours of collection. All samples remained in frozen storage (<-15°C) until shipment (via freezer truck) to BRP. Upon arrival at BRP, barley RAC samples were homogenized with dry ice in a chopper then returned immediately to frozen storage.

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B.3. Analytical Methodology

Residue data for pyrasulfotole in barley RACs were obtained using the analytical method (AI-001-P04-01) for determining total pyrasulfotole (pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl) residue in plant matrices.[10, 11]

This HPLC-MS/MS analytical method quantifies residues of pyrasulfotole and the metabolites from a single sample using isotope labelled internal standards.[10] Briefly, residues are extracted from homogenized barley samples with acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) at 60°C for at least 30 min. After cooling, a mixture of isotope labelled internal standards is added to the sample extract and mixed. A small aliquot (about 1.25 mL) is purified by C18 solid-phase extraction (SPE), followed by chromatographic analysis involving gradient elution from a Gemini C-18 (50 x 2.0 mm) with aqueous 10 mM NH_4HCO_3 solution and methanol as the mobile phase components. An electrospray interface in the negative ion mode is used to introduce the sample into the MS.

In this study, detector response was linear over the range of 0.005 ppm to 2.5 ppm for all analytes with associated correlation coefficients all greater than 0.99. The analytical standards for pyrasulfotole and the metabolites were > 99% pure. The individual analyte residues were converted to pyrasulfotole molar equivalents and summed to give a total pyrasulfotole residue.

C. RESULTS AND DISCUSSION

Field trials were conducted at 35 locations during the 2004/2005 growing seasons covering 9 US states and 5 Canadian provinces, representing a total of 8 NAFTA regions (TABLE B.1.3). At least 24 trials were performed on barley RACs for each formulation.

Method validation for pyrasulfotole and the metabolites was performed on barley RACs using various spiking levels (TABLE C.1). Pyrasulfotole standards were corrected for purity and prepared in parent compound molar equivalents during initial standard solution preparation. At the LOQ concurrent recoveries for pyrasulfotole and the metabolites ranged from 73% to 110%. Therefore, the method is deemed suitable for data gathering. The LOQ for each analyte was 0.010 ppm in all barley matrices. The calculated limits of detection (LODs) in barley hay and barley straw were 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl, and 0.003 ppm for pyrasulfotole-benzoic acid. The calculated LODs in barley grain were 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl, and 0.002 ppm for pyrasulfotole-benzoic acid.

The samples in this study were frozen a maximum of 9 months (249 days) prior to analysis of pyrasulfotole and its metabolites (TABLE C.2). Storage stability data were not provided for barley RACs, however wheat storage stability results were translated to barley RACs.[12, 13] The data suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all barley matrices. Residues of pyrasulfotole-desmethyl are also stable in barley grain and straw, but are expected to decline in barley hay (ca. 0.12 % per day) during frozen storage (APPENDIX 2). Therefore, residue values for barley hay trials that were stored for longer than 163 days were corrected according to the equation of the linear regression in APPENDIX 2 (wheat hay).

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Uncorrected and corrected residue data for pyrasulfotole and the metabolites in/on barley RACs are presented in TABLE C.3.1 (SE06 formulation) and TABLE C.3.2 (EC23 formulation). Representative chromatograms appeared to be symmetrical and well defined at or above the LOD and therefore all values above LOD are reported. Nevertheless, values between LOD and LOQ were considered nonquantitative estimates as they fell below the lower limit of method validation and no information on the linearity of the standard curve at these low levels was provided. Therefore, to calculate total pyrasulfotole residue, analyte values that were reported as <LOD were first assigned a finite value of half the LOQ, then residue values for pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid were summed. The amount of residue in/on barley RACs appeared to be higher following the SE06 application, with hay retaining the highest levels of residues and grain retaining the lowest levels of residues (FIGURE C.1).

In order to estimate means and standard deviations, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ or 0.005 ppm (TABLE C.4.1, TABLE C.4.2). The highest average field trial (HAFT) value for pyrasulfotole-benzoic acid residue in barley hay was 0.614 ppm; in barley grain was 0.110 ppm; and in barley straw was 0.380 ppm. The HAFT value for pyrasulfotole-desmethyl residue in barley hay was 0.171 ppm, in barley grain was 0.008 ppm and in barley straw was 0.156 ppm. The HAFT value for pyrasulfotole residue in barley hay was 0.044 ppm; in barley grain was 0.008 ppm and in barley straw was 0.022 ppm. Independent of formulation, the maximum pyrasulfotole-benzoic acid residue levels observed were 0.631 ppm (hay), 0.116 ppm (grain) and 0.451 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.185 ppm (hay), 0.008 ppm (grain) and 0.220 ppm (straw); and the maximum pyrasulfotole residue levels observed were 0.050 ppm (hay), 0.005 ppm (grain) and 0.031 ppm (straw).

In decline trial samples, the amounts of each analyte decreased with time in/on the barley hay and straw, but did not change significantly from its already low levels in/on barley grain (FIGURE C.2).

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TABLE C.1. Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole-desmethyl and Pyrasulfotole-benzoic Acid from Barley Matrices.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Barley Hay				
Pyrasulfotole -benzoic acid	0.01	7	96, 92, 101, 93, 94, 99, 95	96 ± 3.3
	0.05	10	95, 103, 92, 94, 91, 96, 95, 95, 92, 96	95 ± 3.2
	0.25	3	96, 96, 97	96 ± 0.3
	2.00	3	100, 100, 101	100 ± 0.7
	5.00	3	93, 93, 92	93 ± 0.8
Pyrasulfotole -desmethyl	0.01	7	88, 92, 90, 89, 89, 88, 87	89 ± 1.8
	0.05	10	107, 105, 101, 97, 98, 101, 99, 96, 96, 94	99 ± 4.2
	0.25	3	101, 101, 100	100 ± 0.3
	2.00	3	98, 100, 96	98 ± 1.6
	5.00	3	106, 103, 107	106 ± 2.1
Pyrasulfotole	0.01	7	73, 99, 94, 86, 91, 83, 87	88 ± 8.3
	0.05	10	92, 94, 97, 98, 96, 91, 89, 91, 100, 94	94 ± 3.5
	0.25	3	98, 96, 95	96 ± 1.5
	2.00	3	93, 93, 93	93 ± 0.2
	5.00	3	90, 91, 91	91 ± 1.0
Barley Grain				
Pyrasulfotole -benzoic acid	0.01	15	103, 90, 87, 89, 110, 81, 90, 107, 86, 103, 89, 98, 81, 90, 86	93 ± 9.1
	0.05	2	103, 101	102 ± 1.5
	0.25	3	97, 97, 98	97 ± 0.4
Pyrasulfotole -desmethyl	0.01	15	88, 90, 85, 80, 100, 81, 93, 106, 77, 94, 84, 102, 78, 85, 85	89 ± 9.0
	0.05	2	109, 113	111
	0.25	3	103, 101, 101	102 ± 1.1
Pyrasulfotole	0.01	15	86, 87, 84, 78, 91, 83, 82, 94, 77, 80, 80, 89, 84, 84, 87	85 ± 4.7
	0.05	2	88, 88	88
	0.25	3	94, 91, 91	92 ± 1.6
Barley Straw				
Pyrasulfotole -benzoic acid	0.01	5	100, 92, 83, 93, 91	92 ± 6.1
	0.05	13	101, 93, 101, 88, 96, 96, 93, 104, 92, 93, 91, 93, 90	95 ± 4.7
	0.25	3	97, 98, 94	97 ± 2.4
	1.00	3	106, 96, 97	100 ± 5.5
Pyrasulfotole -desmethyl	0.01	5	93, 91, 87, 89, 86	89 ± 2.9
	0.05	13	112, 116, 103, 100, 99, 101, 103, 101, 101, 104, 107, 103, 100	104 ± 5.1
	0.25	3	101, 105, 97	101 ± 3.7
	1.00	3	117, 104, 110	110 ± 6.6
Pyrasulfotole	0.01	5	91, 86, 87, 97, 94	91 ± 4.6
	0.05	13	92, 97, 94, 99, 94, 102, 98, 95, 96, 95, 97, 95, 96	96 ± 2.5
	0.25	3	97, 100, 96	97 ± 1.9
	1.00	3	103, 94, 93	97 ± 5.6

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TABLE C.2. Summary of Storage Conditions for Barley Matrices.

Extract		Storage Temperature (°C)	Actual Storage Duration (days)	Interval of Demonstrated Storage Stability(days)
pyrasulfotole-benzoic acid, pyrasulfotole				
Barley	Grain	<-15	266	336
	Hay	<-15	266	336
	Straw	<-15	266	336
pyrasulfotole-desmethyl				
Barley	Grain	<-15	266	336
	Hay	<-15	266	163
	Straw	<-15	266	336

TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Hay	0.044 (0.049)	25	0.098 0.147	0.093 0.127	— —	0.005 0.007	0.196 0.281
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Hay	0.045 (0.050)	25	0.064 0.066	0.037 0.045	0.048 0.060	0.007 0.008	0.119 0.134
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Hay	0.045 (0.051)	21	0.038 0.056	0.017 0.029	0.022 0.039	0.003 0.004	0.063 0.099
Carrington, ND AI039-04HA 2004; Region7	Barley (Rows)/ Robust	Hay	0.046 (0.051)	23	0.200 0.332	0.083 0.134	0.108 0.179	0.008 0.013	0.316 0.524
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Hay	0.045 (0.050)	22	0.112 0.092	0.030 0.026	0.039 0.035	0.004 0.004	0.155 0.131
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Hay	0.046 (0.052)	25	0.149 0.176	0.073 0.086	0.095 0.115	0.005 0.005	0.249 0.296
Jerome, ID AI043-04H 2004; Region 9	Barley (Rows)/ Lud	Hay	0.045 (0.051)	24	0.145 0.123	0.050 0.042	— —	0.007 0.006	0.202 0.171
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Hay	0.043 (0.048)	23	0.360 0.316	0.121 0.109	0.170 0.153	0.014 0.013	0.544 0.482
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Hay	0.092 (0.102)	25	0.079 0.100	0.048 0.065	— —	0.003 0.004	0.130 0.169
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Hay	0.045 (0.050)	25	0.068 0.063	0.068 0.066	— —	0.010 0.008	0.146 0.137
Winchester, ON AI047-04H 2004; Region 5B	Barley (Rows)/ Grant	Hay	0.048 (0.054)	22	0.078 0.092	0.042 0.046	0.055 0.062	0.007 0.009	0.140 0.163
Fort Saskatchewan, AB AI048-04H 2004; Region 14	Barley (Rows)/ Metcalf	Hay	0.044 (0.049)	24	0.094 0.105	0.044 0.045	0.058 0.060	0.005 0.003	0.157 0.168
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Hay	0.045 (0.051)	24	0.146 0.112	0.090 0.066	— —	0.018 0.011	0.254 0.189

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TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Blaine Lake, SK AI051-04H 2004; Region 14	Barley (Rows)/ CDC Kendall	Hay	0.044 (0.050)	25	0.243 0.186	0.061 0.043	— —	0.009 0.007	0.313 0.236
Wakaw, SK AI052-04H 2004; Region 14	Barley (Rows)/ CDC Kendall	Hay	0.044 (0.050)	24	0.218 0.226	0.039 0.044	— —	0.007 0.008	0.264 0.278
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ Copeland	Hay	0.046 (0.052)	25	0.027 0.027	0.010 0.011	— —	0.001 <LOD	0.038 0.043
Wakaw, SK AI053-04H 2004; Region 14	Barley (Rows)/ CDC Dolly	Hay	0.046 (0.051)	24	0.132 0.132	0.068 0.065	— —	0.006 0.006	0.206 0.203
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Hay	0.046 (0.051)	21	0.478 0.494	0.144 0.146	— —	0.034 0.037	0.656 0.677
Indian Head, SK AI054-04H 2004; Region 14	Barley (Rows)/ Robust	Hay	0.045 (0.051)	21	0.133 0.092	0.085 0.056	0.115 0.077	0.010 0.007	0.258 0.176
Ituna, SK AI055-04H 2004; Region 14	Barley (Rows)/ Robust	Hay	0.045 (0.050)	23	0.073 0.072	0.015 0.021	0.020 0.029	0.015 0.022	0.108 0.123
Fort Qu'Appelle, SK AI056-04H 2004; Region 14	Barley (Rows)	Hay	0.045 (0.050)	21	0.212 0.234	0.088 0.093	— —	0.037 0.048	0.337 0.375
Fort Qu'Appelle, SK AI057-04H 2004; Region 14	Barley (Rows)	Hay	0.044 (0.050)	21	0.112 0.120	0.034 0.040	0.046 0.054	0.003 0.003	0.161 0.177
Brookdale, MB AI058-04H 2004; Region 14	Barley (Rows)/ Stratus	Hay	0.045 (0.051)	23	0.332 0.421	0.157 0.185	— —	0.014 0.023	0.503 0.629
Clanwilliam, MB AI059-04H 2004; Region 14	Barley (Rows)/ Stratus	Hay	0.046 (0.052)	21	0.631 0.597	0.134 0.138	— —	0.037 0.038	0.802 0.773
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Hay	0.045 (0.050)	25	0.401 0.314	0.110 0.086	— —	0.050 0.037	0.561 0.437
Mundare, AB AI186-05H 2005; Region 14	Barley (Rows)/ AC Dolly	Hay	0.045 (0.050)	22	0.095 0.075	0.072 0.049	— —	0.009 0.008	0.176 0.132
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Hay	0.044 (0.050)	0	0.284 0.384	0.410 0.585	0.559 0.805	3.236 3.987	4.079 5.176
				15	0.260 0.223	0.145 0.128	— —	0.055 0.060	0.460 0.411
				24	0.181 0.252	0.086 0.122	— —	0.013 0.016	0.280 0.390
				29	0.173 0.163	0.069 0.074	— —	0.013 0.006	0.255 0.243
				35	0.194 0.129	0.089 0.055	— —	0.008 0.008	0.291 0.192

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TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Hay	0.045 (0.050)	0	0.037 0.029	0.507 0.303	— —	2.141 2.226	2.685 2.558
				13	0.237 0.307	0.195 0.279	— —	0.051 0.055	0.483 0.641
				25	0.212 0.171	0.155 0.127	— —	0.026 0.015	0.393 0.313
				29	0.160 0.168	0.107 0.110	— —	0.018 0.022	0.285 0.300
				34	0.232 0.120	0.131 0.091	— —	0.021 0.009	0.384 0.220
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Grain	0.044 (0.049)	45	0.046 0.056	0.007 0.008	— —	0.002 0.003	0.055 0.067
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Grain	0.045 (0.050)	44	0.031 0.035	0.002 0.002	— —	<LOD <LOD	0.038 0.042
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Grain	0.045 (0.051)	44	0.004 0.004	0.001 0.001	— —	<LOD <LOD	0.010 0.010
Carrington, ND AI039-04HA 2004; Region 7	Barley (Rows)/ Robust	Grain	0.046 (0.051)	41	0.031 0.032	0.001 0.001	— —	<LOD <LOD	0.037 0.038
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Grain	0.045 (0.050)	41	0.041 0.037	0.002 0.002	— —	<LOD <LOD	0.048 0.044
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Grain	0.046 (0.052)	44	0.010 0.011	0.001 <LOD	— —	<LOD <LOD	0.016 0.021
Jerome, ID AI043-04H 2004; Region9	Barley (Rows)/ Lud	Grain	0.045 (0.051)	45	0.048 0.043	0.001 0.001	— —	<LOD <LOD	0.054 0.049
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Grain	0.043 (0.048)	44	0.080 0.090	0.005 0.007	— —	0.004 0.004	0.089 0.101
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Grain	0.092 (0.102)	45	0.012 0.012	0.001 0.001	— —	<LOD <LOD	0.018 0.018
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Grain	0.045 (0.050)	43	0.033 0.029	0.007 0.007	— —	0.002 0.002	0.042 0.038
Winchester, ON AI047-04H 2004; Region 5B	Barley (Rows)/ Grant	Grain	0.048 (0.054)	35	0.018 0.018	<LOD <LOD	— —	<LOD <LOD	0.028 0.028
Fort Saskatchewan, AB AI048-04HA 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.045 (0.051)	42	0.009 0.006	0.001 0.001	— —	0.005 0.003	0.015 0.010
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Grain	0.045 (0.051)	45	0.029 0.032	0.001 0.001	— —	<LOD <LOD	0.035 0.038

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TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Blaine Lake, SK AI051-04H 2004; Region 14	Barley (Rows)/ CDC Kendall	Grain	0.044 (0.050)	45	0.064 0.049	0.001 <LOD	— —	<LOD <LOD	0.070 0.059
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.046 (0.052)	43	0.009 0.007	<LOD <LOD	— —	<LOD <LOD	0.019 0.017
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Grain	0.046 (0.051)	42	0.116 0.104	0.001 0.001	— —	<LOD <LOD	0.122 0.110
Regina, SK AI054-04HA 2005; Region 14	Barley (Rows)/ Kendall	Grain	0.045 (0.050)	45	0.024 0.024	<LOD <LOD	— —	<LOD <LOD	0.034 0.034
Fort Qu'Appelle, SK AI055-04HA 2005; Region 14	Barley (Rows)/ Kendall	Grain	0.045 (0.051)	45	0.015 0.017	<LOD <LOD	— —	<LOD <LOD	0.025 0.027
Brookdale, MB AI058-04HA 2005; Region 14	Barley (Rows)/ AC Rosser 2005	Grain	0.045 (0.050)	45	0.027 0.026	0.003 0.003	— —	<LOD <LOD	0.035 0.034
Clanwilliam, MB AI059-04HA 2005; Region 14	Barley (Rows)/ Robust	Grain	0.044 (0.050)	45	0.034 0.039	<LOD <LOD	— —	<LOD <LOD	0.044 0.049
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Grain	0.045 (0.050)	45	0.054 0.055	0.005 0.005	— —	0.003 0.004	0.062 0.064
Mundare, AB AI186-05H 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.045 (0.050)	40	0.004 0.004	<LOD <LOD	— —	<LOD <LOD	0.014 0.014
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Grain	0.044 (0.050)	35	0.040 0.039	0.002 0.001	— —	0.002 0.002	0.044 0.042
				45	0.046 0.049	0.001 0.001	— —	<LOD <LOD	0.052 0.055
				52	0.073 0.066	0.001 0.001	— —	<LOD <LOD	0.079 0.072
				59	0.076 0.065	<LOD <LOD	— —	<LOD <LOD	0.086 0.075
				69	0.073 0.078	0.001 0.001	— —	<LOD 0.001	0.079 0.080
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Grain	0.045 (0.050)	34	0.017 0.016	0.003 0.004	— —	0.001 0.002	0.021 0.022
				43	0.020 0.019	0.002 0.002	— —	<LOD <LOD	0.027 0.026
				50	0.020 0.021	0.002 0.002	— —	<LOD <LOD	0.027 0.028
				60	0.017 0.016	0.001 0.001	— —	<LOD <LOD	0.023 0.022
				70	0.027 0.025	0.002 0.002	— —	<LOD 0.001	0.034 0.028
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Straw	0.044 (0.049)	45	0.121 0.091	0.089 0.060	— —	0.004 0.003	0.214 0.154

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TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Straw	0.045 (0.050)	44	0.038 0.035	0.032 0.027	— —	0.003 0.003	0.073 0.065
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Straw	0.045 (0.051)	44	0.023 0.024	0.015 0.016	— —	0.003 0.003	0.041 0.043
Carrington, ND AI039-04HA 2004; Region 7	Barley (Rows)/ Robust	Straw	0.046 (0.051)	41	0.040 0.044	0.018 0.019	— —	0.001 <LOD	0.059 0.068
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Straw	0.045 (0.050)	41	0.105 0.099	0.022 0.022	— —	0.002 0.002	0.129 0.123
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Straw	0.046 (0.052)	44	0.043 0.055	0.036 0.036	— —	0.004 0.002	0.083 0.093
Jerome, ID AI043-04H 2004; Region 9	Barley (Rows)/ Lud	Straw	0.045 (0.051)	51	0.105 0.108	0.035 0.036	— —	0.005 0.005	0.145 0.149
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Straw	0.043 (0.048)	44	0.386 0.370	0.108 0.103	— —	0.012 0.012	0.506 0.485
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Straw	0.092 (0.102)	45	0.060 0.108	0.028 0.046	— —	0.002 0.003	0.090 0.157
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Straw	0.045 (0.050)	43	0.052 0.027	0.037 0.019	— —	0.003 0.002	0.092 0.048
Winchester, ON AI047-04H 2004; Region 5B	Barley (Rows)/ Grant	Straw	0.048 (0.054)	35	0.049 0.050	0.025 0.027	— —	0.003 0.003	0.077 0.080
Fort Saskatchewan, AB AI048-04HA 2005; Region 14	Barley (Rows)/ AC Dolly	Straw	0.045 (0.051)	42	0.072 0.049	0.025 0.020	— —	0.023 0.014	0.120 0.083
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Straw	0.045 (0.051)	45	0.062 0.074	0.027 0.027	— —	0.003 0.002	0.092 0.103
Blaine Lake, SK AI051-04H 2004; Region 14	Barley (Rows)/ Bold	Straw	0.044 (0.050)	45	0.150 0.157	0.031 0.035	— —	0.003 0.004	0.184 0.196
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ Copeland	Straw	0.046 (0.052)	43	0.008 0.009	0.005 0.004	— —	<LOD <LOD	0.018 0.018
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Straw	0.046 (0.051)	42	0.075 0.060	0.034 0.026	— —	0.006 0.006	0.115 0.092
Regina, SK AI054-04HA 2004; Region 14	Barley (Rows)/ Kendall	Straw	0.045 (0.050)	45	0.039 0.036	0.021 0.020	— —	0.001 0.001	0.061 0.057
Fort Qu'Appelle, SK AI055-04HA 2005; Region 14	Barley (Rows)/ Kendall	Straw	0.045 (0.051)	45	0.017 0.017	0.015 0.012	— —	0.002 0.001	0.034 0.030

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TABLE C.3.1. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 SE06 A1).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg .i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Brookdale, MB AI058-04HA 2005; Region 14	Barley (Rows)/ AC Rosser 2005	Straw	0.045 (0.050)	45	0.055 0.058	0.074 0.087	— —	0.004 0.003	0.133 0.148
Clanwilliam, MB AI059-04HA 2005; Region 14	Barley (Rows)/ Stratus	Straw	0.046 (0.052)	55	0.109 0.060	0.008 0.005	— —	0.002 0.001	0.119 0.066
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Straw	0.045 (0.050)	45	0.085 0.079	0.039 0.035	— —	0.014 0.012	0.138 0.126
Mundare, AB AI186-04H 2005; Region 14	Barley (Rows)/ AC Dolly	Straw	0.045 (0.050)	40	0.027 0.051	0.023 0.018	— —	0.002 0.002	0.052 0.071
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Straw	0.044 (0.050)	35	0.173 0.451	0.092 0.220	— —	0.014 0.031	0.279 0.702
				45	0.031 0.032	0.016 0.015	— —	0.004 0.003	0.051 0.050
				52	0.052 0.054	0.020 0.017	— —	0.004 0.003	0.076 0.074
				59	0.066 0.066	0.020 0.018	— —	0.004 0.002	0.090 0.086
				69	0.073 0.062	0.017 0.016	— —	0.002 0.002	0.092 0.080
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Straw	0.045 (0.050)	34	0.128 0.123	0.126 0.113	— —	0.011 0.015	0.265 0.251
				43	0.030 0.050	0.053 0.062	— —	0.006 0.008	0.089 0.120
				50	0.028 0.026	0.055 0.049	— —	0.006 0.007	0.089 0.082
				60	0.034 0.030	0.059 0.050	— —	0.007 0.005	0.100 0.085
				70	0.037 0.037	0.053 0.056	— —	0.010 0.009	0.100 0.102

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation total pyrasulfotole.

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Hay	0.033 (0.037)	25	0.159 0.138	0.126 0.108	— —	0.007 0.007	0.292 0.253
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Hay	0.032 (0.035)	25	0.048 0.051	0.005 0.005	0.007 0.007	0.003 0.003	0.058 0.061
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Hay	0.035 (0.039)	21	0.067 0.062	0.027 0.026	0.035 0.035	0.004 0.004	0.106 0.100
Carrington, ND AI039-04HA 2004; Region 7	Barley (Rows)/ Robust	Hay	0.034 (0.038)	23	0.192 0.179	0.071 0.058	0.093 0.078	0.008 0.006	0.293 0.261
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Hay	0.034 (0.038)	22	0.103 0.109	0.028 0.031	0.036 0.041	0.006 0.007	0.145 0.156
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Hay	0.035 (0.039)	25	0.242 0.259	0.079 0.078	0.103 0.104	0.008 0.009	0.353 0.370
Jerome, ID AI043-04H 2004; Region 9	Barley (Rows)/ Lud	Hay	0.034 (0.038)	25	0.099 0.097	0.021 0.019	— —	0.006 0.005	0.126 0.121
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Hay	0.033 (0.037)	23	0.266 0.296	0.07 0.067	0.098 0.094	0.015 0.014	0.379 0.404
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Hay	0.072 (0.080)	25	0.069 0.093	0.06 0.058	— —	0.005 0.006	0.134 0.157
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Hay	0.034 (0.038)	25	0.084 0.082	0.06 0.055	— —	0.007 0.007	0.151 0.144
Fort Saskatchewan, AB AI048-04H 2004; Region 14	Barley (Rows)/ Metcalf	Hay	0.033 (0.037)	24	0.112 0.108	0.042 0.041	0.055 0.055	0.004 0.005	0.171 0.167
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Hay	0.034 (0.038)	24	0.083 0.098	0.047 0.049	— —	0.011 0.009	0.141 0.156
Innisfail, AB AI050-04HB 2005; Region 14	Barley (Rows)/ CDC Bold	Hay	0.034 (0.038)	24	0.059 0.067	0.032 0.037	— —	0.005 0.007	0.096 0.111
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ Copeland	Hay	0.035 (0.039)	25	0.024 0.026	0.009 0.01	— —	0.002 0.002	0.035 0.038
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Hay	0.034 (0.039)	21	0.386 0.350	0.122 0.103	— —	0.021 0.017	0.529 0.470
Indian Head, SK AI054-04H 2004; Region 14	Barley (Rows)/ Robust	Hay	0.034 (0.038)	21	0.050 0.047	0.028 0.027	0.038 0.037	0.002 0.002	0.090 0.085
Ituna, SK AI055-04H 2004; Region 14	Barley (Rows)/ Robust	Hay	0.033 (0.037)	23	0.067 0.117	0.007 0.012	0.009 0.016	0.001 0.005	0.077 0.138

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Brookdale, MB AI058-04H 2004; Region 14	Barley (Rows)/ Stratus	Hay	0.034 (0.038)	23	0.337 0.293	0.168 0.154	— —	0.015 0.013	0.520 0.460
Clanwilliam, MB AI059-04H 2004; Region 14	Barley (Rows)/ Stratus	Hay	0.035 (0.039)	21	0.380 0.401	0.065 0.074	— —	0.020 0.019	0.465 0.494
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Hay	0.033 (0.037)	25	0.277 0.270	0.068 0.06	— —	0.024 0.022	0.369 0.352
Mundare, AB AI186-05H 2005; Region 14	Barley (Rows)/ AC Dolly	Hay	0.033 (0.037)	22	0.116 0.117	0.071 0.073	— —	0.007 0.006	0.194 0.196
Saint-Cesaire, QB AI191-05H 2005; Region 5B	Barley (Rows)/ Sabrina	Hay	0.035 (0.040)	24	0.189 0.120	0.031 0.02	— —	0.004 0.003	0.224 0.143
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Hay	0.033 (0.038)	0	0.273 0.263	0.306 0.342	— —	1.891 1.784	2.470 2.389
				15	0.152 0.169	0.067 0.079	— —	0.021 0.024	0.240 0.272
				24	0.158 0.157	0.062 0.066	— —	0.010 0.009	0.230 0.232
				29	0.132 0.122	0.05 0.048	— —	0.005 0.005	0.187 0.175
				35	0.094 0.116	0.035 0.039	— —	0.004 0.005	0.133 0.160
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Hay	0.034 (0.038)	0	0.028 0.025	0.179 0.06	— —	1.414 1.556	1.621 1.641
				13	0.251 0.203	0.227 0.128	— —	0.046 0.037	0.524 0.368
				25	0.170 0.183	0.107 0.106	— —	0.020 0.027	0.297 0.316
				29	0.149 0.172	0.083 0.094	— —	0.017 0.020	0.249 0.286
				34	0.147 0.211	0.073 0.118	— —	0.018 0.022	0.238 0.351
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Grain	0.033 (0.037)	45	0.052 0.046	0.005 0.005	— —	0.002 0.001	0.059 0.052
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Grain	0.032 (0.035)	44	0.024 0.029	<LOD <LOD	— —	<LOD <LOD	0.034 0.039
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Grain	0.035 (0.039)	44	0.006 0.007	0.001 0.001	— —	<LOD <LOD	0.012 0.013
Carrington, ND AI039-04HA 2004; Region 7	Barley (Rows)/ Robust	Grain	0.034 (0.038)	41	0.021 0.022	0.001 0.001	— —	<LOD <LOD	0.027 0.028
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Grain	0.034 (0.038)	41	0.033 0.036	0.003 0.002	— —	0.001 <LOD	0.037 0.043

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Grain	0.035 (0.039)	44	0.018 0.020	<LOD <LOD	— —	<LOD <LOD	0.028 0.030
Jerome, ID AI043-04H 2004; Region 9	Barley (Rows)/ Lud	Grain	0.034 (0.038)	45	0.065 0.063	0.001 0.001	— —	<LOD <LOD	0.071 0.069
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Grain	0.033 (0.037)	44	0.065 0.063	0.004 0.005	— —	0.003 0.003	0.072 0.071
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Grain	0.072 (0.080)	45	0.014 0.011	0.001 0.001	— —	<LOD <LOD	0.020 0.017
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Grain	0.034 (0.038)	43	0.026 0.030	0.005 0.005	— —	0.002 0.002	0.033 0.037
Fort Saskatchewan, AB AI048-04HA 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.034 (0.038)	42	0.003 0.003	<LOD <LOD	— —	<LOD <LOD	0.013 0.013
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Grain	0.034 (0.038)	45	0.016 0.018	0.001 <LOD	— —	<LOD <LOD	0.022 0.028
Innisfail, AB AI050-04HB 2005; Region 14	Barley (Rows)/ CDC Bold	Grain	0.034 (0.038)	45	0.013 0.012	<LOD <LOD	— —	<LOD <LOD	0.023 0.022
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.035 (0.039)	43	0.006 0.006	<LOD <LOD	— —	<LOD <LOD	0.016 0.016
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Grain	0.034 (0.039)	42	0.080 0.074	0.001 <LOD	— —	<LOD <LOD	0.086 0.084
Regina, SK AI054-04HA 2005; Region 14	Barley (Rows)/ Kendall	Grain	0.034 (0.038)	45	0.026 0.026	<LOD <LOD	— —	<LOD <LOD	0.036 0.036
Fort Qu'Appelle, SK AI055-04HA 2005; Region 14	Barley (Rows)/ Kendall	Grain	0.033 (0.038)	45	0.024 0.026	<LOD 0.001	— —	<LOD <LOD	0.034 0.032
Brookdale, MB AI058-04HA 2005; Region 14	Barley (Rows)/ AC Rosser 2005	Grain	0.032 (0.036)	45	0.026 0.027	0.003 0.003	— —	<LOD <LOD	0.034 0.035
Clanwilliam, MB AI059-04HA 2005; Region 14	Barley (Rows)/ Robust	Grain	0.033 (0.037)	45	0.018 0.017	<LOD <LOD	— —	<LOD <LOD	0.028 0.027
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Grain	0.033 (0.037)	45	0.049 0.048	0.004 0.004	— —	0.002 0.003	0.055 0.055
Mundare, AB AI186-05H 2005; Region 14	Barley (Rows)/ AC Dolly	Grain	0.033 (0.037)	40	0.007 0.006	<LOD <LOD	— —	<LOD <LOD	0.017 0.016
Saint-Cesaire, QB AI191-05H 2005; Region 5B	Barley (Rows)/ Sabrina	Grain	0.035 (0.040)	45	0.068 0.065	<LOD <LOD	— —	<LOD <LOD	0.078 0.075

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Grain	0.033 (0.038)	35	0.044	0.001	—	<LOD	0.050
					0.040	0.001	—	<LOD	0.046
				45	0.058	0.002	—	<LOD	0.065
					0.073	0.002	—	<LOD	0.080
				52	0.060	<LOD	—	<LOD	0.070
					0.056	0.001	—	<LOD	0.062
				59	0.055	0.001	—	<LOD	0.061
					0.051	0.001	—	<LOD	0.057
				69	0.061	0.001	—	<LOD	0.067
					0.057	<LOD	—	<LOD	0.067
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Grain	0.034 (0.038)	34	0.020	0.002	—	<LOD	0.027
					0.021	0.002	—	<LOD	0.028
				43	0.027	0.002	—	<LOD	0.030
					0.028	0.003	—	0.001	0.027
				50	0.024	0.001	—	<LOD	0.029
					0.021	0.001	—	<LOD	0.032
				60	0.023	0.001	—	<LOD	0.027
					0.022	<LOD	—	<LOD	0.028
				70	0.021	0.001	—	<LOD	0.050
					0.022	0.001	—	<LOD	0.046
Athens, GA AI035-04H 2005; Region 2	Barley (Rows)/ GA Acton	Straw	0.033 (0.037)	45	0.109	0.062	—	0.004	0.175
					0.106	0.070	—	0.005	0.181
Sabin, MN AI037-04H 2004; Region 5	Barley (Rows)/ Robust	Straw	0.032 (0.035)	44	0.018	0.004	—	0.001	0.023
					0.027	0.003	—	0.001	0.031
Guelph, ON AI038-04H 2004; Region 5	Barley (Rows)/ AC Parkhill	Straw	0.035 (0.039)	44	0.038	0.022	—	0.005	0.065
					0.035	0.018	—	0.005	0.058
Carrington, ND AI039-04HA 2004; Region 7	Barley (Rows)/ Robust	Straw	0.034 (0.038)	41	0.048	0.014	—	0.001	0.063
					0.039	0.013	—	<LOD	0.057
Grand Island, NE AI040-04H 2005; Region 7	Barley (Rows)/ Robust	Straw	0.034 (0.038)	41	0.086	0.019	—	0.003	0.108
					0.082	0.020	—	0.004	0.106
Dundurn, SK AI041-04H 2004; Region 7	Barley (Rows)/ Metcalf	Straw	0.035 (0.039)	44	0.073	0.029	—	0.004	0.106
					0.079	0.027	—	0.004	0.110
Jerome, ID AI043-04H 2004; Region 9	Barley (Rows)/ Lud	Straw	0.034 (0.038)	45	0.093	0.022	—	0.008	0.123
					0.102	0.026	—	0.009	0.137
Fresno, CA AI044-04H 2005; Region 10	Barley (Rows)/ UC 937	Straw	0.033 (0.037)	44	0.326	0.064	—	0.011	0.401
					0.251	0.047	—	0.010	0.308
Madras, OR AI045-04H 2004; Region 11	Barley (Rows)/ Gustoe	Straw	0.072 (0.080)	45	0.074	0.035	—	0.004	0.113
					0.086	0.037	—	0.005	0.128
Ephrata, WA AI046-04H 2004; Region 11	Barley (Rows)/ Washford	Straw	0.034 (0.038)	43	0.052	0.032	—	0.002	0.086
					0.036	0.025	—	0.002	0.063
Fort Saskatchewan, AB AI048-04HA 2005; Region 14	Barley (Rows)/ AC Dolly	Straw	0.034 (0.038)	42	0.059	0.031	—	0.003	0.093
					0.053	0.024	—	0.002	0.079

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Mundare, AB AI049-04H 2004; Region 14	Barley (Rows)/ Seebe	Straw	0.034 (0.038)	45	0.058 0.052	0.027 0.021	— —	0.004 0.002	0.089 0.075
Innisfail, AB AI050-04HB 2005; Region 14	Barley (Rows)/ CDC Bold	Straw	0.034 (0.038)	45	0.012 0.011	0.010 0.008	— —	0.002 0.002	0.024 0.021
Cudworth, SK AI052-04HB 2005; Region 14	Barley (Rows)/ Copeland	Straw	0.035 (0.039)	43	0.008 0.007	0.005 0.004	— —	0.001 0.001	0.014 0.012
Cudworth, SK AI053-04HB 2005; Region 14	Barley (Rows)/ Metcalf	Straw	0.034 (0.039)	42	0.047 0.048	0.024 0.026	— —	0.003 0.004	0.074 0.078
Regina, SK AI054-04HA 2005; Region 14	Barley (Rows)/ Kendall	Straw	0.034 (0.038)	45	0.050 0.049	0.021 0.026	— —	0.002 0.002	0.073 0.077
Fort Qu'Appelle, SK AI055-04HA 2005; Region 14	Barley (Rows)/ Kendall	Straw	0.033 (0.038)	45	0.038 0.036	0.025 0.022	— —	0.004 0.002	0.067 0.060
Brookdale, MB AI058-04HA 2005; Region 14	Barley (Rows)/ AC Rosser 2005	Straw	0.032 (0.036)	45	0.053 0.051	0.067 0.062	— —	0.006 0.004	0.126 0.117
Clanwilliam, MB AI059-04HA 2005; Region 14	Barley (Rows)/ Robust	Straw	0.033 (0.037)	45	0.046 0.046	0.005 0.006	— —	0.002 0.002	0.053 0.054
Arkansaw, WI AI185-04H 2005; Region 5	Barley (Rows)/ Kewaunee Barley	Straw	0.033 (0.037)	45	0.085 0.080	0.031 0.031	— —	0.011 0.011	0.127 0.122
Mundare, AB AI186-04H 2005; Region 14	Barley (Rows)/ AC Dolly	Straw	0.033 (0.037)	40	0.035 0.052	0.027 0.023	— —	0.002 0.002	0.064 0.077
Saint-Cesaire, QB AI191-05H 2005; Region 5B	Barley (Rows)/ Sabrina	Straw	0.035 (0.040)	45	0.114 0.059	0.005 0.005	— —	<LOD 0.001	0.124 0.065
Springfield, NE AI036-04D 2005; Region 5	Barley (Rows)/ Robust	Straw	0.033 (0.038)	35	0.129 0.179	0.061 0.090	— —	0.007 0.010	0.197 0.279
				45	0.021 0.026	0.012 0.012	— —	0.002 0.002	0.035 0.040
				52	0.033 0.043	0.017 0.016	— —	0.004 0.002	0.054 0.061
				59	0.054 0.044	0.024 0.024	— —	0.007 0.003	0.085 0.071
				69	0.046 0.049	0.029 0.026	— —	0.002 0.003	0.077 0.078
Windthorst, SK AI042-04DA 2005; Region 7	Barley (Rows)/ AC Metcalf	Straw	0.034 (0.038)	34	0.116 0.116	0.088 0.089	— —	0.013 0.013	0.217 0.218
				43	0.040 0.054	0.037 0.047	— —	0.008 0.008	0.085 0.109
				50	0.028 0.024	0.028 0.026	— —	0.010 0.006	0.066 0.056
				60	0.060 0.051	0.050 0.041	— —	0.011 0.009	0.121 0.101

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TABLE C.3.2. Residue Data from Crop Field Trials with Pyrasulfotole (AE 0317309 02 EC23 A8).

City, State Trial ID Year; Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total pyrasulfotole[3] (ppm)
					pyrasulfotole-benzoic acid	pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
				70	0.041 0.047	0.040 0.042	— —	0.008 0.009	0.089 0.098

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation Total pyrasulfotole.

TABLE C.4.1. Summary of Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid (AE B197555)									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	0.004	0.116	0.110	0.031	0.034	0.025
Hay		21-25	56	0.027	0.631	0.614	0.133	0.184	0.140
Straw		34-45	48	0.008	0.451	0.380	0.054	0.084	0.092
Pyrasulfotole-desmethyl									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	<LOD	0.008	0.008	0.002	0.003	0.002
Hay		21-25	56	0.010	0.185	0.171	0.067	0.082	0.045
Straw		34-45	48	0.004	0.220	0.156	0.027	0.043	0.040
Pyrasulfotole									
Grain	0.040–0.049 (0.046–0.055)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.001
Hay		21-25	56	<LOD	0.050	0.044	0.008	0.013	0.012
Straw		34-45	48	<LOD	0.031	0.022	0.003	0.006	0.006

HAFT is the highest average field trial.
For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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TABLE C.4.2. Summary of Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	0.003	0.080	0.077	0.026	0.031	0.022
Hay		21-25	48	0.024	0.401	0.391	0.116	0.155	0.104
Straw		35-45	50	0.007	0.326	0.289	0.050	0.062	0.054
Pyrasulfotole-desmethyl									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.002
Hay		21-25	48	0.007	0.168	0.161	0.059	0.062	0.039
Straw		35-45	50	0.003	0.070	0.066	0.024	0.026	0.017
Pyrasulfotole									
Grain	0.031–0.038 (0.035–0.042)	35-45	50	<LOD	0.005	0.005	0.005	0.004	0.001
Hay		21-25	48	0.001	0.027	0.024	0.007	0.009	0.007
Straw		35-45	50	<LOD	0.011	0.010	0.004	0.004	0.003

HAFT is the highest average field trial.
For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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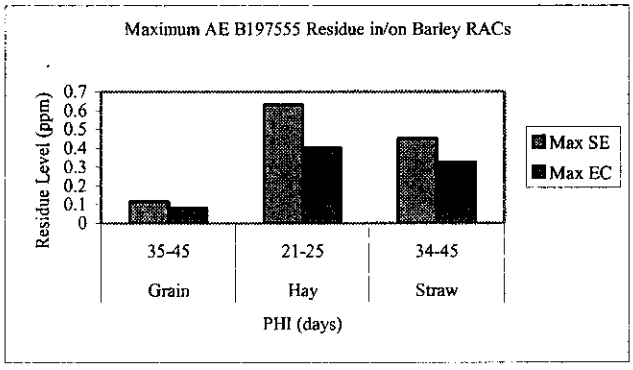
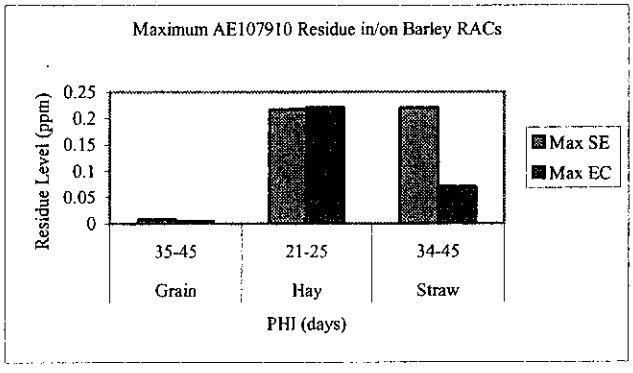
FIGURE C.1. Maximum Residue Detected in/on Barley RACs





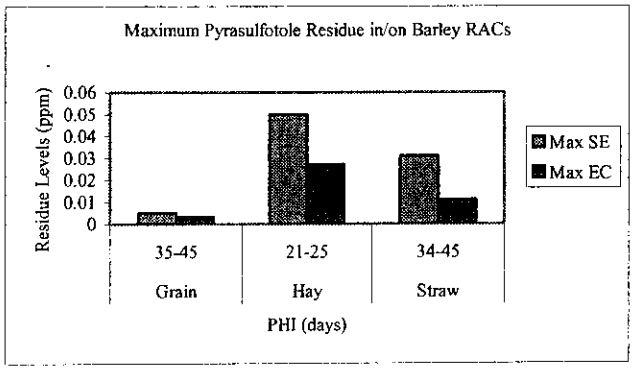


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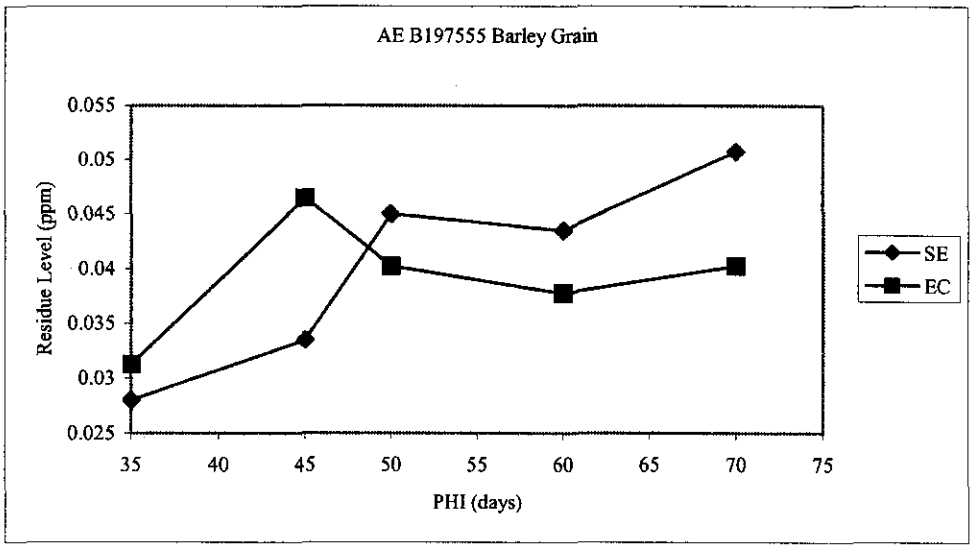
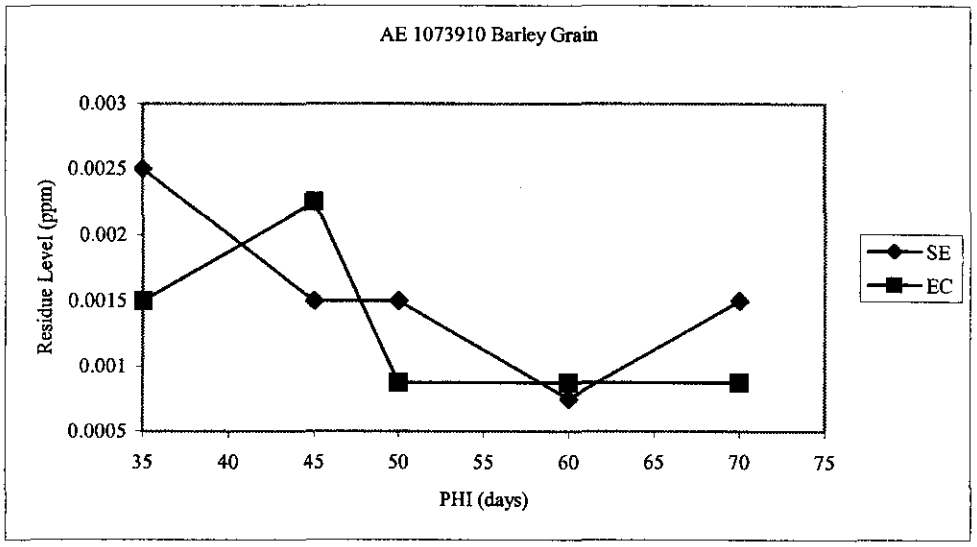
FIGURE C.2. Time Course of Analyte Residues in/on Barley RACs





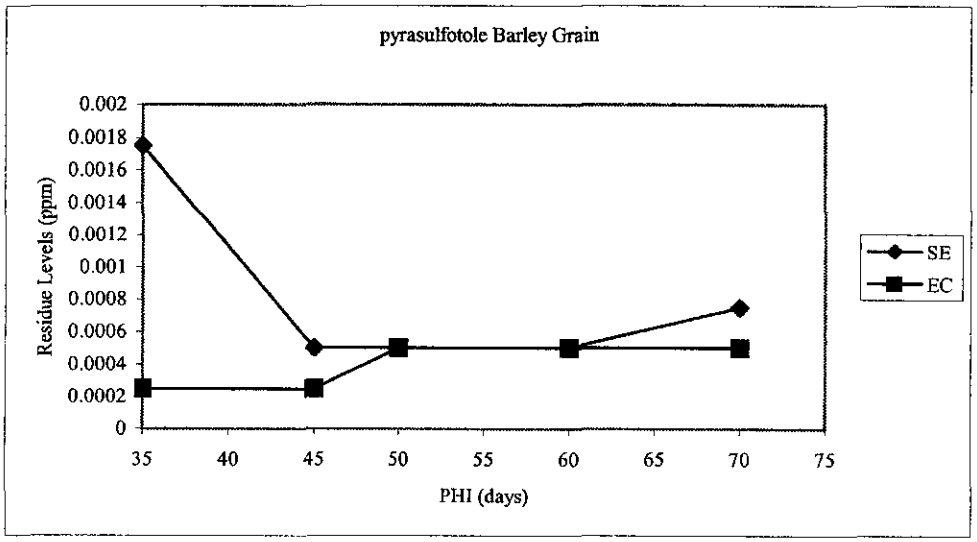


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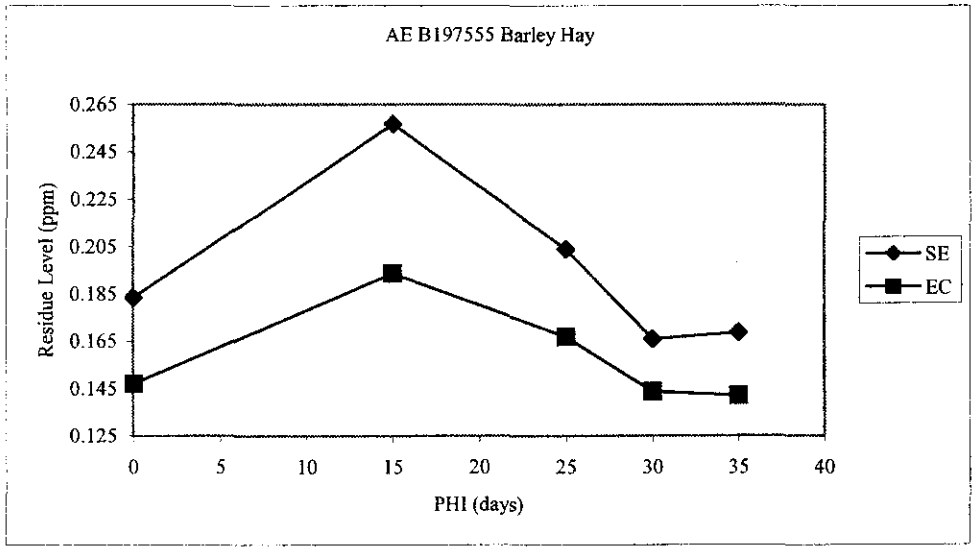
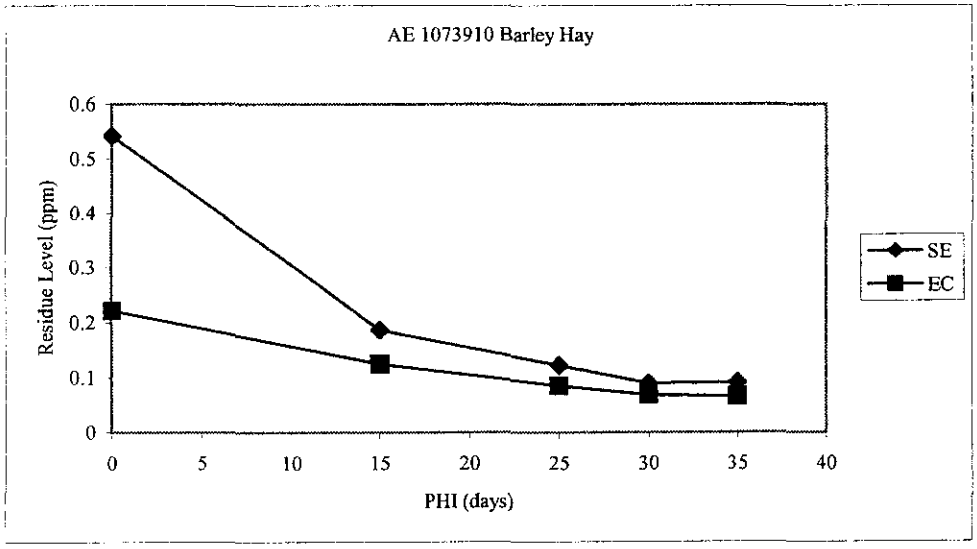
FIGURE C.2. Continued





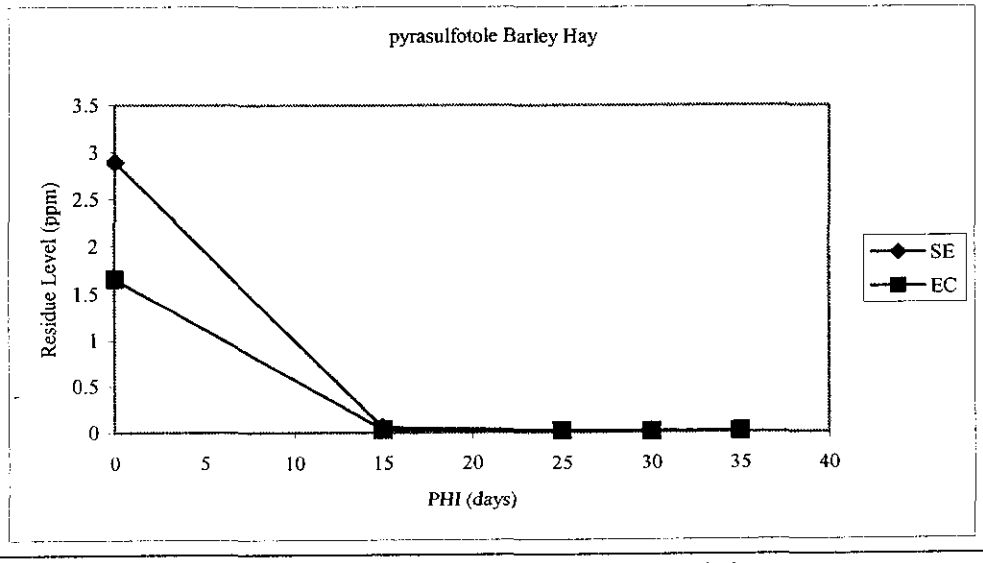


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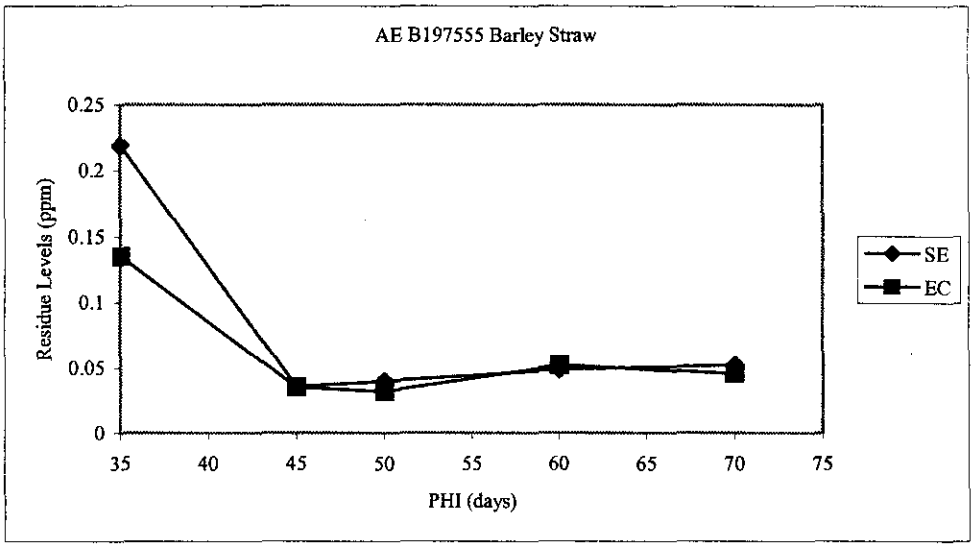
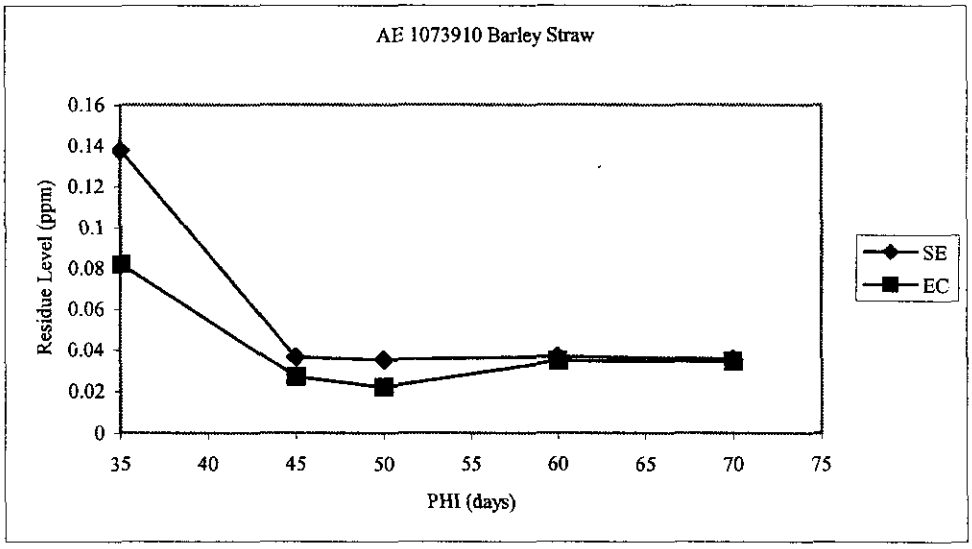
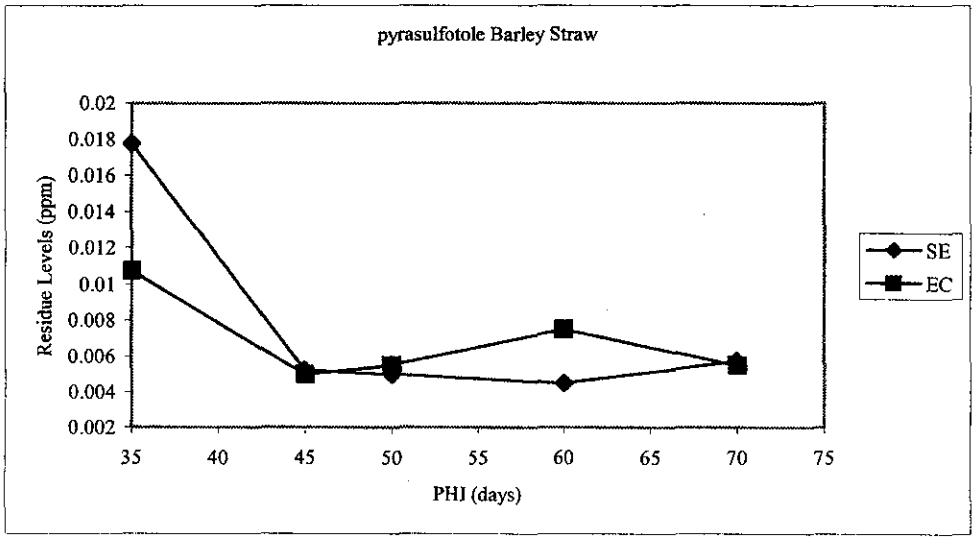
FIGURE C.2. Continued







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D. CONCLUSION

The crop field data on barley RACs (grain, hay and straw) were deemed acceptable for the determination of pyrasulfotole, as well as the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl, when using the AE 017309 02 SE06 or the AE 017309 03 EC23 formulation. The study use pattern had a maximum seasonal application rate of 0.048 lbs a.i./A (0.054 kg a.i./ha) for SE06 or 0.037 lbs a.i./A (0.041 kg a.i./ha) for EC23 on barley grain, hay, and straw (PHI of 21 to 25 days for hay, 35 to 45 days for straw and grain). The residue profiles were similar between formulations; however, the amount of each analyte in/on barley RACs appeared to be higher following the SE06 application, with hay having the highest levels of residues and grain the lowest. Pyrasulfotole-benzoic acid residue levels are not expected to exceed 0.631 ppm (hay), 0.116 ppm (grain) and 0.451 ppm (straw); pyrasulfotole-desmethyl residue levels are not expected to exceed 0.185 ppm (hay), 0.008 ppm (grain) and 0.220 ppm (straw); and pyrasulfotole residue levels are not expected to exceed 0.050 ppm (hay), 0.005 ppm (grain) and 0.031 ppm (straw). In decline trials, the amounts of all analytes decreased with time in/on the barley hay and straw, but they did not change significantly in/on barley grain where analytes residue levels were relatively low.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of pyrasulfotole: substance, pure code: pyrasulfotole 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of pyrasulfotole. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). Pyrasulfotole - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of pyrasulfotole at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). pyrasulfotole: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). Pyrasulfotole: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

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8. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). Pyrasulfotole: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. MRID No. 46801806 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using LC-MS/MS.

11. MRID No. 46801808 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Extraction efficiency of Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using lc/ms/ms. Bayer CropScience Report No. RAAIX011.

12. MRID No. 46801819 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Storage stability of pyrasulfotole, AE1073910, and AE B197555 in soybean grain, wheat grain, wheat forage, and wheat hay. Bayer CropScience Study No. RAAIX009.

13. MRID No. 46801819 Coopersmith, H. (2006). Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (8 November 2006); George Kramer (8 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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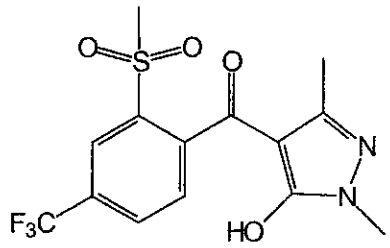
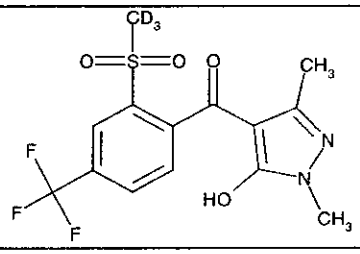
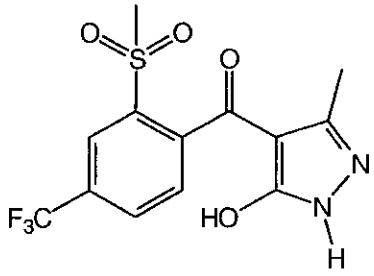
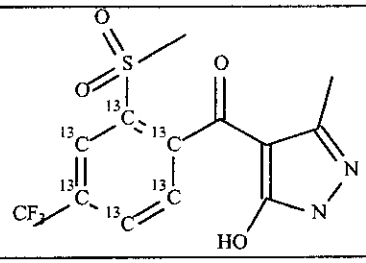
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
AE 0317309 Pyrasulfotole	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-AE 0317309 d_3-Pyrasulfotole	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
AE 1073910 Pyrasulfotole-desmethyl	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
AE 1073910-IS [phenyl-$^{13}C_6$]AE 107391	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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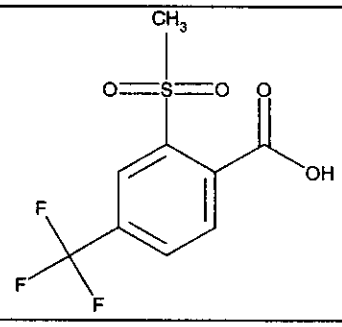
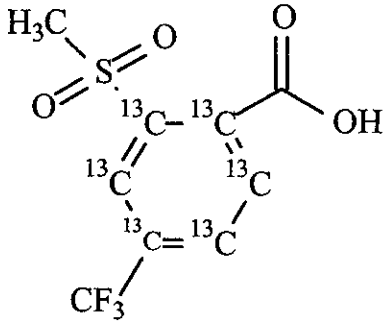
Reference standards continued.

Common name/code	Chemical name	Chemical structure
AE B197555 Pyrasulfotole benzoic acid	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
AE B197555-IS [phenyl-$^{13}C_6$]AE B197555]	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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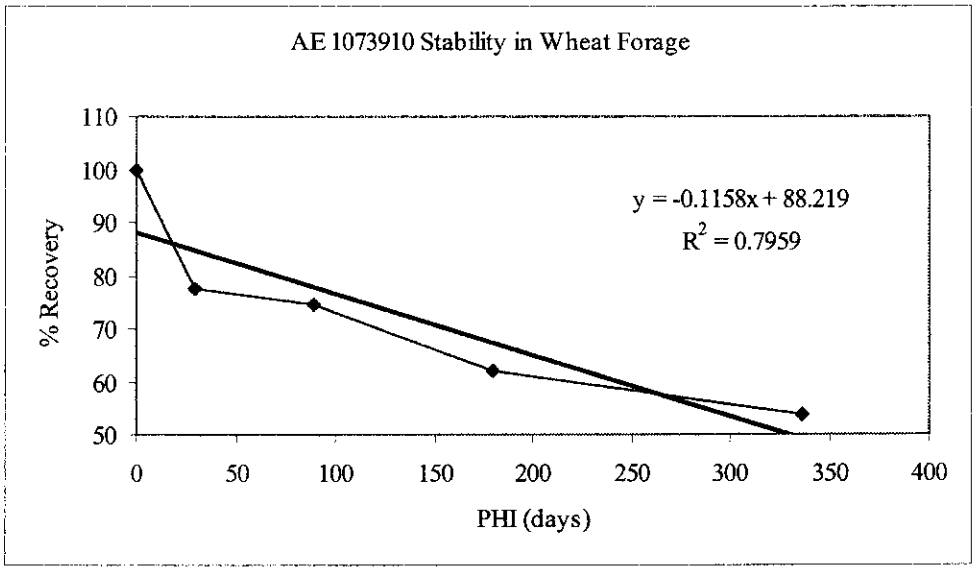
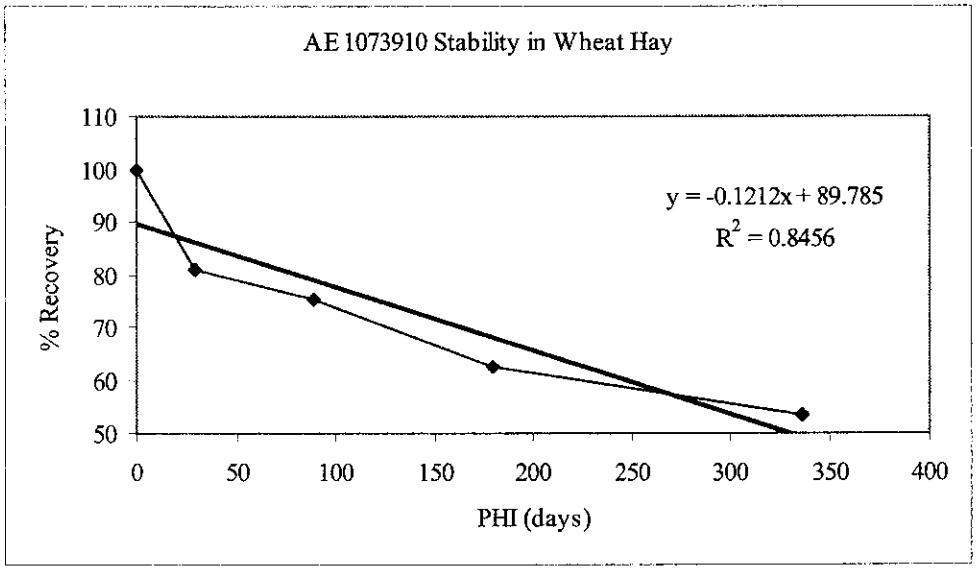
APPENDIX 2





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Primary Evaluator	William S Mohan, Ph.D. Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Peer Reviewer	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801825 Milo, J., and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 0317309 EC23 A8: Magnitude of the Residue in/on Wheat. Lab Project Number: RAAIM002. Unpublished study prepared by Bayer CropScience, Inc. 1562 p.

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EXECUTIVE SUMMARY:

Bayer CropScience has submitted field trial data for pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone) on wheat. During the 2004 and 2005 wheat growing seasons, field trials were conducted to evaluate the magnitude of residues in/on wheat forage, hay, grain, and straw following application of either end-use product, AE 0317309 02 SE06 A1 (SE06) or AE 0317309 03 EC23 A8 (EC23). AE 0317309 02 SE06 A1 is a suspo-emulsion (SE) containing 50 g pyrasulfotole/L and 12.5 g mefenpyr-diethyl/L safener. AE 0317309 03 EC23 A8 is an emulsifiable concentrate (EC) containing 37.5 g pyrasulfotole/L, 210 g bromoxynil/L, and 9.38 g mefenpyr-diethyl/L.

In total, 35 hay trials, 34 forage trials, and 32 grain and straw trials were conducted using SE06, while 31 hay trials and 32 forage, grain and straw trials were conducted using EC23. Trials for both formulations occurred in Regions 2 (GA; 2 trials), 4 (MS; 1 trial), 5 (KS, IL, NE, MN, ON; 6 trials), 6 (TX; 1 trial), 7 (ND, NE, SD, ND, SA; 10 trials), 7A (AB; 1 trial), 8 (KS, TX; 6 trials), 11 (ID; 1 trial) and 14 (SA, AB, MB; 15 trials). At each trial location, SE06 (5% a.i.) or EC23 (3.75 % a.i.) was applied once to pre-emergent wheat as a foliar broadcast spray at a rate of 0.040 to 0.049 lb a.i./A (0.046 to 0.055 kg a.i./ha) or 0.031 to 0.038 lb a.i./A (0.035 to 0.042 kg a.i./ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 24 (forage) BBCH 37 to 51 (hay, grain, and straw). All trials used ammonium sulphate as an adjuvant.

Preharvest intervals (PHIs) for wheat raw agricultural commodities (RACs) were 18 to 25 days or 41 to 46 days for forage, 21 to 25 days for hay and 40 to 56 days for grain and straw. In the decline trials, forage samples were collected at five intervals (± 2 days) corresponding to PHIs of 15, 25, 35, 45, and 55 days and hay samples were collected at five intervals (± 2 days) corresponding to PHIs of 0, 15, 25, 30, and 35 days. Grain and straw samples were collected at five intervals (± 3 days) corresponding to PHIs of 40, 50, 55, 60, and 70 days.

Pyrasulfotole (AE 0317309) residues and the metabolites pyrasulfotole-benzoic acid (AE B197555) and pyrasulfotole-desmethyl (AE 1073910) were quantified by high-performance liquid chromatography-electrospray ionization with tandem mass spectrometry (HPLC-MS/MS) using stable isotope labelled analytes as internal standards. The limit of quantitation (LOQ) for each analyte was 0.010 ppm in wheat forage, hay, grain, and straw.

The samples in this study were frozen a maximum of 9 months (272 days), with the exception of forage samples from a single trial (SE06 formulation) that were stored frozen a maximum of 15 months (462 days), prior to analysis. Data from an 11-month storage stability study on wheat RACs demonstrate that residues of pyrasulfotole and pyrasulfotole-benzoic acid were stable in all wheat matrices. Residues of pyrasulfotole-desmethyl were also stable in soybeans and wheat grain but were found to decline in wheat forage and hay (ca. 0.12 % per day).

With the exception of pyrasulfotole-desmethyl in/on wheat hay, the levels of analyte residues appeared to be slightly higher following SE06 application. The maximum amount of pyrasulfotole-benzoic acid reported were 0.447 ppm (forage, 25-day PHI), 1.15 ppm (hay), 0.873 ppm (grain) and 0.420 ppm (straw); maximum amount of pyrasulfotole-desmethyl reported were

0.165 ppm (forage, 25-day PHI), 0.601 ppm (hay), 0.009 ppm (grain) and 0.154 ppm (straw); and the maximum amount of pyrasulfotole reported were 0.061 ppm (forage, 25-day PHI), 0.625 ppm (hay), 0.009 ppm (grain) and 0.030 ppm (straw).

Residue decline data showed that residues of pyrasulfotole and the metabolites decreased with time in wheat forage and wheat hay, but decreased only slightly or remained unchanged in wheat grain and wheat straw with increasing PHIs.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the field trial residue data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

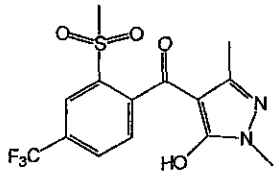
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C *No boiling point, decomposition starts at 245°C*		1
pH at 22.9°C	3.03		2
Density	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7×10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0pH 7.0pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

TABLE B.1.1 Trial Site Conditions.

Trial Identification (City, State/Year)	Trial ID	Soil characteristics				Meteorological Data	
		Type	%OM	pH	CEC (meq/g)	Total Rainfall in (cm)	Temp. Range °F (°C)
Tifton, GA/2004-05	AI001-04H	Sand	0.79	5.8	3.6	26.52 (67.36)	46–69 (8–21)
Leland, MS/2004-05	AI002-04H	Silt Loam	0.7	6.68	7.6	20.65 (52.45)	46–66 (8–19)
Stilwell, KS/2004-05	AI003-04H	Silty Clay	2.8	6.1	20.2	30.67 (77.90)	40–59 (4–15)
Seymour, IL/2004-05	AI004-04H	Silt Loam	3.4	6.8	19.2	27.64 (70.21)	38–59 (3–15)
Springfield, NE/2004-05	AI005-04H	Silt Loam	2.9	6.2	14.1	24.36 (61.87)	36–62 (2–17)
Sabin, MN/2005	AI006-04DB	Silt Loam	3.5	7.9	25	9.24 (23.47)	55–78 (13–26)
Metz, ON/2004	AI007-04H	Silt Loam	4.3	7.6	15.7	8.03 (20.40)	52–72 (11–22)
Rockwood, ON/2005	AI007-04HA	Silt Loam	3.7	7.4	12.4	9.56 (24.28)	58–81 (14–27)
Uvalde, TX/2004-05	AI008-04H	Clay Loam	2.1	7.8	36.9	8.2 (20.83)	52–73 (11–23)

US EPA ARCHIVE DOCUMENT

TABLE B.1.1 Trial Site Conditions.

Trial Identification (City, State/Year)	Trial ID	Soil characteristics				Meteorological Data	
		Type	%OM	pH	CEC (meq/g)	Total Rainfall in (cm)	Temp. Range °F (°C)
New Rockford, ND/2004	AI009-04HA	Sandy Loam	2.9	7.2	15.6	8.05 (20.45)	32–87 (0–31)
New Rockford, ND/2005	AI009-04HB	Sandy Loam	2.2	7.7	17.0	4.07 (10.34)	55–81 (13–27)
Elridge, ND/2004	AI010-04H	Loam	3.9	7.2	25.5	9.92 (25.20)	50–74 (0–23)
Grand Island, NE/2005	AI011-04H	Clay Loam	2.7	6.6	21.8	19.95 (50.67)	52–81 (11–27)
Leola, SD/2004	AI012-04H	Loam	4.9	6.9	22.6	12.4 (31.50)	52–76 (11–24)
Eldridge, ND/2004	AI013-04D	Sandy Loam	3.3	6.9	20.2	12.77 (32.44)	50–74 (10–23)
Dundurn, SA/2004	AI014-04H	Sandy Loam	3.56	7.1	18.1	5.94 (15.09)	61–72 (16–22)
Kenaston, SA/2004	AI015-04H	Sandy Loam	3.56	7.1	18.1	11.04 (28.04)	47–69 (8–21)
Taber, AB/2004	AI016-04H	Loam	2.38	8.1	16.6	6.03 (15.32)	45–74 (7–23)
Taber, AB/2005	AI016-04HA	Sandy Loam	2.91	8.1	12.7	8.87 (22.53)	49–75 (9–24)
Larned, KS/2004-05	AI017-04H	Loam	2.5	7.3	17.3	17.53 (44.53)	37–62 (3–17)
Hanston, KS/2004-05	AI018-04H	Silt Loam	2.3	7.0	23.3	13.98 (35.51)	38–62 (3–17)
Levelland, TX/2004-05	AI019-04H	Sandy Loam	0.8	8.3	13.9	13.23 (33.60)	39–64 (4–18)
Lubbock, TX/2004-05	AI020-04H	Sandy Loam	0.4	8.4	15.5	11 (27.94)	41–67 (5–19)
Uvalde, TX/2004-05	AI021-04H	Clay	2.8	7.7	41.4	14.71 (37.36)	50–74 (10–23)
Weatherford, OK/2004-05	AI022-04H	Silt Loam	1.0	7.2	12	22.82 (57.96)	44–64 (7–18)
Payette, ID/2004	AI023-04H	Loam	2.6	6.4	21.2	0.62 (1.57)	55–91 (13–33)
Wakaw, SA/2004	AI024-04HA	Loam	7.0	7.2	28	7.39 (18.77)	46–68 (8–20)
Fort Saskathchewan, AB/2004	AI025-04H	Silty Clay Loam	7	6.3	37	11.98 (30.43)	49–67 (9–19)
Fort Saskathchewan, AB/2005	AI025-04HA	Silty Clay Loam	10.2	5.8	37	5.2 (13.21)	50–71 (10–22)
Edmonton, AB/2004	AI026-04H	Silty Clay Loam	7	6.3	37	6.32 (16.05)	40–58 (4–14)
Edmonton, AB/2005	AI026-04HB	Silty Clay Loam	7	6.3	37	7.02 (17.83)	48–70 (9–21)
Edmonton, AB/2004	AI027-04H	Silty Clay Loam	7	6.3	37	9.49 (24.10)	50–71 (10–22)

US EPA ARCHIVE DOCUMENT

TABLE B.1.1 Trial Site Conditions.

Trial Identification (City, State/Year)	Trial ID	Soil characteristics				Meteorological Data	
		Type	%OM	pH	CEC (meq/g)	Total Rainfall in (cm)	Temp. Range °F (°C)
Indian Head, SA/2004	AI028-04H	Clay Loam	2.6	7.9	14.4	18.51 (47.02)	46–70 (8–21)
Ituna, SA/2005	AI028-04HA	Sandy Loam	5.5	7.5	17.6	6.53 (16.59)	51–74 (11–23)
Ituna, SA/2004	AI029-04H	Clay Loam	15	7.1	11.6	18.51 (47.02)	46–70 (8–21)
Fort Qu'Appelle, SA/2004	AI030-04H	Clay	4.5	7.9	18.3	18.51 (47.02)	46–70 (8–21)
Yorkton, SA/2004	AI031-04H	Clay Loam	2	7.8	9.8	9.13 (23.19)	46–68 (8–20)
Brookdale, MB/2004	AI032-04H	Loam	5.1	6.3	23.3	9.48 (24.08)	48–69 (9–21)
Brookdale, MB/2005	AI032-04HA	Loam	5.1	6.3	23.3	4.08 (10.36)	51–76 (11–24)
Clanwilliam, MB/2004	AI033-04H	Loam	6.98	8.4	38.2	9.48 (24.08)	48–69 (9–21)
Clanwilliam, MB/2005	AI033-04HA	Loam	6.98	8.4	38.2	1.96 (4.98)	57–75 (14–24)
Rosthern, SA/2005	AI184-04H	Loam	7.2	7	27.6	10.53 (26.75)	49–71 (9–22)
Carrington, ND/2005	AI189-05H	Loam	2.7	7.6	19.5	7.39 (18.77)	44–94 (7–34)
Velva, ND/2005	AI190-05H	Loam	3.4	6.6	19.1	15.51 (39.40)	53–76 (12–24)

OM = organic matter; CEC = cation exchange capacity; NA = not available

Temperatures and rainfall data were provided, and some cases were above or below normal. Specifically, due to a cold wet fall in 2004, grain and straw commodities in Region 14 did not reach commercial harvest growth stages within the protocol-defined PHI intervals. For this reason many of the 2004 Region 14 trials were reinitiated in 2005. Although growing conditions in 2005 were more favourable, grain and straw samples in some trials did not reach commercial maturity (BBCH 89) when harvested at the desired PHI; as a result they were harvested outside the normal percent dry matter ranges. The early harvests in these trials did not appear to affect residue levels compared to those observed in other regions.

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TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
Tifton, GA 2004-05	SE06	1 appl: start of tillering	17 (163)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 foliar appl: flag leaf stage	18 (167)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 appl: start of tillering	17 (163)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 foliar appl: flag leaf stage	18 (167)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Leland, MS 2004-05	SE06	1 Appl: 5 Leaves unfolded	15 (139)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf sheath opening	14 (132)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: 5 Leaves unfolded	15 (140)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Late boot stage: flag leaf sheath swollen	14 (133)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Stilwell, KS 2004-05	SE06	1 Appl: Beginning of tillering: first tiller detectable	13 (123)	0.043 (0.048)	N/A	0.043 (0.048)	Yes
		1 Appl: Flag leaf stage	15 (141)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	13 (125)	0.033 (0.036)	N/A	0.033 (0.036)	Yes
		1 Appl: Flag leaf stage	15 (139)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Seymour, IL 2004-0	SE06	1 Appl: 2 Leaves unfolded	14 (129)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Beginning of heading	16 (148)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 2 Leaves unfolded	14 (129)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Beginning of heading	16 (152)	0.035 (0.039)	N/A	0.035 (0.039)	Yes
Springfield, NE 2004-05	SE06	1 Appl: 3 Leaves unfolded	15 (136)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf stage	14 (130)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 3 Leaves unfolded	15 (137)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	14 (130)	0.033 (0.038)	N/A	0.033 (0.038)	Yes
Sabin, MN 2005	SE06	1 Appl: Beginning of tillering: first tiller detectable	19 (173)	0.047 (0.053)	N/A	0.047 (0.053)	Yes
		1 Appl: Beginning of heading	17 (160)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	18 (166)	0.034 (0.038)	N/A	0.034 (0.038)	Yes

US EPA ARCHIVE DOCUMENT

TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
		1 Appl: Beginning of heading	17 (157)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Metz, ON 2004	SE06	1 Appl: 4 Leaves unfolded	11 (100)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 4 Leaves unfolded	11 (102)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Rockwood, ON 2005	SE06	1 Appl: Flag leaf stage	12 (108)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: Flag leaf stage	12 (109)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
Uvalde, TX 2004-05	SE06	1 Appl: 3 Leaves unfolded	14 (134)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
		1 Appl: Flag leaf just visible still rolled	18 (166)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: 3 Leaves unfolded	15 (137)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf just visible still rolled	18 (167)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
New Rockford, ND 2004	SE06	1 Appl: 4 Leaves unfolded	11 (106)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf stage	15 (141)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 4 Leaves unfolded	11 (105)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	15 (140)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
New Rockford, ND 2005	SE06	1 Appl: Flag leaf stage	15 (139)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	15 (139)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Elridge, ND 2004	SE06	1 Appl: 3 Leaves unfolded	16 (146)	0.046 (0.052)	N/A	0.046 (0.052)	Yes
		1 Appl: Flag leaf just visible still rolled	20 (191)	0.047 (0.052)	N/A	0.047 (0.052)	Yes
	EC23	1 Appl: 3 Leaves unfolded	16 (145)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
		1 Appl: Flag leaf just visible still rolled	20 (190)	0.035 (0.039)	N/A	0.035 (0.039)	Yes
Grand Island, NE 2005	SE06	1 Appl: First leaf unfolded	20 (186)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Flag leaf stage	19 (180)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: First leaf unfolded	20 (187)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	19 (180)	0.033 (0.037)	N/A	0.033 (0.037)	Yes

US EPA ARCHIVE DOCUMENT

TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
Leola, SD 2004	SE06	1 Appl: 2 Leaves unfolded	10 (94)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf stage	10 (94)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: 2 Leaves unfolded	10 (94)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	10 (94)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Eldridge, ND 2004	SE06	1 Appl: 4 Leaves unfolded	15 (142)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
		1 Appl: Flag leaf stage	18 (173)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
	EC23	1 Appl: 4 Leaves unfolded	15 (143)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	19 (174)	0.035 (0.039)	N/A	0.035 (0.039)	Yes
Dundurn, SA 2004	SE06	1 Appl: 2 Leaves unfolded	12 (111)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
		1 Appl: Flag leaf stage	12 (110)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: 2 Leaves unfolded	12 (111)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	12 (108)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Kenaston, SA 2004	SE06	1 Appl: 2 Leaves unfolded	12 (111)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
		1 Appl: leaf just visible still rolled	12 (111)	0.046 (0.052)	N/A	0.046 (0.052)	Yes
	EC23	1 Appl: 2 Leaves unfolded	12 (111)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (111)	0.035 (0.039)	N/A	0.035 (0.039)	Yes
Taber, AB 2004	SE06	1 Appl: 3 Leaves unfolded	12 (111)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		Flag leaf stage	12 (112)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
	EC23	1 Appl: 3 Leaves unfolded	12 (110)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		Flag leaf stage	12 (112)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Taber, AB 2005	SE06	1 Appl: Flag leaf just visible still rolled	11 (100)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: Flag leaf just visible still rolled	11 (100)	0.033 (0.038)	N/A	0.033 (0.038)	Yes
Larned, KS 2004-05	SE06	1 Appl: Beginning of tillering: first tiller detectable	12 (114)	0.044 (0.050)	N/A	0.044 (0.050)	Yes

US EPA ARCHIVE DOCUMENT

TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
		1 Appl: Flag leaf stage	18 (165)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	12 (114)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	18 (169)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Hanston, KS 2004-05	SE06	1 Appl: No tillers	12 (114)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
		1 Appl: Flag leaf stage	18 (165)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: No tillers	12 (114)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	18 (167)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Levelland, TX 2004-05	SE06	1 Appl: 4 Tillers detectable	20 (190)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
		1 Appl: Flag leaf stage	20 (188)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: 4 Tillers detectable	21 (197)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	20 (185)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Lubbock, TX 2004-05	SE06	1 Appl: Beginning of tillering: first tiller detectable	20 (188)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf stage	20 (189)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	20 (188)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	21 (199)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
Uvalde, TX 2004-0	SE06	1 Appl: 4 Leaves unfolded	16 (151)	0.042 (0.047)	N/A	0.042 (0.047)	Yes
		1 Appl: Flag leaf stage	17 (162)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 4 Leaves unfolded	17 (156)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	17 (162)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Weatherford, OK 2004-05	SE06	1 Appl: Beginning of tillering: first tiller detectable	15 (141)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
		1 Appl: Flag leaf stage	15 (144)	0.047 (0.053)	N/A	0.047 (0.053)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	15 (141)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	15 (141)	0.035 (0.039)	N/A	0.035 (0.039)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
Payette, ID 2004	SE06	1 Appl: Beginning of tillering: first tiller detectable	20 (190)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
		1 Appl: Flag leaf stage	20 (191)	0.046 (0.051)	N/A	0.046 (0.051)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	21 (195)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
		1 Appl: Flag leaf stage	20 (191)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
Wakaw, SA 2004	SE06	1 Appl: Early boot stage: flag leaf sheath extending	12 (110)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: Early boot stage: flag leaf sheath extending	12 (110)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Fort Saskathchewan, AB 2004	SE06	1 Appl: 3 Leaves unfolded	11 (100)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
		1 Appl: Early boot stage: flag leaf sheath extending	16 (150)	0.046 (0.052)	N/A	0.046 (0.052)	Yes
	EC23	1 Appl: 3 Leaves unfolded	11 (102)	0.035 (0.039)	N/A	0.035 (0.039)	Yes
		1 Appl: Early boot stage: flag	16 (149)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
Fort Saskathchewan, AB 2005	SE06	1 Appl: 3 Leaves unfolded	12 (111)	0.049 (0.055)	N/A	0.049 (0.055)	Yes
		1 Appl: Flag leaf just visible still rolled	11 (108)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
	EC23	1 Appl: 3 Leaves unfolded	12 (113)	0.037 (0.042)	N/A	0.037 (0.042)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (109)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Edmonton, AB 2004	SE06	1 Appl: Flag leaf just visible still rolled	15 (145)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
Edmonton, AB 2005	EC23	1 Appl: Flag leaf just visible still rolled	12 (111)	0.036 (0.041)	N/A	0.036 (0.041)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (110)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Edmonton, AB 2004	SE06	1 Appl: 3 Leaves unfolded	10 (96)	0.043 (0.049)	N/A	0.043 (0.049)	Yes
		1 Appl: Flag leaf stage	11 (99)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
Indian Head, SA 2004	SE06	1 Appl: Beginning of tillering: first tiller detectable	12 (111)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (109)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	12 (110)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (111)	0.034 (0.038)	N/A	0.034 (0.038)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
Ituna, SA 2005	SE06	1 Appl: Flag leaf just visible still rolled	12 (111)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: Flag leaf stage	12 (112)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Ituna, SA 2004	SE06	1 Appl: Flag leaf just visible still rolled	12 (111)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
		1 Appl: Flag leaf just visible still	12 (109)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
Fort Qu'Appelle, SA 2004	SE06	1 Appl: Flag leaf just visible still rolled	12 (112)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (110)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
Yorkton, SA 200	SE06	1 Appl: Flag leaf just visible still rolled	12 (108)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (111)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
Brookdale, MB 2004	SE06	1 Appl: Flag leaf just visible still rolled	12 (109)	0.044 (0.048)	N/A	0.044 (0.048)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (112)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: Beginning of tillering: first tiller detectable	12 (108)	0.032 (0.036)	N/A	0.032 (0.036)	Yes
		1 Appl: Flag leaf stage	12 (112)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Brookdale, MB 2005	SE06	1 Appl: Flag leaf just visible still rolled	12 (115)	0.046 (0.052)	N/A	0.046 (0.052)	Yes
	EC23	1 Appl: Flag leaf stage	12 (112)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
Clanwilliam, MB 2004	SE06	1 Appl: 4 Leaves unfolded	12 (110)	0.044 (0.049)	N/A	0.044 (0.049)	Yes
		1 Appl: Flag leaf just visible still rolled	12 (115)	0.045 (0.051)	N/A	0.045 (0.051)	Yes
	EC23	1 Appl: 4 Leaves unfolded	12 (111)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
		1 Appl: Flag leaf stage	12 (115)	0.034 (0.039)	N/A	0.034 (0.039)	Yes
Clanwilliam, MB 2005	SE06	1 Appl: Flag leaf just visible still rolled	12 (112)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: Flag leaf just visible still	12 (110)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Rosthern, SA 2005	SE06	1 Appl: 2 Leaves unfolded	11 (99)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Flag leaf just visible still rolled	11 (105)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: 2 Leaves unfolded	11 (100)	0.033 (0.037)	N/A	0.033 (0.037)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Year	EP[1]	Application					Tank Mix/ Adjuvants
		Method/Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	RTI[3] (days)	Total Rate lb a.i./A (kg a.i./ha)	
		1 Appl: Flag leaf just visible still rolled	11 (102)	0.033 (0.037)	N/A	0.033 (0.037)	Yes
Carrington, ND 200	SE06	1 Appl: No tillers	15 (139)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Flag leaf stage	15 (138)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
	EC23	1 Appl: No tillers	15 (140)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	15 (140)	0.033 (0.038)	N/A	0.033 (0.038)	Yes
Velva, ND 2005	SE06	1 Appl: 2 Leaves unfolded	10 (92)	0.044 (0.050)	N/A	0.044 (0.050)	Yes
		1 Appl: Flag leaf stage	10 (94)	0.045 (0.050)	N/A	0.045 (0.050)	Yes
	EC23	1 Appl: 2 Leaves unfolded	10 (93)	0.034 (0.038)	N/A	0.034 (0.038)	Yes
		1 Appl: Flag leaf stage	10 (94)	0.034 (0.038)	N/A	0.034 (0.038)	Yes

Tank mix adjuvant = ammonium sulphate at a nominal rate of 0.45 lb a.i./acre (500 g a.i./ha).
[1]EP = End-use Product.
[2] Gallons per acre, L/ha.
[3] Retreatment Interval.
N/A = Not applicable.

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TABLE B.1.3. Trial Numbers and Geographical Locations.

NAFTA Growing Region	SE06 Formulation		EC23 Formulation	
	Submitted	NAFTA[a]	Submitted	NAFTA
1				
1A				
2	1	1	1	1
3				
4	1	1	1	1
5	5	5	5	5
5A				
5B				
6	1	1	1	1
7	9	7	9 (8[c])	7
7A	1	1	1	1
8	6	6	6	6
9				
10				
11	1	1	1	1
12				
13				
14	7 (10[d])	10	7	10
15				
16				
17				
18				
19				
20				
21				
Total	32 (35[e])	33	32 (31[f])	33

a NAFTA registration requirements for wheat request a total of 33 trials distributed as indicated.
c A total of 8 hay trials and 9 forage, grain, and straw trials were successfully completed in Region 7 for the EC23 formulation.
d A total of 10 forage and hay trials and 7 grain and straw trials were successfully completed in Region 14 for the SE06 formulation.
e A total of 35 hay trials, 34 forage trials and and 32 grain and straw trials were successfully completed for the SE06 formulation.
f A total of 31 hay trials and 32 forage, grain, and straw trials were successfully completed for the EC23 formulation.

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B.2. Sample Handling and Preparation

Composite samples for all matrices were collected and placed into labelled cloth bags for storage. Control and treated samples were a composite from at least 12 areas of the plot and weighed a minimum of 1 kg for forage and grain and 0.5 kg for hay and straw. Treated samples were frozen within 7 hours of collection. All samples remained in frozen storage (<-15°C) until shipment (via freezer truck) to BRP. Upon arrival at BRP, wheat RAC samples were homogenized with dry ice in a chopper then returned to frozen storage immediately.

B.3. Analytical Methodology

Residue data for pyrasulfotole in wheat RACs were obtained using the analytical method (AI-001-P04-01) for determining total pyrasulfotole (pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl) residue in plant matrices.[10, 11]

This HPLC-MS/MS analytical method quantifies residues of pyrasulfotole and the metabolites from a single sample using isotope labelled internal standards.[10] Briefly, residues are extracted from homogenized wheat samples with acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) at 60°C for at least 30 minutes. After cooling, a mixture of isotope labelled internal standards is added to the sample extract and mixed. A small aliquot (about 1.25 mL) is purified by C18 solid-phase extraction (SPE), followed by chromatographic analysis involving gradient elution from a Gemini C-18 (50 x 2.0 mm) with aqueous 10 mM NH_4HCO_3 solution and methanol as the mobile phase components. An electrospray interface in the negative ion mode is used to introduce the sample into the MS.

Detector response was linear over the range of 0.005 ppm to 2.5 ppm for all analytes with associated correlation coefficients all greater than 0.99. The analytical standards for pyrasulfotole and the metabolites were >99% pure. The individual analyte residues were converted to pyrasulfotole molar equivalents and summed to give a total pyrasulfotole residue.

C. RESULTS AND DISCUSSION

Residue trials were conducted during the 2004/2005 growing seasons covering 9 US states and 4 Canadian provinces representing a total of 9 NAFTA regions (TABLE B.1.3). At least 31 trials were performed for each RAC using the EC23 formulation and 32 trials for each RAC using the SE06 formulation. The temperatures and rainfall were in some cases above or below normal, but did not appear to have an impact on this study. Irrigation was used where needed.

Method validation for pyrasulfotole and its metabolites was performed using various spiking levels (TABLE C.1). Standards were corrected for purity and prepared in parent compound molar equivalents during initial standard solution preparation. At the LOQ the concurrent recoveries for pyrasulfotole and the metabolites ranged form 75% to 107%. Chromatograms were symmetrical and well defined at or above the limit of detection (LOD). Therefore, the method is deemed suitable for data gathering.

The LOQ for each analyte was 0.01 ppm in wheat forage, hay, grain, and straw. The calculated

US EPA ARCHIVE DOCUMENT

LOD in wheat forage was 0.001 ppm for pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl; in wheat hay and wheat straw was 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl and 0.003 ppm for pyrasulfotole-benzoic acid; in wheat grain was 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl and 0.002 ppm for pyrasulfotole-benzoic acid.

The samples in this study were frozen a maximum of 266 days (9 months) prior to analysis with the exception of wheat forage samples from trial AI016-04H, which were stored 462 days (15 months) prior to analysis (TABLE C.2). A freezer storage stability study has monitored the stability of pyrasulfotole and metabolite residues in/on wheat forage, wheat hay, wheat grain, and soybean grain.[12, 13] Data from the 11-month study demonstrate that residues of pyrasulfotole and pyrasulfotole-benzoic acid remained stable in all wheat matrices. In contrast, residues of pyrasulfotole-desmethyl were found to be stable in soybeans and wheat grain but were found to decline in wheat forage and hay approximately 0.12 % per day. Therefore, residue values for wheat hay trials that were stored longer than 163 days, and for wheat forage trials that were stored longer than 157 days, were corrected according to the linear regression analyses (APPENDIX 2).

Uncorrected and corrected residue data for pyrasulfotole and the metabolites in/on wheat are presented in TABLE C.3.1 (SE06 treated) and TABLE C.3.2 (EC23 treated). Representative chromatograms appeared to be symmetrical and well defined at or above the LOD and therefore all values above LOD are reported. Nevertheless, values between LOD and LOQ were considered nonquantitative estimates as they fell below the lower limit of method validation and no information on the linearity of the standard curve at these low levels was provided. Therefore, to calculate total pyrasulfotole residue, analyte values that were reported as <LOD were first assigned a finite value of half the LOQ, then residue values for pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid were summed. With the exception of pyrasulfotole-desmethyl in wheat hay, the amount of analytes appeared to be slightly higher following the SE06 application (FIGURE C.1), with wheat hay retaining the highest amounts of analyte residues.

In order to estimate means and standard deviations, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ or 0.005 ppm (TABLE C.4.1, TABLE C.4.2). The highest average field trial (HAFT) for pyrasulfotole-benzoic acid residue in wheat forage was 0.437 ppm (25-day PHI) and 0.273 ppm (45-day PHI); in wheat hay was 1.10 ppm; in wheat grain was 0.502 ppm; and in wheat straw was 0.388 ppm. The HAFT for pyrasulfotole-desmethyl residue in wheat forage was 0.169 ppm (25-day PHI) and 0.064 ppm (45-day PHI); in wheat hay was 0.594 ppm; in wheat grain was 0.008 ppm; and in wheat straw was 0.149 ppm. The HAFT for pyrasulfotole residue in wheat forage was 0.060 ppm (25-day PHI) and 0.026 ppm (45-day PHI); in wheat hay was 0.563 ppm; in wheat grain was 0.008 ppm; and in wheat straw was 0.025 ppm.

The maximum amount of pyrasulfotole-benzoic acid reported were 0.447 ppm (forage, 25-day PHI), 1.15 ppm (hay), 0.873 ppm (grain) and 0.420 ppm (straw); maximum amount of pyrasulfotole-desmethyl reported were 0.165 ppm (forage, 25-day PHI), 0.601 ppm (hay), 0.009 ppm (grain) and 0.154 ppm (straw), maximum amount of pyrasulfotole reported were 0.061 ppm

US EPA ARCHIVE DOCUMENT

(forage, 25-day PHI), 0.625 ppm (hay), 0.009 ppm (grain) and 0.030 ppm (straw).

Residue decline data showed that residues of pyrasulfotole and the metabolites decreased with time in wheat forage and wheat hay, but decreased only slightly or remained unchanged in wheat grain and wheat straw with increasing PHIs (FIGURE C.2).

TABLE C.1. Summary of Concurrent Recoveries for Pyrasulfotole, Pyrasulfotole-benzoic Acid, and Pyrasulfotole-desmethyl from Wheat.

Matrix	Analyte	Spike level (ppm)	Sample size (n)	Recoveries (%)	Mean std dev (%)
Wheat					
Forage		0.01	3	86, 94, 92	91 ± 4.3
	Pyrasulfotole-benzoic Acid	0.05	30	98, 92, 101, 97, 97, 97, 94, 93, 100, 98, 92, 95, 95, 102, 94, 97, 98, 99, 96, 105, 99, 94, 101, 114, 96, 96, 98, 100, 101, 101	98 ± 4.3
		0.25	3	90, 90, 90	90 ± 0.2
		0.50	3	101, 101, 103	102 ± 0.8
		1.00	3	93, 95, 95	94 ± 1.3
	Pyrasulfotole-desmethyl	0.01	3	90, 84, 86	86 ± 3.0
		0.05	30	99, 98, 99, 97, 101, 112, 100, 99, 114, 104, 97, 99, 103, 118, 100, 102, 100, 99, 101, 120, 103, 106, 119, 117, 101, 100, 102, 117, 114, 115	105 ± 7.7
		0.25	3	95, 94, 94	94 ± 0.8
		0.50	3	103, 97, 100	100 ± 2.6
		1.00	3	114, 111, 110	111 ± 2.4
	Pyrasulfotole	0.01	3	84, 86, 89	87 ± 2.4
		0.05	30	95, 92, 94, 80, 89, 90, 92, 84, 98, 97, 89, 96, 86, 101, 87, 92, 95, 99, 89, 104, 90, 98, 100, 110, 90, 97, 91, 102, 106, 103	94 ± 6.9
		0.25	3	91, 91, 92	91 ± 0.4
		0.50	3	101, 101, 101	101 ± 0.3
		1.00	3	89, 87, 92	89 ± 2.2
Hay	Pyrasulfotole-benzoic Acid	0.01	3	95, 99, 92	95 ± 3.2
		0.05	19	93, 90, 103, 97, 98, 99, 108, 103, 98, 97, 93, 99, 98, 99, 101, 100, 92, 100, 96	98 ± 4.3
		0.25	3	92, 95, 94	94 ± 1.3
		7.50	3	96, 102, 103	100 ± 4.0
	Pyrasulfotole-desmethyl	0.01	3	90, 88, 91	89 ± 1.6
		0.05	19	106, 103, 116, 95, 114, 113, 119, 110, 98, 95, 98, 116, 104, 100, 97, 101, 103, 99, 119	106 ± 8.2
		0.25	3	97, 97, 93	96 ± 2.1
		7.50	3	107, 110, 109	109 ± 1.3
	Pyrasulfotole	0.01	3	85, 83, 88	85 ± 2.3
		0.05	19	96, 94, 104, 98, 93, 99, 107, 99, 95, 86, 86, 101, 101, 89, 100, 90, 87, 102, 95	96 ± 6.1
		0.25	3	89, 89, 90	89 ± 0.2
		7.50	3	79, 76, 80	78 ± 2.3

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TABLE C.1. Summary of Concurrent Recoveries for Pyrasulfotole, Pyrasulfotole-benzoic Acid, and Pyrasulfotole-desmethyl from Wheat.

Matrix	Analyte	Spike level (ppm)	Sample size (n)	Recoveries (%)	Mean ± std dev (%)
Grain	Pyrasulfotole-benzoic Acid	0.01	20	98, 105, 95, 104, 106, 96, 87, 92, 103, 88, 100, 96, 103, 91, 82, 75, 91, 96, 101, 103	96 ± 8.2
		0.25	3	96, 94, 96	95 ± 1.2
		1.00	3	95, 96, 94	95 ± 1.1
	Pyrasulfotole-desmethyl	0.01	20	98, 100, 103, 105, 105, 103, 95, 106, 95, 91, 97, 100, 95, 93, 95, 107, 96, 96, 102, 101	99 ± 4.6
		0.25	3	97, 99, 99	98 ± 1.1
		1.00	3	114, 115, 112	114 ± 1.3
	Pyrasulfotole	0.01	20	90, 84, 93, 89, 88, 98, 97, 86, 87, 86, 96, 96, 82, 85, 83, 91, 91, 87, 88, 87	89 ± 4.7
		0.25	3	87, 86, 87	87 ± 0.2
		1.00	3	97, 91, 92	94 ± 3.3
Straw	Pyrasulfotole-benzoic Acid	0.01	3	89, 97, 93	93 ± 3.9
		0.05	17	97, 100, 91, 99, 102, 112, 99, 98, 105, 104, 100, 94, 102, 94, 99, 88, 82	98 ± 6.9
		0.25	3	94, 90, 94	93 ± 2.2
		1.00	3	90, 88, 88	89 ± 1.3
	Pyrasulfotole-desmethyl	0.01	3	89, 95, 92	92 ± 2.8
		0.05	17	105, 109, 96, 113, 112, 120, 110, 103, 104, 102, 115, 108, 109, 87, 118, 87, 94	105 ± 9.6
		0.25	3	100, 98, 98	98 ± 1.0
		1.00	3	97, 97, 97	97 ± 0.2
	Pyrasulfotole	0.01	3	81, 92, 81	85 ± 6.4
		0.05	17	100, 100, 93, 99, 106, 106, 105, 98, 99, 101, 97, 101, 101, 88, 105, 91, 93	99 ± 5.3
		0.25	3	91, 93, 92	92 ± 0.8
		1.00	3	88, 88, 91	89 ± 1.5

TABLE C.2. Summary of Storage Conditions for Wheat.

Extract		Storage Temperature (°C)	Actual Storage Duration (days)	Interval of Demonstrated Storage Stability (days)
Pyrasulfotole-benzoic Acid, Pyrasulfotole				
Wheat	Forage	<-15	266	336
	Grain	<-15	266	336
	Hay	<-15	266	336
	Straw	<-15	266	336
Pyrasulfotole-desmethyl				
Wheat	Forage	<-15	266	120
	Grain	<-15	266	336
	Hay	<-15	266	136
	Straw	<-15	266	336

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Tifton, GA 2004-05 2	Winter Wheat/ Coker 9663	Forage	0.045 (0.050)	25	0.426	0.164	—	0.033	0.623
					0.447	0.165	—	0.025	0.637
				45	0.296	0.032	—	0.004	0.332
					0.250	0.025	—	0.004	0.279
		Grain	0.045 (0.050)	50	0.088	<LOD	—	<LOD	0.098
					0.099	<LOD	—	<LOD	0.109
		Hay	0.045 (0.050)	25	0.066	0.023	—	0.003	0.092
					0.074	0.025	—	0.003	0.102
		Straw	0.045 (0.050)	50	0.139	0.045	—	0.004	0.188
					0.120	0.060	—	0.005	0.185
Leland, MS 2004-05 4	Winter Wheat/ Coker 9152	Forage	0.045 (0.050)	19	0.121	0.071	—	0.009	0.201
					0.112	0.063	—	0.011	0.186
				43	0.024	0.002	—	0.001	0.027
					0.027	0.002	—	0.001	0.030
		Grain	0.044 (0.049)	49	0.149	<LOD	—	<LOD	0.159
					0.179	<LOD	—	<LOD	0.189
		Hay	0.044 (0.049)	25	0.134	0.052	—	0.004	0.190
					0.144	0.053	—	0.004	0.201
		Straw	0.044 (0.049)	49	0.091	0.043	—	0.004	0.138
					0.098	0.042	—	0.003	0.143
Stilwell, KS 2004-05 5	Winter Wheat/ P2137	Forage	0.043 (0.048)	23	0.016	0.050	—	0.004	0.070
					0.013	0.047	—	0.004	0.064
				46	0.021	0.046	—	0.004	0.071
					0.028	0.061	—	0.005	0.094
		Grain	0.045 (0.051)	48	0.121	0.001	—	<LOD	0.127
					0.118	0.001	—	<LOD	0.124
		Hay	0.045 (0.051)	25	0.419	0.094	—	0.009	0.522
					0.425	0.090	—	0.010	0.525
		Straw	0.045 (0.051)	48	0.139	0.022	—	0.001	0.162
					0.150	0.026	—	0.002	0.178
Seymour, IL 2004-05 5	Winter Wheat/ IL94-1653	Forage	0.044 (0.050)	21	0.034	0.021	—	0.002	0.057
					0.030	0.020	—	0.001	0.051
				41	0.023	0.001	—	<LOD	0.029
					0.021	0.001	—	<LOD	0.027
		Grain	0.045 (0.050)	40	0.048	0.002	—	<LOD	0.055
					0.053	0.002	—	<LOD	0.060
		Hay	0.045 (0.050)	21	0.154	0.243	—	0.034	0.431
					0.162	0.291	—	0.038	0.491
		Straw	0.045 (0.050)	40	0.111	0.147	—	0.011	0.269
					0.111	0.146	—	0.012	0.269
Springfield, NE	Winter Wheat/	Forage	0.045 (0.050)	22	0.050	0.014	—	<LOD	0.069
					0.058	0.013	—	<LOD	0.076

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TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
2004-05 5	Jagulene			44	0.054	<LOD	—	<LOD	0.064
					0.044	<LOD	—	<LOD	0.054
		Grain	0.045 (0.050)	48	0.061	<LOD	—	<LOD	0.071
					0.063	<LOD	—	<LOD	0.073
		Hay	0.045 (0.050)	21	0.131	0.100	—	0.026	0.257
					0.129	0.128	—	0.026	0.283
		Straw	0.045 (0.050)	48	0.047	0.026	—	0.003	0.076
					0.058	0.029	—	0.002	0.089
Sabin, MN 2005 5	Spring Wheat/ Alsen	Forage	0.047 (0.053)	15	0.247	0.226	—	0.011	0.484
					0.248	0.210	—	0.013	0.471
				23	0.256	0.147	—	0.006	0.409
					0.237	0.158	—	0.007	0.402
				33	0.205	0.066	—	0.003	0.274
					0.220	0.074	—	0.004	0.298
				43	0.186	0.031	—	0.002	0.219
					0.204	0.036	—	0.001	0.241
				55	0.172	0.053	—	0.001	0.226
					0.174	0.052	—	0.002	0.228
		Grain	0.045 (0.051)	40	0.285	0.008	—	0.002	0.295
					0.274	0.008	—	<LOD	0.287
				50	0.290	0.007	—	0.002	0.299
					0.297	0.007	—	0.001	0.305
				54	0.266	0.007	—	<LOD	0.278
					0.261	0.009	—	0.001	0.271
				58	0.294	0.008	—	0.001	0.303
					0.289	0.006	—	<LOD	0.300
				69	0.296	0.006	—	<LOD	0.307
					0.308	0.006	—	<LOD	0.319
		Hay	0.045 (0.051)	0	0.216	0.552	—	4.471	5.239
					0.226	0.469	—	4.806	5.501
				14	0.361	0.278	—	0.037	0.676
					0.348	0.282	—	0.033	0.663
				24	0.268	0.167	—	0.019	0.454
					0.262	0.151	—	0.016	0.429
				30	0.191	0.059	—	0.008	0.258
					0.171	0.055	—	0.007	0.233
				35	0.199	0.071	—	0.010	0.280
					0.210	0.073	—	0.010	0.293
		Straw	0.045 (0.051)	40	0.157	0.066	—	0.009	0.232
					0.157	0.058	—	0.005	0.220
				50	0.122	0.074	—	0.007	0.203
					0.105	0.062	—	0.006	0.173
				54	0.105	0.051	—	0.007	0.163

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
					0.098	0.036	—	0.003	0.137
				58	0.096	0.053	—	0.005	0.154
					0.100	0.055	—	0.006	0.161
				69	0.106	0.048	—	0.007	0.161
					0.107	0.046	—	0.006	0.159
Metz, ON 2004 5	Spring Wheat/ 606.000	Forage	0.045 (0.050)	24	0.003	0.005	0.007	<LOD	0.015
					0.004	0.005	0.007	<LOD	0.016
				44	0.002	<LOD	0.007	<LOD	0.014
					0.002	<LOD	0.007	<LOD	0.014
Rockwood, ON 2005 5	Spring Wheat/ 606	Grain	0.045 (0.051)	48	0.265	<LOD	—	<LOD	0.275
					0.271	<LOD	—	<LOD	0.281
		Hay	0.045 (0.051)	24	0.397	0.095	—	0.003	0.495
					0.524	0.167	—	0.004	0.695
		Straw	0.045 (0.051)	48	0.345	0.065	—	0.002	0.412
					0.329	0.059	—	0.002	0.390
Uvalde, TX 2004-05 6	Winter Wheat/ Ogallala	Forage	0.044 (0.049)	24	0.102	0.016	—	0.009	0.127
					0.097	0.014	—	0.008	0.119
				44	0.053	0.001	—	<LOD	0.059
					0.045	0.001	—	<LOD	0.051
		Grain	0.044 (0.050)	50	0.147	<LOD	—	<LOD	0.157
					0.053	<LOD	—	<LOD	0.063
		Hay	0.044 (0.050)	22	1.048	0.260	—	0.501	1.809
					1.149	0.275	—	0.625	2.049
		Straw	0.044 (0.050)	50	0.125	0.033	—	0.006	0.164
					0.089	0.027	—	0.006	0.122
New Rockford, ND 2004 7	Spring Wheat/ Briggs	Forage	0.045 (0.050)	22	0.033	0.013	0.017	0.002	0.052
					0.028	0.013	0.017	0.002	0.047
				41	0.040	0.002	0.003	0.001	0.044
					0.039	0.003	0.004	<LOD	0.048
		Grain	0.044 (0.050)	49	0.170	<LOD	—	0.001	0.176
					0.186	<LOD	—	0.002	0.193
		Hay	0.045 (0.050)	21	0.148	0.056	0.073	0.004	0.225
					0.178	0.066	0.088	0.004	0.270
New Rockford, ND 2005 7	Spring Wheat/ Ingot	Straw	0.044 (0.050)	49	0.040	0.008	—	0.002	0.050
					0.045	0.009	—	0.002	0.056
Elridge, ND 2004 7	Spring Wheat/ Granite	Forage	0.047 (0.052)	21	0.031	0.003	0.004	<LOD	0.040
					0.038	0.003	0.004	<LOD	0.047
				42	0.023	<LOD	0.007	<LOD	0.035
					0.026	<LOD	0.007	<LOD	0.038
		Grain	0.047 (0.052)	56	0.239	<LOD	—	<LOD	0.249
					0.228	<LOD	—	<LOD	0.238

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Hay	0.047 (0.052)	21	0.625	0.226	0.299	0.021	0.945
					0.445	0.151	0.200	0.017	0.662
		Straw	0.047 (0.052)	56	0.307	0.076	—	0.007	0.390
					0.289	0.075	—	0.006	0.370
Grand Island, NE 2005 7	Winter Wheat/ Ogallala	Forage	0.044 (0.050)	22	0.019	0.007	—	0.001	0.027
					0.021	0.008	—	0.002	0.031
				41	0.046	<LOD	—	<LOD	0.056
					0.051	<LOD	—	<LOD	0.061
		Grain	0.045 (0.050)	41	0.873	0.008	—	0.004	0.885
					0.132	0.001	—	<LOD	0.138
		Hay	0.045 (0.050)	22	0.164	0.239	—	0.037	0.440
					0.184	0.274	—	0.038	0.496
		Straw	0.045 (0.050)	41	0.111	0.055	—	0.005	0.171
					0.115	0.063	—	0.005	0.183
Leola, SD 2004 7	Spring Wheat/ Knudson	Forage	0.045 (0.050)	21	0.013	0.006	0.008	<LOD	0.026
					0.016	0.007	0.009	<LOD	0.030
				42	0.011	0.001	0.001	<LOD	0.017
					0.009	0.001	0.001	<LOD	0.015
		Grain	0.044 (0.049)	48	0.255	0.001	—	<LOD	0.261
					0.294	0.002	—	<LOD	0.301
		Hay	0.044 (0.049)	24	0.277	0.269	0.355	0.008	0.640
					0.313	0.269	0.355	0.009	0.677
		Straw	0.044 (0.049)	48	0.155	0.112	—	0.002	0.269
					0.190	0.154	—	0.002	0.346
Eldridge, ND 2004 7	Spring Wheat/ Knudson	Forage	0.045 (0.051)	15	0.034	0.031	0.041	0.002	0.077
					0.035	0.029	0.039	0.002	0.076
				25	0.028	0.003	0.004	<LOD	0.037
					0.027	0.003	0.004	<LOD	0.036
				35	0.022	0.001	0.001	<LOD	0.028
					0.021	0.001	0.001	<LOD	0.027
				43	0.023	<LOD	0.007	<LOD	0.035
					0.024	<LOD	0.007	<LOD	0.036
				53	0.029	<LOD	0.007	<LOD	0.041
					0.033	<LOD	0.007	<LOD	0.045
		Grain	0.046 (0.051)	40	0.105	0.002	—	<LOD	0.112
					0.099	0.002	—	<LOD	0.106
				49	0.098	0.001	—	<LOD	0.104
					0.102	0.002	—	<LOD	0.109
				55	0.110	0.002	—	<LOD	0.117
					0.105	0.002	—	<LOD	0.112
				63	0.094	0.001	—	<LOD	0.100
					0.107	0.001	—	<LOD	0.113
				68	0.097	0.002	—	<LOD	0.104
					0.101	0.001	—	<LOD	0.107

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Hay	0.046 (0.051)	0	0.367	1.102	1.550	1.715	3.632
					0.388	1.192	1.676	1.945	4.009
				14	0.162	0.247	0.343	0.010	0.515
					0.134	0.223	0.310	0.009	0.453
				24	0.096	0.135	0.186	0.004	0.286
					0.122	0.154	0.212	0.004	0.338
				30	0.096	0.070	0.096	0.004	0.196
					0.077	0.072	0.099	0.003	0.179
				35	0.097	0.105	0.143	0.004	0.244
					0.090	0.096	0.131	0.003	0.224
		Straw	0.046 (0.051)	40	0.045	0.053	—	0.002	0.100
					0.049	0.072	—	0.002	0.123
				49	0.057	0.075	—	0.002	0.134
					0.044	0.068	—	0.002	0.114
				55	0.039	0.066	—	0.002	0.107
					0.037	0.060	—	0.001	0.098
				63	0.031	0.044	—	0.001	0.076
					0.027	0.046	—	0.002	0.075
				68	0.031	0.058	—	0.003	0.092
					0.039	0.056	—	0.002	0.097
Dundurn, SA 2004 7	Spring Wheat/ AC McKenzie	Forage	0.046 (0.051)	21	0.029	0.006	0.008	0.001	0.038
					0.028	0.005	0.007	<LOD	0.040
				44	0.024	0.001	—	<LOD	0.030
					0.019	<LOD	—	<LOD	0.030
		Grain	0.045 (0.051)	50	0.113	<LOD	—	<LOD	0.123
					0.111	<LOD	—	<LOD	0.121
		Hay	0.045 (0.051)	22	0.087	0.039	0.053	0.004	0.144
					0.092	0.040	0.054	0.005	0.151
		Straw	0.045 (0.051)	50	0.150	0.115	—	0.001	0.266
					0.191	0.152	—	0.002	0.345
Kenaston, SA 2004 7	Spring Wheat/ Protégé	Forage	0.046 (0.051)	25	0.207	0.002	0.003	<LOD	0.215
					0.216	0.002	0.003	<LOD	0.224
				45	0.130	<LOD	0.007	<LOD	0.140
					0.139	<LOD	0.007	<LOD	0.149
		Grain	0.046 (0.052)	50	0.126	0.001	—	<LOD	0.132
					0.138	0.001	—	<LOD	0.144
		Hay	0.046 (0.052)	24	0.279	0.132	0.176	0.004	0.459
					0.291	0.137	0.183	0.004	0.478
		Straw	0.046 (0.052)	50	0.139	0.060	—	0.002	0.201
					0.133	0.049	—	0.002	0.184
Taber, AB 2004	Spring Wheat/ Intrepid	Forage	0.045 (0.050)	25	0.028	<LOD	0.008	<LOD	0.041
					0.019	<LOD	0.008	0.001	0.028
				44	0.019	<LOD	0.008	<LOD	0.032

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
7A					0.017	<LOD	0.008	<LOD	0.030
		Hay	0.046 (0.051)	25	0.197	0.098	0.160	0.003	0.360
					0.251	0.115	0.187	0.003	0.441
Taber, AB 2005 7A	Spring Wheat/ Barrie	Grain	0.044 (0.050)	50	0.065	0.001	—	<LOD	0.071
					0.061	<LOD	—	<LOD	0.071
		Straw	0.044 (0.050)	50	0.048	0.029	—	0.002	0.079
					0.035	0.020	—	0.002	0.057
Larned, KS 2004-05 8	Winter Wheat/ Jagger	Forage	0.044 (0.050)	24	0.145	0.050	—	0.009	0.204
					0.161	0.055	—	0.011	0.227
				44	0.112	0.015	—	0.006	0.133
					0.109	0.017	—	0.007	0.133
		Grain	0.044 (0.049)	55	0.132	0.001	—	<LOD	0.138
					0.269	0.001	—	<LOD	0.275
		Hay	0.044 (0.049)	23	0.239	0.253	—	0.034	0.526
					0.220	0.219	—	0.030	0.469
		Straw	0.044 (0.049)	55	0.034	0.044	—	0.004	0.082
					0.031	0.042	—	0.005	0.078
Hanston, KS 2004-05 8	Winter Wheat/ Jagger	Forage	0.045 (0.051)	22	0.205	0.122	—	0.061	0.388
					0.197	0.119	—	0.055	0.371
				41	0.192	0.058	—	0.026	0.276
					0.175	0.058	—	0.026	0.259
		Grain	0.044 (0.049)	56	0.117	0.001	—	<LOD	0.123
					0.120	0.001	—	<LOD	0.126
		Hay	0.044 (0.049)	23	0.182	0.241	—	0.022	0.445
					0.205	0.237	—	0.023	0.465
		Straw	0.044 (0.049)	56	0.046	0.049	—	0.002	0.097
					0.048	0.045	—	0.003	0.096
Levelland, TX 2004-05 8	Winter Wheat/ TAM 200	Forage	0.044 (0.049)	25	0.156	0.107	—	0.017	0.280
					0.157	0.107	—	0.016	0.280
				45	0.129	0.057	—	0.007	0.193
					0.187	0.071	—	0.010	0.268
		Grain	0.044 (0.050)	50	0.055	0.005	—	0.002	0.062
					0.054	0.004	—	0.002	0.060
		Hay	0.044 (0.050)	25	0.193	0.122	0.152	0.328	0.643
					0.205	0.124	0.155	0.335	0.664
		Straw	0.044 (0.050)	50	0.089	0.048	—	0.030	0.167
					0.073	0.032	—	0.020	0.125
Lubbock, TX 2004-05 8	Winter Wheat/ TAM 200	Forage	0.045 (0.050)	25	0.235	0.062	—	0.023	0.320
					0.283	0.067	—	0.024	0.374
				45	0.209	0.016	—	0.007	0.232
					0.238	0.014	—	0.006	0.258
		Grain	0.044 (0.049)	50	0.144	0.002	—	0.001	0.147
					0.123	0.003	—	<LOD	0.131

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Hay	0.044 (0.049)	24	0.372	0.164	—	0.067	0.603
					0.366	0.148	—	0.056	0.570
		Straw	0.044 (0.049)	50	0.096	0.051	—	0.010	0.157
					0.070	0.052	—	0.011	0.133
Uvalde, TX 2004-05 8	Winter Wheat/ Ogallala	Forage	0.042 (0.047)	22	0.050	0.031	—	0.004	0.085
					0.081	0.044	—	0.006	0.131
				44	0.030	0.002	—	<LOD	0.037
					0.026	0.002	—	<LOD	0.033
		Grain	0.045 (0.050)	50	0.139	<LOD	—	<LOD	0.149
					0.123	<LOD	—	<LOD	0.133
		Hay	0.045 (0.050)	25	0.485	0.178	—	0.162	0.825
					0.404	0.151	—	0.138	0.693
		Straw	0.045 (0.050)	50	0.356	0.093	—	0.016	0.465
					0.420	0.128	—	0.023	0.571
Weatherford, OK 2004-05 8	Winter Wheat/ Jagger	Forage	0.044 (0.049)	25	0.269	0.137	0.195	0.017	0.481
					0.227	0.102	0.145	0.014	0.386
				45	0.125	0.051	0.072	0.008	0.205
					0.099	0.035	0.049	0.006	0.154
		Grain	0.047 (0.053)	51	0.162	0.001	—	<LOD	0.168
					0.165	<LOD	—	<LOD	0.175
		Hay	0.047 (0.053)	25	0.119	0.058	—	0.008	0.185
					0.125	0.058	—	0.006	0.189
		Straw	0.047 (0.053)	51	0.040	0.042	—	0.004	0.086
					0.038	0.042	—	0.003	0.083
Payette, ID 2004 11	Spring Wheat/ Penawawa	Forage	0.045 (0.050)	18	0.028	0.002	0.003	<LOD	0.036
					0.024	0.003	0.004	<LOD	0.033
				41	0.013	<LOD	0.007	<LOD	0.025
					0.016	<LOD	0.007	<LOD	0.028
		Grain	0.046 (0.051)	50	0.141	0.002	—	<LOD	0.148
					0.111	0.001	—	<LOD	0.117
		Hay	0.046 (0.051)	25	0.143	0.131	—	0.009	0.283
					0.156	0.134	—	0.007	0.297
		Straw	0.046 (0.051)	50	0.030	0.029	—	<LOD	0.064
					0.033	0.027	—	<LOD	0.065
Wakaw, SA 2004 14	Spring Wheat/ AC Barrie	Grain	0.045 (0.051)	50	0.069	0.002	—	<LOD	0.076
					0.059	0.002	—	<LOD	0.066
		Hay	0.045 (0.051)	25	0.083	0.076	0.102	0.007	0.192
					0.077	0.067	0.090	0.006	0.173
		Straw	0.045 (0.051)	50	0.051	0.044	—	0.002	0.097
					0.050	0.041	—	0.002	0.093
Fort Saskathchewan, AB	Spring Wheat/ CPS	Forage	0.045 (0.051)	25	0.011	0.001	0.001	<LOD	0.017
					0.009	0.001	0.001	<LOD	0.015
				44	0.012	<LOD	0.007	<LOD	0.024

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TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
2004 14					0.010	<LOD	0.007	<LOD	0.022
		Hay	0.046 (0.052)	25	0.033	0.062	0.084	0.014	0.131
					0.045	0.089	0.120	0.019	0.184
Fort Saskathchewan, AB 2005 14	Spring Wheat/Teal	Forage	0.049 (0.055)	25	0.013	0.002	—	0.001	0.016
					0.015	0.003	—	0.001	0.019
				42	0.017	<LOD	—	<LOD	0.027
					0.020	<LOD	—	<LOD	0.030
		Grain	0.044 (0.049)	45	0.088	0.002	—	0.009	0.099
					0.073	0.002	—	0.006	0.081
		Straw	0.044 (0.049)	45	0.132	0.045	—	0.012	0.189
					0.128	0.055	—	0.016	0.199
Edmonton, AB 2004 14	Spring Wheat/ 5700 CPS	Forage	0.043 (0.049)	22	0.017	0.012	0.016	<LOD	0.038
					0.017	0.011	0.015	<LOD	0.037
				43	0.012	<LOD	0.007	<LOD	0.024
					0.011	<LOD	0.007	<LOD	0.023
		Grain	0.044 (0.050)	50	0.042	<LOD	—	<LOD	0.052
					0.043	<LOD	—	<LOD	0.053
		Hay	0.044 (0.050)	24	0.016	0.016	0.021	0.006	0.043
					0.015	0.017	0.022	0.008	0.045
Edmonton, AB 2004 14	Spring Wheat/5700 CPS	Straw	0.044 (0.050)	50	0.025	0.011	—	<LOD	0.041
					0.024	0.012	—	<LOD	0.041
		Hay	0.044 (0.050)	22	0.074	0.040	0.054	0.004	0.132
					0.079	0.037	0.050	0.004	0.133
Indian Head, SA 2004 14	Spring Wheat/ Superb	Forage	0.045 (0.050)	23	0.042	0.011	0.015	<LOD	0.062
					0.040	0.011	0.015	<LOD	0.060
				44	0.031	<LOD	0.007	<LOD	0.043
					0.028	<LOD	0.007	<LOD	0.040
		Hay	0.044 (0.050)	25	0.070	0.023	0.031	<LOD	0.106
					0.084	0.028	0.038	<LOD	0.127
Ituna, SA 2005 14	Winter Whea/ CDC Kestrel	Grain	0.044 (0.050)	52	0.096	<LOD	—	<LOD	0.106
					0.125	<LOD	—	<LOD	0.135
		Straw	0.044 (0.050)	52	0.052	0.021	—	0.001	0.074
					0.061	0.022	—	0.002	0.085
Ituna, SA 2004 14	Spring Wheat/ Hay 46 Superb	Hay	0.044 (0.050)	23	0.095	0.071	0.097	0.003	0.195
					0.102	0.092	0.125	0.002	0.196
Fort Qu'Appelle, SA 2004 14	Spring Wheat Superb	Forage	0.045 (0.051)	23	0.040	0.003	0.004	<LOD	0.049
					0.039	0.007	0.010	<LOD	0.054
				44	0.023	<LOD	0.007	<LOD	0.035
					0.016	<LOD	0.007	<LOD	0.028
		Hay	0.045 (0.050)	21	0.173	0.128	0.171	0.032	0.376
					0.137	0.109	0.146	0.014	0.297
Yorkton,	Spring	Forage	0.044	22	0.016	0.003	0.004	<LOD	0.025

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TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
SA 2004 14	Wheat/ Superb		(0.049)		0.018	0.002	0.003	<LOD	0.026
				41	0.014	<LOD	0.007	<LOD	0.026
					0.016	<LOD	0.007	<LOD	0.028
		Hay	0.045 (0.051)	25	0.099	0.088	0.118	0.002	0.219
					0.080	0.077	0.103	0.001	0.184
Brookdale, MB 2004 14	Spring Wheat/ AC	Forage	0.043 (0.048)	21	0.023	0.012	0.017	<LOD	0.045
					0.023	0.009	0.012	<LOD	0.040
				41	0.022	0.001	0.001	<LOD	0.028
					0.024	0.001	0.001	<LOD	0.030
		Hay	0.045 (0.050)	23	0.404	0.309	0.418	0.010	0.832
					0.439	0.419	0.567	0.014	1.020
Brookdale, MB 2005 14	Spring Wheat/ AC Barrie	Grain	0.046 (0.052)	47	0.028	<LOD	—	<LOD	0.038
					0.029	<LOD	—	<LOD	0.039
		Straw	0.046 (0.052)	47	0.056	0.151	—	0.003	0.210
					0.060	0.147	—	0.003	0.210
Clanwilliam, MB 2004 14	Spring Wheat/ AC Teal	Forage	0.044 (0.049)	22	0.053	0.005	0.007	<LOD	0.065
					0.051	0.005	0.007	<LOD	0.063
				44	0.030	<LOD	0.007	<LOD	0.042
					0.024	<LOD	0.007	<LOD	0.036
		Hay	0.046 (0.051)	21	0.333	0.316	0.431	0.012	0.776
					0.313	0.340	0.464	0.012	0.789
Clanwilliam, MB 2005 14	Spring Wheat/ AC Domain 2005	Grain	0.045 (0.050)	45	0.049	<LOD	—	<LOD	0.059
					0.050	<LOD	—	<LOD	0.060
		Straw	0.045 (0.050)	45	0.025	0.007	—	<LOD	0.037
					0.022	0.005	—	<LOD	0.032
Rosthern, SA 2005 14	Winter Wheat/ CDC Bounty	Forage	0.044 (0.050)	25	0.006	0.002	—	<LOD	0.013
					0.006	0.001	—	<LOD	0.012
				43	0.007	<LOD	—	<LOD	0.017
					0.008	<LOD	—	<LOD	0.018
		Grain	0.045 (0.051)	48	0.101	<LOD	—	<LOD	0.111
					0.103	<LOD	—	<LOD	0.113
		Hay	0.045 (0.051)	24	0.342	0.275	—	0.012	0.629
					0.396	0.330	—	0.015	0.741
		Straw	0.045 (0.051)	48	0.051	0.032	—	0.001	0.084
					0.063	0.036	—	0.002	0.101
Carrington, ND 2005 7	Winter Wheat/ Ingot	Forage	0.044 (0.050)	21	0.010	0.004	—	<LOD	0.019
					0.010	0.003	—	<LOD	0.018
				42	0.011	0.001	—	<LOD	0.017
					0.011	0.001	—	<LOD	0.017
		Grain	0.044 (0.050)	49	0.307	<LOD	—	<LOD	0.317
					0.283	<LOD	—	<LOD	0.293
		Hay	0.044 (0.050)	22	0.190	0.053	—	0.004	0.247
					0.170	0.050	—	0.003	0.223

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TABLE C.3.1. Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Straw	0.044 (0.050)	49	0.083	0.011	—	0.001	0.095
					0.093	0.009	—	<LOD	0.107
Velva, ND 2005 7	Winter Wheat/ Dapps	Forage	0.044 (0.050)	21	0.015	0.001	—	<LOD	0.021
					0.019	0.001	—	<LOD	0.025
				41	0.010	<LOD	—	<LOD	0.020
					0.011	<LOD	—	<LOD	0.021
		Grain	0.045 (0.051)	46	0.152	<LOD	—	<LOD	0.162
					0.163	<LOD	—	<LOD	0.173
		Straw	0.045 (0.051)	46	0.078	0.055	—	0.003	0.136
					0.082	0.060	—	0.003	0.145

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation Total pyrasulfotole.

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Tifton, GA 2004-05 2	Winter Wheat/ Coker 9663	Forage	0.033 (0.037)	25	0.337	0.058	—	0.019	0.414
					0.362	0.068	—	0.030	0.460
				45	0.183	0.010	—	0.003	0.196
					0.144	0.010	—	0.003	0.157
		Grain	0.033 (0.038)	50	0.059	<LOD	—	<LOD	0.069
					0.057	<LOD	—	<LOD	0.067
		Hay	0.033 (0.038)	25	0.036	0.017	—	0.002	0.055
					0.041	0.014	—	0.002	0.057
		Straw	0.033 (0.038)	50	0.043	0.015	—	0.002	0.060
					0.048	0.016	—	0.003	0.067
Leland, MS 2004-05 4	Winter Wheat/ Coker 9152	Forage	0.034 (0.038)	19	0.151	0.076	—	0.024	0.251
					0.158	0.076	—	0.035	0.269
				43	0.019	0.001	—	0.003	0.023
					0.024	0.002	—	0.002	0.028
		Grain	0.033 (0.037)	49	0.183	<LOD	—	<LOD	0.193
					0.198	0.001	—	<LOD	0.204
		Hay	0.033 (0.037)	25	0.144	0.053	—	0.007	0.204
					0.142	0.043	—	0.005	0.190
		Straw	0.033 (0.037)	49	0.097	0.040	—	0.005	0.142
					0.097	0.040	—	0.004	0.141
Stilwell, KS 2004-05 5	Winter Wheat/ P2137	Forage	0.032 (0.036)	23	0.013	0.037	—	0.005	0.055
					0.013	0.034	—	0.005	0.052
				46	0.014	0.038	—	0.004	0.056
					0.023	0.050	—	0.005	0.078
		Grain	0.033 (0.037)	48	0.148	<LOD	—	<LOD	0.158
					0.115	<LOD	—	<LOD	0.125
		Hay	0.033 (0.037)	25	0.423	0.045	—	0.008	0.476
					0.383	0.040	—	0.007	0.430
		Straw	0.033 (0.037)	48	0.094	0.008	—	<LOD	0.107
					0.120	0.009	—	0.001	0.130
Seymour, IL 2004-05 5	Winter Wheat/ IL94-1653	Forage	0.033 (0.037)	21	0.036	0.033	—	0.002	0.071
					0.037	0.031	—	0.002	0.070
				41	0.017	0.001	—	<LOD	0.023
					0.017	0.001	—	<LOD	0.023
		Grain	0.035 (0.039)	40	0.039	0.002	—	<LOD	0.046
					0.042	0.003	—	<LOD	0.050
		Hay	0.035 (0.039)	21	0.153	0.257	—	0.033	0.443
					0.168	0.275	—	0.037	0.480
		Straw	0.035 (0.039)	40	0.075	0.113	—	0.013	0.201
					0.084	0.117	—	0.013	0.214
Springfield, NE	Winter Wheat/ Jagulene	Forage	0.034 (0.038)	22	0.047	0.010	—	<LOD	0.062
					0.058	0.012	—	<LOD	0.075

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
2004-05 5				44	0.027	<LOD	—	<LOD	0.037
					0.039	<LOD	—	<LOD	0.049
		Grain	0.033 (0.038)	48	0.055	<LOD	—	<LOD	0.065
					0.054	<LOD	—	<LOD	0.064
		Hay	0.033 (0.038)	21	0.092	0.094	—	0.017	0.203
					0.089	0.098	—	0.020	0.207
		Straw	0.033 (0.038)	48	0.049	0.026	—	0.002	0.077
					0.061	0.036	—	0.004	0.101
Sabin, MN 2005 5	SpringWheat/Alsen	Forage	0.034 (0.038)	15	0.165	0.165	—	0.008	0.338
					0.205	0.191	—	0.009	0.405
				23	0.195	0.131	—	0.005	0.331
					0.184	0.138	—	0.006	0.328
				33	0.190	0.078	—	0.004	0.272
					0.185	0.106	—	0.005	0.296
				43	0.187	0.034	—	0.002	0.223
					0.174	0.031	—	0.002	0.207
				55	0.160	0.031	—	0.001	0.192
					0.131	0.029	—	0.001	0.161
		Grain	0.033 (0.037)	40	0.195	0.006	—	<LOD	0.206
					0.217	0.006	—	0.002	0.225
				50	0.233	0.006	—	0.002	0.241
					0.233	0.006	—	0.001	0.240
				54	0.227	0.006	—	0.001	0.234
					0.232	0.006	—	0.001	0.239
				58	0.196	0.005	—	<LOD	0.206
					0.197	0.005	—	0.001	0.203
				69	0.208	0.005	—	0.001	0.214
					0.221	0.004	—	0.001	0.226
		Hay	0.033 (0.037)	0	0.156	0.359	—	2.909	3.424
					0.146	0.350	—	3.075	3.571
				14	0.277	0.251	—	0.038	0.566
					0.290	0.258	—	0.033	0.581
				24	0.173	0.119	—	0.012	0.304
					0.201	0.132	—	0.014	0.347
				30	0.172	0.075	—	0.010	0.257
					0.154	0.069	—	0.009	0.232
				35	0.142	0.069	—	0.010	0.221
					0.154	0.067	—	0.010	0.231
		Straw	0.033 (0.037)	40	0.100	0.047	—	0.006	0.153
					0.121	0.049	—	0.006	0.176
				50	0.123	0.046	—	0.004	0.173
					0.121	0.059	—	0.005	0.185
				54	0.092	0.048	—	0.006	0.146

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
					0.097	0.052	—	0.005	0.154
				58	0.113	0.050	—	0.004	0.167
					0.108	0.055	—	0.004	0.167
				69	0.087	0.043	—	0.005	0.135
					0.076	0.040	—	0.005	0.121
Metz, ON 2004 5	Spring Wheat/ 606.000	Forage	0.034 (0.038)	24	0.005	0.006	0.008	<LOD	0.018
					0.006	0.008	0.011	<LOD	0.022
				44	0.004	<LOD	0.007	<LOD	0.016
					0.003	<LOD	0.007	<LOD	0.015
Rockwood, ON 2005 5	Spring Wheat/ 606.000	Grain	0.034 (0.039)	48	0.156	<LOD	—	<LOD	0.166
					0.137	<LOD	—	<LOD	0.147
		Hay	0.034 (0.039)	24	0.249	0.091	—	0.003	0.343
					0.255	0.089	—	0.003	0.347
		Straw	0.034 (0.039)	48	0.148	0.030	—	0.001	0.179
					0.189	0.043	—	0.002	0.234
Uvalde, TX 2004-05 6	Winter Wheat/ Ogallala	Forage	0.034 (0.038)	24	0.096	0.027	—	0.003	0.126
					0.123	0.029	—	0.005	0.157
				44	0.046	0.001	—	<LOD	0.052
					0.042	0.002	—	<LOD	0.049
		Grain	0.033 (0.037)	50	0.068	<LOD	—	<LOD	0.078
					0.034	<LOD	—	<LOD	0.044
		Hay	0.033 (0.037)	22	0.659	0.138	—	0.227	1.024
					0.795	0.170	—	0.361	1.326
		Straw	0.033 (0.037)	50	0.130	0.044	—	0.012	0.186
					0.126	0.045	—	0.011	0.182
New Rockford, ND 2004 7	Spring Wheat/ Briggs	Forage	0.033 (0.037)	22	0.037	0.010	0.013	0.002	0.052
					0.029	0.010	0.013	0.001	0.043
				41	0.026	0.001	0.001	<LOD	0.032
					0.022	0.001	0.001	<LOD	0.028
New Rockford, ND 2005 7	Spring Wheat/ Ingot	Hay	0.033 (0.037)	21	0.104	0.054	0.071	0.003	0.178
					0.176	0.089	0.116	0.006	0.298
		Grain	0.033 (0.037)	49	0.159	<LOD	—	0.001	0.165
					0.170	<LOD	—	0.001	0.176
		Straw	0.033 (0.037)	49	0.060	0.004	—	0.003	0.067
					0.051	0.006	—	0.002	0.059
Elridge, ND 2004 7	Spring Wheat/ Granite	Forage	0.035 (0.039)	21	0.017	0.002	0.003	<LOD	0.025
					0.011	0.001	0.001	<LOD	0.017
				42	0.016	<LOD	0.007	<LOD	0.028
					0.009	<LOD	0.007	<LOD	0.021
		Grain	0.035 (0.039)	56	0.176	<LOD	—	<LOD	0.186
					0.195	<LOD	—	<LOD	0.205
		Hay	0.035 (0.039)	21	0.401	0.157	0.208	0.023	0.632
					0.403	0.168	0.222	0.017	0.642

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Straw	0.035 (0.039)	56	0.254	0.075	—	0.007	0.336
					0.233	0.073	—	0.009	0.315
Grand Island, NE 2005 7	Winter Wheat/ Ogallala	Forage	0.033 (0.037)	22	0.013	0.006	—	<LOD	0.024
					0.012	0.006	—	0.001	0.019
				41	0.023	<LOD	—	<LOD	0.033
					0.022	<LOD	—	<LOD	0.032
		Grain	0.033 (0.037)	41	0.166	0.002	—	<LOD	0.173
					0.130	0.002	—	<LOD	0.137
		Hay	0.033 (0.037)	22	0.157	0.264	—	0.038	0.459
					0.174	0.283	—	0.041	0.498
		Straw	0.033 (0.037)	41	0.102	0.078	—	0.008	0.188
					0.096	0.071	—	0.009	0.176
Leola, SD 2004 7	Spring Wheat/ Knudson	Forage	0.033 (0.037)	21	0.018	0.009	0.012	<LOD	0.035
					0.017	0.007	0.009	<LOD	0.031
				42	0.011	0.001	0.001	<LOD	0.017
					0.011	0.001	0.001	<LOD	0.017
		Grain	0.033 (0.037)	48	0.322	0.001	—	<LOD	0.328
					0.386	0.001	—	<LOD	0.392
		Hay	0.033 (0.037)	24	0.284	0.244	0.322	0.012	0.618
					0.280	0.203	0.268	0.008	0.556
		Straw	0.033 (0.037)	48	0.173	0.099	—	0.001	0.273
					0.206	0.135	—	0.002	0.343
Eldridge, ND 2004 7	Spring Wheat/ Knudson	Forage	0.034 (0.038)	15	0.037	0.060	0.083	0.002	0.122
					0.035	0.052	0.072	0.002	0.109
				25	0.024	0.004	0.005	<LOD	0.034
					0.020	0.004	0.005	<LOD	0.030
				35	0.018	0.001	0.001	<LOD	0.024
					0.022	0.001	0.001	<LOD	0.028
				43	0.025	<LOD	0.007	<LOD	0.037
					0.028	0.001	0.001	<LOD	0.034
				53	0.027	<LOD	0.007	<LOD	0.039
					0.023	<LOD	0.007	<LOD	0.035
		Grain	0.035 (0.039)	40	0.094	0.002	—	<LOD	0.101
					0.090	0.002	—	<LOD	0.097
				49	0.083	0.002	—	<LOD	0.090
					0.092	0.002	—	<LOD	0.099
				55	0.101	0.002	—	<LOD	0.108
					0.098	0.002	—	<LOD	0.105
				63	0.109	0.002	—	<LOD	0.116
					0.100	0.002	—	<LOD	0.107
				68	0.094	0.002	—	<LOD	0.101
					0.098	0.002	—	<LOD	0.105
		Hay	0.035 (0.039)	0	0.315	0.830	1.167	1.358	2.840
					0.320	0.794	1.117	1.204	2.641

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
				14	0.139	0.239	0.332	0.020	0.491
					0.125	0.222	0.308	0.015	0.448
				24	0.116	0.167	0.230	0.008	0.354
					0.094	0.183	0.252	0.008	0.354
				30	0.069	0.078	0.107	0.006	0.182
					0.065	0.073	0.100	0.006	0.171
				35	0.087	0.090	0.123	0.004	0.214
					0.098	0.084	0.115	0.003	0.216
		Straw	0.035 (0.039)	40	0.062	0.101	—	0.004	0.167
					0.069	0.114	—	0.005	0.188
				49	0.049	0.081	—	0.004	0.134
					0.059	0.089	—	0.004	0.152
				55	0.038	0.064	—	0.003	0.105
					0.047	0.081	—	0.005	0.133
				63	0.029	0.054	—	0.004	0.087
					0.034	0.054	—	0.004	0.092
				68	0.030	0.058	—	0.004	0.092
					0.029	0.057	—	0.004	0.090
Dundurn, SA 2004 7	Spring Wheat/ AC McKenzie	Forage	0.034 (0.038)	21	0.024	0.006	0.008	<LOD	0.037
					0.019	0.007	0.010	<LOD	0.034
				44	0.012	<LOD	0.007	<LOD	0.024
					0.013	<LOD	0.007	<LOD	0.025
		Grain	0.034 (0.038)	50	0.115	<LOD	—	<LOD	0.125
					0.119	<LOD	—	<LOD	0.129
		Hay	0.034 (0.038)	22	0.096	0.024	0.032	0.003	0.131
					0.089	0.021	0.028	0.004	0.121
		Straw	0.034 (0.038)	50	0.173	0.098	—	0.001	0.272
					0.211	0.134	—	0.002	0.347
Kenaston, SA 2004 7	Spring Wheat/ Protégé	Forage	0.034 (0.038)	25	0.109	0.001	0.001	<LOD	0.115
					0.107	0.001	0.001	<LOD	0.113
				45	0.077	<LOD	0.007	<LOD	0.089
					0.084	<LOD	0.007	<LOD	0.096
		Grain	0.034 (0.039)	50	0.139	<LOD	—	<LOD	0.149
					0.143	<LOD	—	<LOD	0.153
		Hay	0.034 (0.039)	24	0.333	0.101	0.135	0.005	0.473
					0.330	0.094	0.125	0.005	0.460
		Straw	0.034 (0.039)	50	0.150	0.041	—	0.002	0.193
					0.160	0.047	—	0.003	0.210
Taber, AB 2004 7A	Spring Wheat/ Intrepid	Forage	0.033 (0.037)	25	0.008	0.001	0.002	<LOD	0.015
					0.008	0.001	0.002	<LOD	0.015
				44	0.013	<LOD	0.008	<LOD	0.026
					0.012	<LOD	0.008	<LOD	0.025
		Hay	0.034	25	0.139	0.104	0.170	0.004	0.313

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
			(0.038)		0.149	0.113	0.185	0.004	0.338
Taber, AB 2005 7A	Spring Wheat/ Barrie	Grain	0.033 (0.037)	50	0.075	0.001	—	<LOD	0.081
					0.076	0.001	—	<LOD	0.082
		Straw	0.033 (0.037)	50	0.048	0.031	—	0.003	0.082
					0.052	0.034	—	0.003	0.089
Larned, KS 2004-05 8	Winter Wheat/ Jagger	Forage	0.033 (0.037)	24	0.125	0.050	—	0.009	0.184
					0.129	0.049	—	0.011	0.189
				44	0.074	0.015	—	0.004	0.093
					0.079	0.018	—	0.006	0.103
		Grain	0.034 (0.038)	55	0.149	0.001	—	<LOD	0.155
					0.368	0.002	—	<LOD	0.375
		Hay	0.034 (0.038)	23	0.198	0.230	—	0.026	0.454
					0.230	0.292	—	0.038	0.560
		Straw	0.034 (0.038)	55	0.028	0.041	—	0.005	0.074
					0.033	0.038	—	0.003	0.074
Hanston, KS 2004-05 8	Winter Wheat/ Jagger	Forage	0.034 (0.038)	22	0.204	0.086	—	0.060	0.350
					0.223	0.092	—	0.060	0.375
				41	0.160	0.042	—	0.024	0.226
					0.171	0.047	—	0.026	0.244
		Grain	0.033 (0.037)	56	0.100	0.001	—	<LOD	0.106
					0.077	0.001	—	<LOD	0.083
		Hay	0.033 (0.037)	23	0.174	0.252	—	0.025	0.451
					0.181	0.255	—	0.026	0.462
		Straw	0.033 (0.037)	56	0.043	0.050	—	0.004	0.097
					0.032	0.046	—	0.005	0.083
Levelland, TX 2004-05 8	Winter Wheat/ TAM 200	Forage	0.034 (0.038)	25	0.156	0.070	—	0.020	0.246
					0.166	0.079	—	0.023	0.268
				45	0.154	0.045	—	0.011	0.210
					0.153	0.040	—	0.011	0.204
		Grain	0.033 (0.037)	50	0.046	0.002	—	<LOD	0.053
					0.049	0.002	—	<LOD	0.056
		Hay	0.033 (0.037)	25	0.152	0.140	—	0.177	0.469
					0.181	0.163	—	0.203	0.547
		Straw	0.033 (0.037)	50	0.070	0.043	—	0.016	0.129
					0.061	0.036	—	0.010	0.107
Lubbock, TX 2004-05 8	Winter Wheat/ TAM 200	Forage	0.034 (0.038)	25	0.295	0.058	—	0.027	0.380
					0.301	0.066	—	0.029	0.396
				45	0.202	0.016	—	0.007	0.225
					0.214	0.015	—	0.007	0.236
		Grain	0.034 (0.039)	50	0.122	0.002	—	<LOD	0.129
					0.134	0.002	—	<LOD	0.141
		Hay	0.034 (0.039)	24	0.295	0.189	—	0.038	0.522
					0.281	0.165	—	0.034	0.480

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
		Straw	0.034 (0.039)	50	0.064	0.067	—	0.008	0.139
					0.080	0.078	—	0.011	0.169
Uvalde, TX 2004-05 8	Winter Wheat/ Ogallala	Forage	0.033 (0.037)	22	0.065	0.034	—	0.004	0.103
					0.103	0.048	—	0.007	0.158
				44	0.029	0.002	—	<LOD	0.036
					0.026	0.002	—	<LOD	0.033
		Grain	0.033 (0.037)	50	0.109	<LOD	—	<LOD	0.119
					0.151	<LOD	—	<LOD	0.161
		Hay	0.033 (0.037)	25	0.333	0.142	—	0.107	0.582
					0.340	0.151	—	0.109	0.600
		Straw	0.033 (0.037)	50	0.211	0.074	—	0.012	0.297
					0.281	0.113	—	0.016	0.410
Weatherford, OK 2004-05 8	Winter Wheat/ Jagger	Forage	0.033 (0.037)	25	0.201	0.071	0.101	0.013	0.315
					0.218	0.083	0.118	0.014	0.350
				45	0.109	0.029	0.041	0.007	0.157
					0.107	0.029	0.041	0.007	0.155
		Grain	0.035 (0.039)	51	0.160	<LOD	—	<LOD	0.170
					0.137	0.001	—	<LOD	0.143
		Hay	0.035 (0.039)	25	0.118	0.057	—	0.008	0.183
					0.120	0.067	—	0.007	0.194
		Straw	0.035 (0.039)	51	0.025	0.038	—	0.005	0.068
					0.028	0.033	—	0.004	0.065
Payette, ID 2004 11	Spring Wheat/ Penawawa	Forage	0.034 (0.039)	18	0.034	0.003	0.004	<LOD	0.043
					0.031	0.003	0.004	<LOD	0.040
				41	0.023	<LOD	0.007	<LOD	0.035
					0.019	<LOD	0.007	<LOD	0.031
		Grain	0.034 (0.039)	50	0.111	0.001	—	<LOD	0.117
					0.095	<LOD	—	<LOD	0.105
		Hay	0.034 (0.039)	25	0.170	0.142	—	0.007	0.319
					0.124	0.121	—	0.006	0.251
		Straw	0.034 (0.039)	50	0.036	0.020	—	<LOD	0.061
					0.041	0.021	—	<LOD	0.067
Wakaw, SA 2004 14	Spring Wheat/ AC Barrie	Grain	0.034 (0.038)	50	0.082	0.002	—	<LOD	0.089
					0.071	0.001	—	<LOD	0.077
		Hay	0.034 (0.038)	25	0.065	0.040	0.054	0.007	0.126
					0.073	0.043	0.058	0.007	0.138
		Straw	0.034 (0.038)	50	0.059	0.036	—	0.002	0.097
					0.055	0.032	—	0.002	0.089
Fort Saskathchewan, AB 2004 14	Spring Wheat/ CPS	Forage	0.035 (0.039)	25	0.009	<LOD	0.007	<LOD	0.021
					0.010	<LOD	0.007	<LOD	0.022
				44	0.008	<LOD	0.007	<LOD	0.020
					0.009	<LOD	0.007	<LOD	0.021
		Hay	0.034	25	0.068	0.127	0.171	0.008	0.247

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
			(0.039)		0.044	0.077	0.104	0.006	0.154
Fort Saskathchewan, AB 2005 14	Spring Wheat/ Teal	Forage	0.037 (0.042)	25	0.013	0.008	—	0.002	0.023
					0.016	0.005	—	0.002	0.023
				42	0.018	<LOD	—	<LOD	0.028
					0.017	<LOD	—	<LOD	0.027
		Grain	0.033 (0.037)	45	0.046	<LOD	—	<LOD	0.056
					0.058	<LOD	—	<LOD	0.068
		Straw	0.033 (0.037)	45	0.060	0.022	—	0.002	0.084
					0.085	0.026	—	0.001	0.112
Edmonton, AB 2005 14	Spring Wheat/ Teal	Forage	0.037 (0.041)	25	0.010	0.004	—	0.002	0.016
					0.010	0.004	—	0.002	0.016
				42	0.008	<LOD	—	<LOD	0.018
					0.009	<LOD	—	<LOD	0.019
		Hay	0.034 (0.038)	23	0.101	0.122	0.159	0.010	0.270
					0.104	0.117	0.153	0.006	0.263
		Grain	0.034 (0.038)	45	0.024	<LOD	—	<LOD	0.034
					0.022	<LOD	—	<LOD	0.032
		Straw	0.034 (0.038)	45	0.037	0.013	—	<LOD	0.055
					0.027	0.011	—	<LOD	0.043
Indian Head, SA 2004 14	Spring Wheat/ Superb	Forage	0.034 (0.038)	23	0.043	0.009	0.012	<LOD	0.060
					0.042	0.006	0.008	<LOD	0.055
				44	0.038	<LOD	0.007	<LOD	0.050
					0.033	<LOD	0.007	<LOD	0.045
		Hay	0.034 (0.038)	25	0.071	0.078	0.106	0.003	0.180
					0.057	0.036	0.049	<LOD	0.111
Ituna, SA 2005 14	Winter Wheat/ CDC Kestrel	Grain	0.033 (0.038)	52	0.099	<LOD	—	<LOD	0.109
					0.056	<LOD	—	<LOD	0.066
		Straw	0.033 (0.038)	52	0.056	0.015	—	<LOD	0.076
					0.037	0.005	—	<LOD	0.047
Brookdale, MB 2004 14	Spring Wheat/ AC	Forage	0.032 (0.036)	21	0.017	0.003	0.004	<LOD	0.026
					0.018	0.010	0.014	<LOD	0.037
				41	0.017	<LOD	0.001	<LOD	0.029
					0.021	0.001	0.001	<LOD	0.027
		Hay	0.033 (0.037)	23	0.347	0.423	0.572	0.015	0.934
					0.353	0.444	0.601	0.018	0.972
Brookdale, MB 2005 14	Spring Wheat/ AC Barrie	Grain	0.034 (0.038)	47	0.030	<LOD	—	0.001	0.036
					0.028	<LOD	—	<LOD	0.038
		Straw	0.034 (0.038)	47	0.060	0.141	—	0.005	0.206
					0.060	0.151	—	0.006	0.217
Clanwilliam, MB 2004 14	Spring Wheat/ AC Teal	Forage	0.033 (0.037)	22	0.029	0.008	0.011	<LOD	0.045
					0.028	0.004	0.005	<LOD	0.038
				44	0.012	<LOD	0.007	<LOD	0.024
					0.012	<LOD	0.007	<LOD	0.024
		Hay	0.034	21	0.190	0.258	0.352	0.011	0.553

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TABLE C.3.2. Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

City, State Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
			(0.039)		0.206	0.287	0.391	0.012	0.609
Clanwilliam, MB 2005 14	Spring Wheat/ AC Domain 2005	Grain	0.033 (0.037)	45	0.046	<LOD	—	<LOD	0.056
					0.042	<LOD	—	<LOD	0.052
		Straw	0.033 (0.037)	45	0.019	0.010	—	<LOD	0.034
					0.021	0.012	—	<LOD	0.038
Rosthern, SA 2005 14	Winter Wheat / CDC Bounty	Forage	0.033 (0.037)	25	0.007	0.001	—	<LOD	0.013
					0.007	0.001	—	<LOD	0.013
				43	0.008	<LOD	—	<LOD	0.018
					0.005	<LOD	—	<LOD	0.015
		Grain	0.033 (0.037)	48	0.074	<LOD	—	<LOD	0.084
					0.078	<LOD	—	<LOD	0.088
		Hay	0.033 (0.037)	24	0.260	0.164	—	0.010	0.434
					0.285	0.195	—	0.012	0.492
		Straw	0.033 (0.037)	48	0.041	0.019	—	0.001	0.061
					0.048	0.024	—	0.002	0.074
Carrington, ND 2005 7	Winter Wheat / Ingot	Forage	0.033 (0.038)	21	0.016	0.008	—	<LOD	0.029
					0.013	0.009	—	<LOD	0.027
				42	0.014	0.001	—	<LOD	0.020
					0.015	0.002	—	<LOD	0.022
		Grain	0.034 (0.038)	49	0.298	<LOD	—	<LOD	0.308
					0.273	<LOD	—	0.001	0.279
		Hay	0.034 (0.038)	22	0.185	0.050	—	0.004	0.239
					0.226	0.071	—	0.005	0.302
		Straw	0.034 (0.038)	49	0.066	0.010	—	0.001	0.077
					0.076	0.010	—	0.001	0.087
Velva, ND 2005 7	Winter Wheat/ Dapps	Forage	0.034 (0.038)	21	0.011	0.001	—	<LOD	0.017
					0.010	0.002	—	<LOD	0.017
				41	0.008	<LOD	—	<LOD	0.018
					0.007	<LOD	—	<LOD	0.017
		Grain	0.034 (0.038)	46	0.197	0.001	—	<LOD	0.203
					0.175	<LOD	—	<LOD	0.185
		Straw	0.034 (0.038)	46	0.076	0.050	—	0.002	0.128
					0.093	0.058	—	0.003	0.154

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation Total pyrasulfotole.

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TABLE C.4.1 Summary of Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	0.003	0.447	0.437	0.030	0.081	0.100
		41-46	68	0.002	0.296	0.273	0.024	0.058	0.071
Grain		40-56	72	0.028	0.873	0.502	0.121	0.149	0.117
Hay		21-25	70	0.015	1.149	1.100	0.176	0.236	0.202
Straw		40-56	72	0.022	0.420	0.388	0.083	0.104	0.085
Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	<LOD	0.165	0.169	0.009	0.032	0.047
		41-46	68	<LOD	0.072	0.064	0.007	0.013	0.018
Grain		40-56	72	0.001	0.009	0.008	0.005	0.004	0.002
Hay		21-25	70	0.016	0.567	0.492	0.150	0.165	0.115
Straw		40-56	72	0.005	0.154	0.149	0.049	0.055	0.038
Pyrasulfotole									
Forage	0.040–0.049 (0.046–0.055)	18-25	68	<LOD	0.061	0.058	0.005	0.008	0.011
		41-46	68	<LOD	0.026	0.026	0.005	0.006	0.004
Grain		40-56	72	0.001	0.009	0.008	0.005	0.005	0.001
Hay		21-25	70	<LOD	0.625	0.563	0.009	0.042	0.108
Straw		40-56	72	0.001	0.030	0.025	0.003	0.005	0.005

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ. HAFT is the highest average field trial.

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TABLE C.4.2 Summary of Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	0.005	0.362	0.350	0.029	0.076	0.091
		41-46	64	0.003	0.214	0.208	0.022	0.049	0.059
Grain		40-56	72	0.022	0.386	0.354	0.110	0.127	0.081
Hay		21-25	62	0.036	0.795	0.727	0.174	0.207	0.140
Straw		40-56	72	0.019	0.281	0.246	0.065	0.088	0.059
Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	<LOD	0.138	0.135	0.010	0.029	0.035
		41-46	64	<LOD	0.050	0.044	0.005	0.010	0.013
Grain		40-56	72	0.001	0.006	0.006	0.005	0.004	0.002
Hay		21-25	62	0.014	0.601	0.594	0.142	0.165	0.118
Straw		40-56	72	0.004	0.151	0.146	0.043	0.051	0.037
Pyrasulfotole									
Forage	0.031–0.038 (0.035–0.042)	18-25	64	<LOD	0.060	0.060	0.005	0.009	0.012
		41-46	64	<LOD	0.026	0.024	0.005	0.006	0.004
Grain		40-56	72	0.001	0.005	0.005	0.005	0.005	0.001
Hay		21-25	62	<LOD	0.361	0.294	0.008	0.031	0.062
Straw		40-56	72	0.001	0.016	0.016	0.004	0.005	0.004

For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ. HAFT is the highest average field trial.

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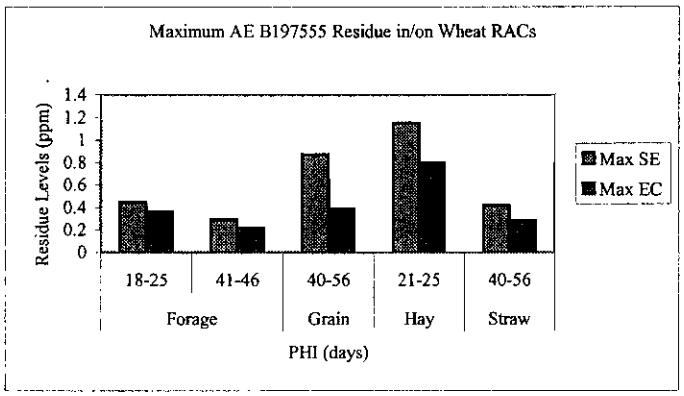
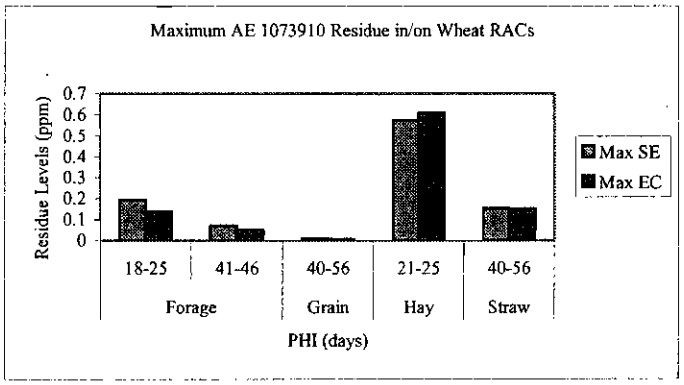
FIGURE C.1. Maximum Residue Levels in/on Wheat RACs.





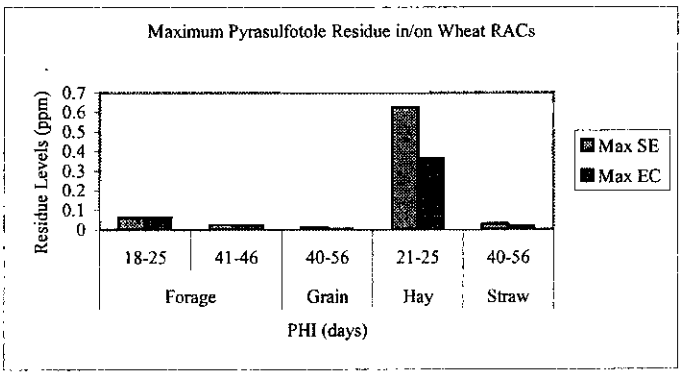
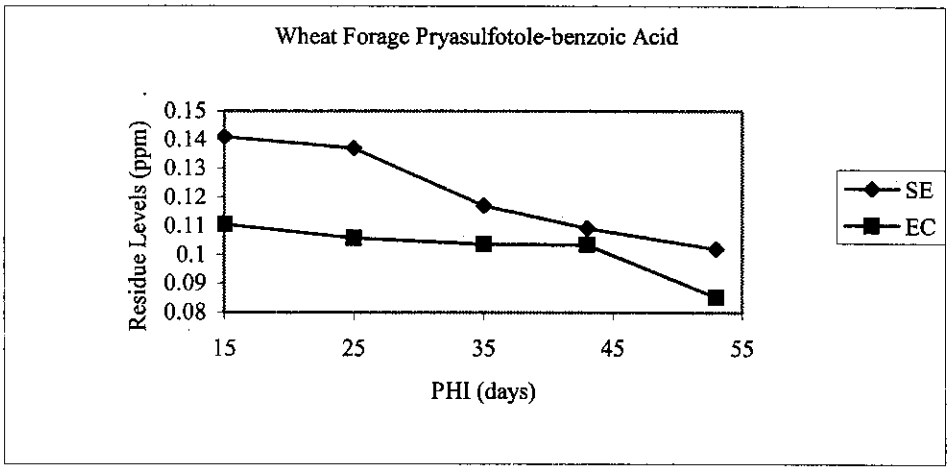
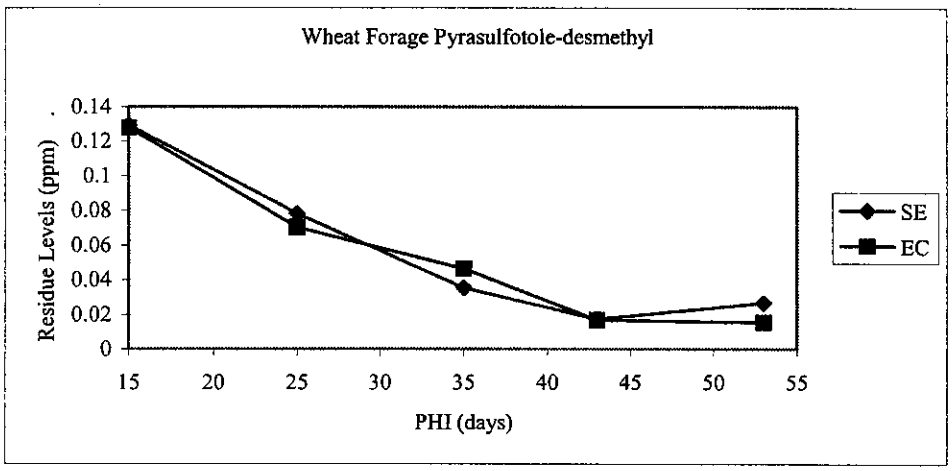


FIGURE C.2. Time Course of Residue Data from Decline Trials in/on Wheat RACs





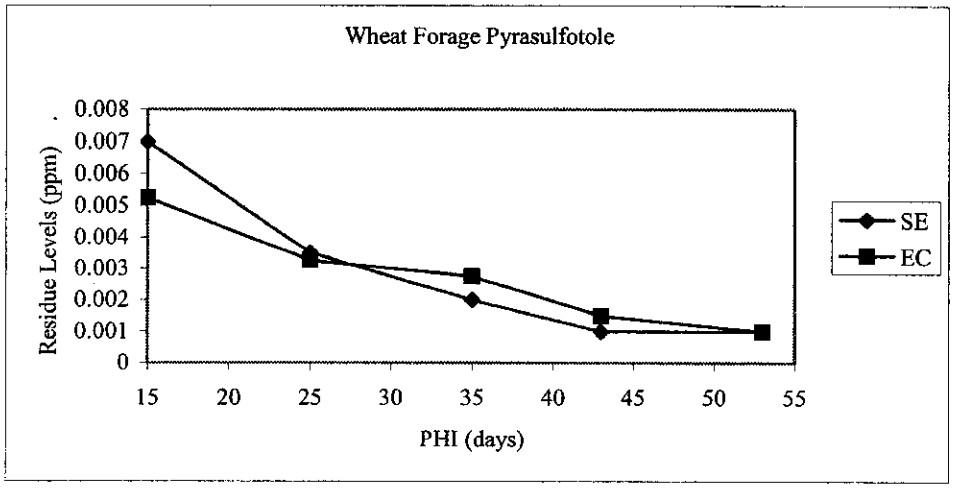


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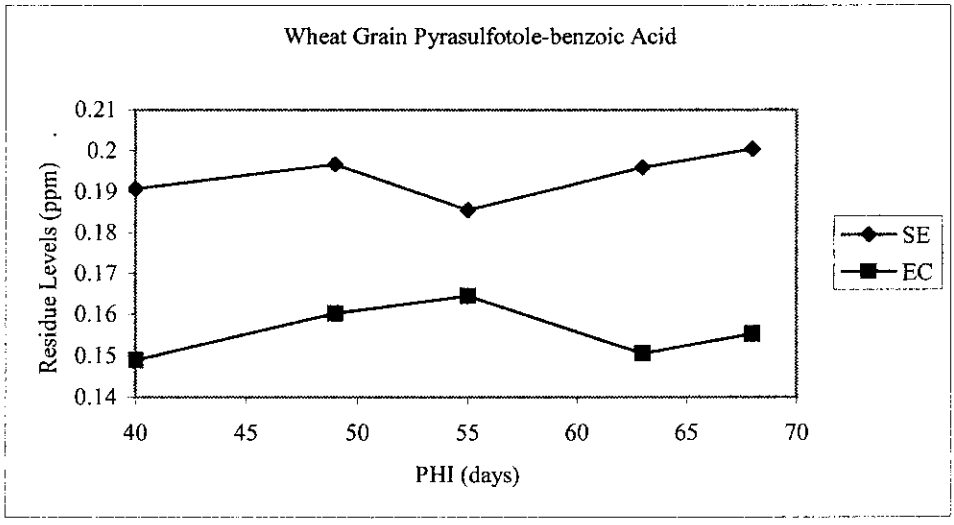
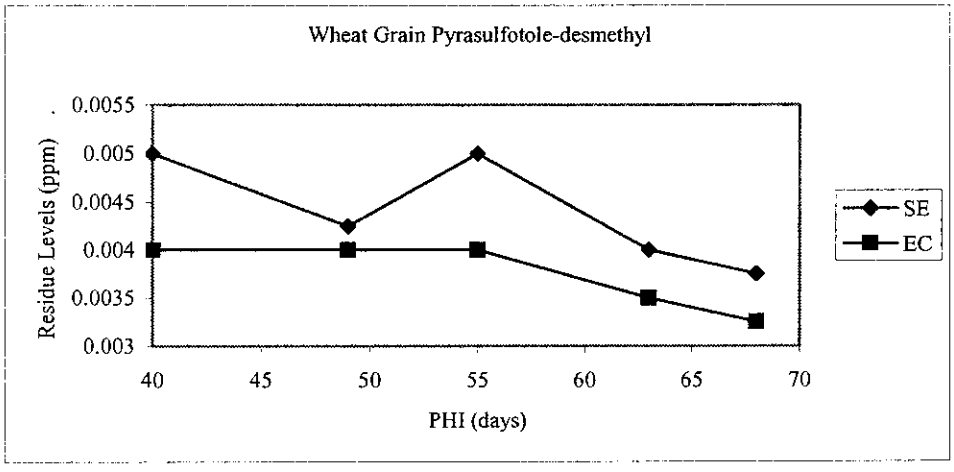
FIGURE C.2. continued





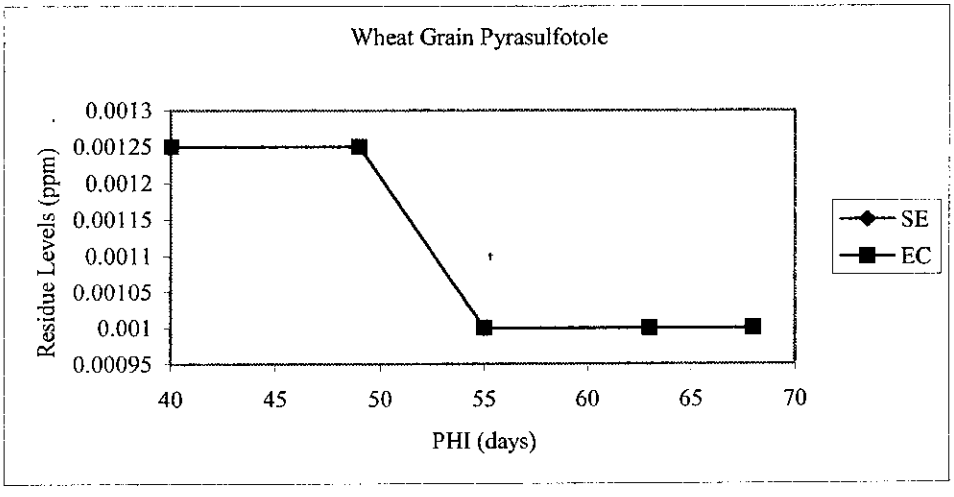


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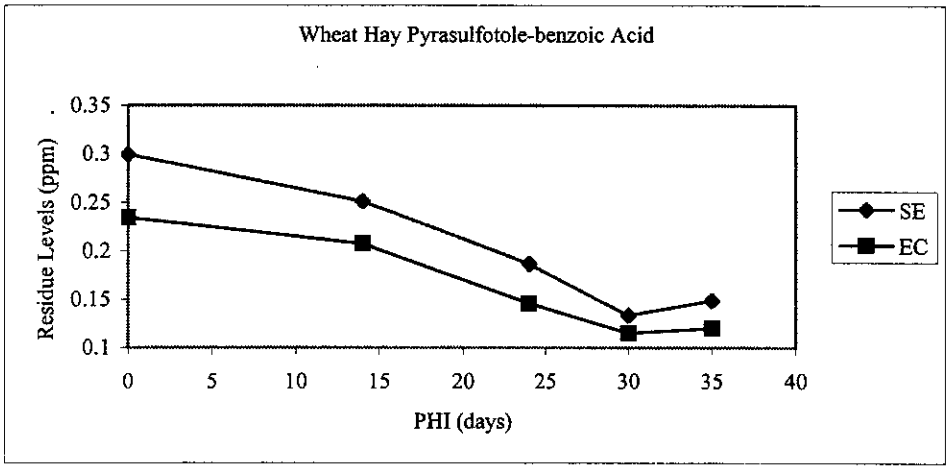
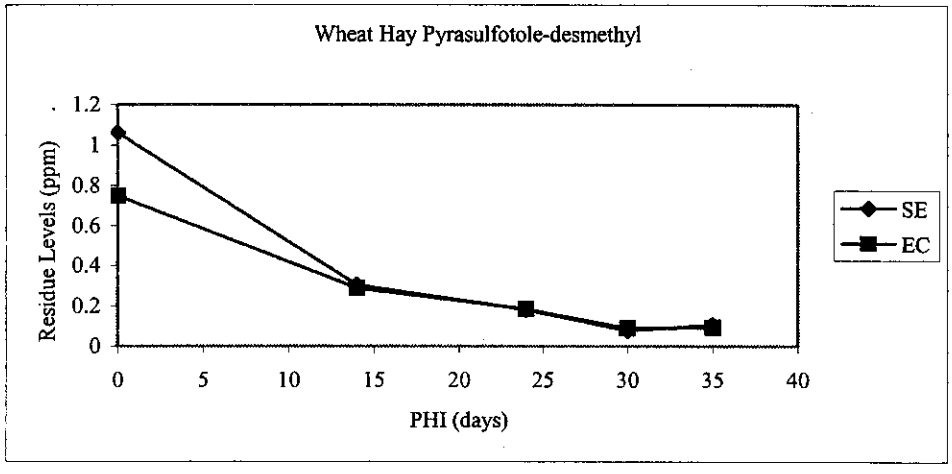
FIGURE C.2. continued





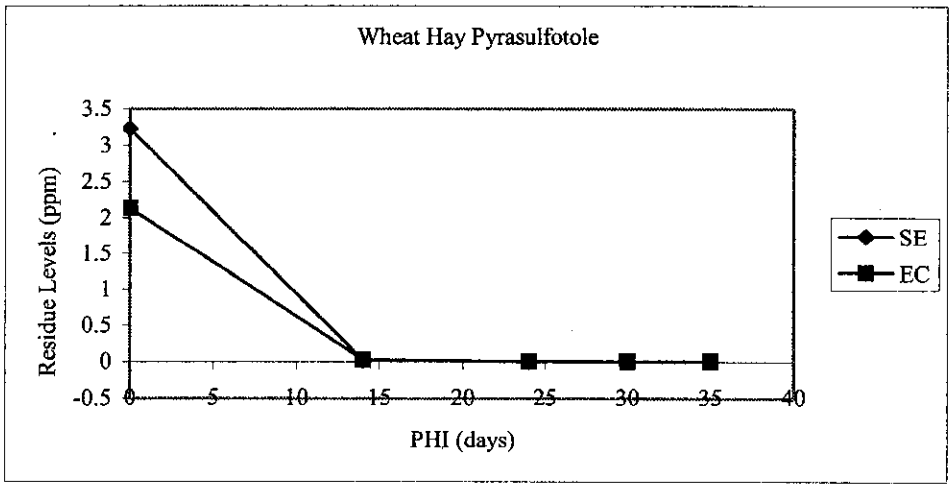


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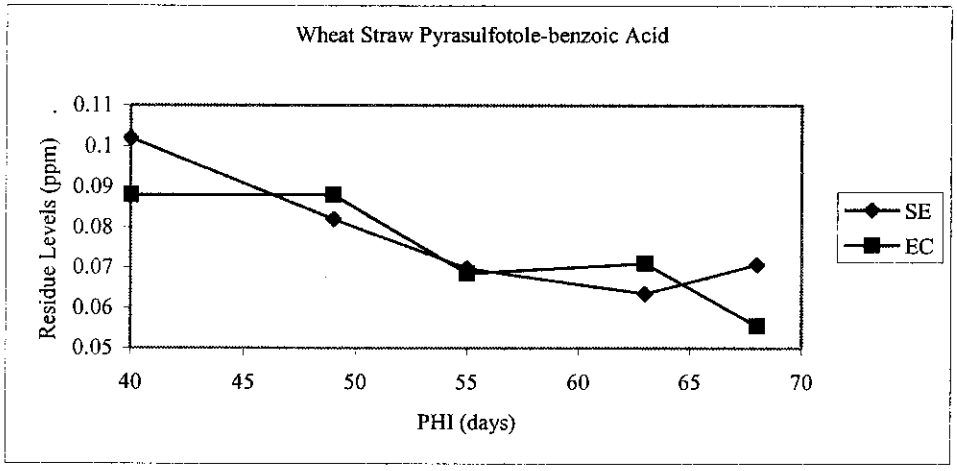
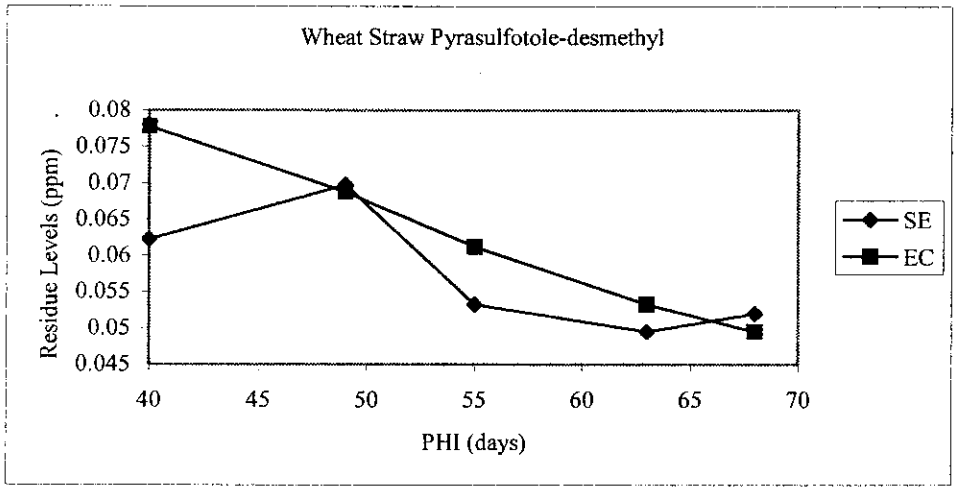
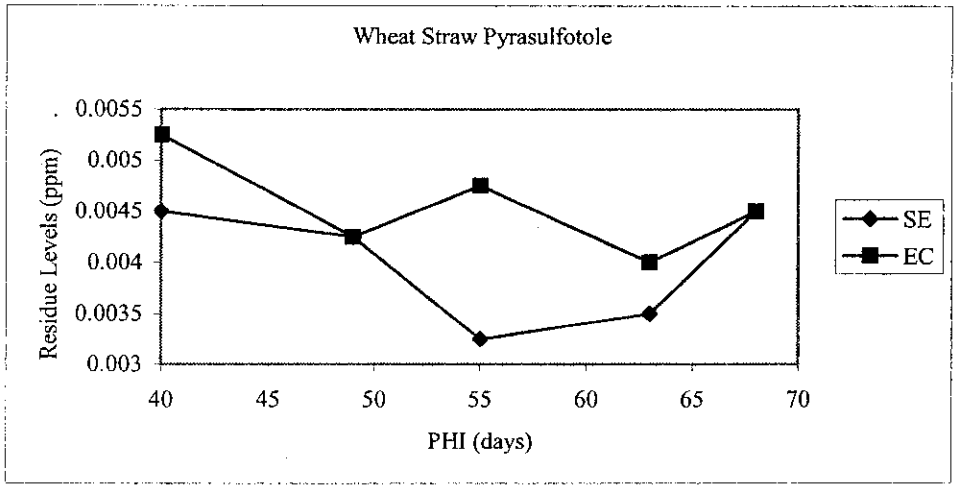
FIGURE C.2. continued







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D. CONCLUSION

The crop field data were deemed acceptable for the determination of the magnitude of residue for the active ingredient pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl in/on wheat RACs (forage, grain, hay and straw) when using the end use products AE 017309 02 SE06 or AE 017309 03 EC23. The study use pattern had a maximum seasonal application rate of 0.049 lbs a.i./A (0.055 kg a.i./ha) for SE06 or 0.038 lbs a.i./A (0.042 kg a.i./ha) for EC23 on wheat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw and grain).

With these use patterns, residue levels of pyrasulfotole and metabolites in/on wheat RACs were slightly higher with the SE06 formulation in all but one case, with wheat hay retaining the highest amounts of analyte residues. Residues of pyrasulfotole-benzoic acid are not expected to exceed 0.447 ppm (forage, 25-day PHI), 1.15 ppm (hay), 0.873 ppm (grain), 0.420 ppm (straw); residues of pyrasulfotole-desmethyl are not expected to exceed 0.165 ppm (forage, 25-day PHI), 0.601 ppm (hay), 0.009 ppm (grain), 0.154 ppm (straw); and residues of pyrasulfotole are not expected to exceed 0.061 ppm (forage, 25-day PHI), 0.625 ppm (hay), 0.009 ppm (grain), 0.030 ppm (straw).

Pyrasulfotole-benzoic acid is the primary component of the residue detected on wheat grain. In decline trials, residues of all analytes declined with time in wheat forage and wheat hay, but declined only slightly or remained unchanged in wheat grain and wheat straw with increasing PHIs.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of pyrasulfotole: substance, pure code: pyrasulfotole 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of pyrasulfotole. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). Pyrasulfotole - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of pyrasulfotole at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). pyrasulfotole: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

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7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). Pyrasulfotole: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). Pyrasulfotole: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. MRID No. 46801806 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using LC-MS/MS.

11. MRID No. 46801808 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Extraction efficiency of Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using lc/ms/ms. Bayer CropScience Report No. RAAIX011.

12. MRID No. 46801819 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Storage stability of pyrasulfotole, AE1073910, and AE B197555 in soybean grain, wheat grain, wheat forage, and wheat hay. Bayer CropScience Study No. RAAIX009.

13. MRID No. 46801819 Coopersmith, H. (2006). Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (20 December 2006); George Kramer (20 December 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 1073910 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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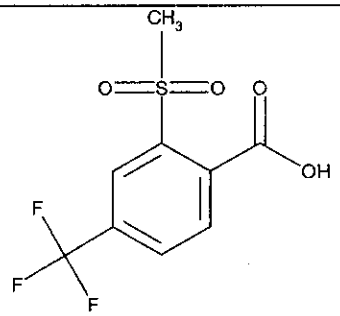
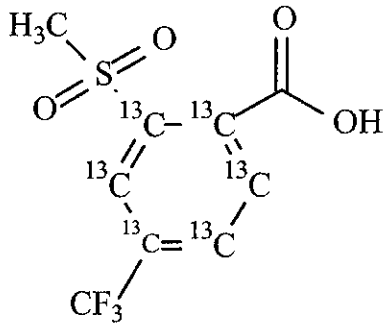
Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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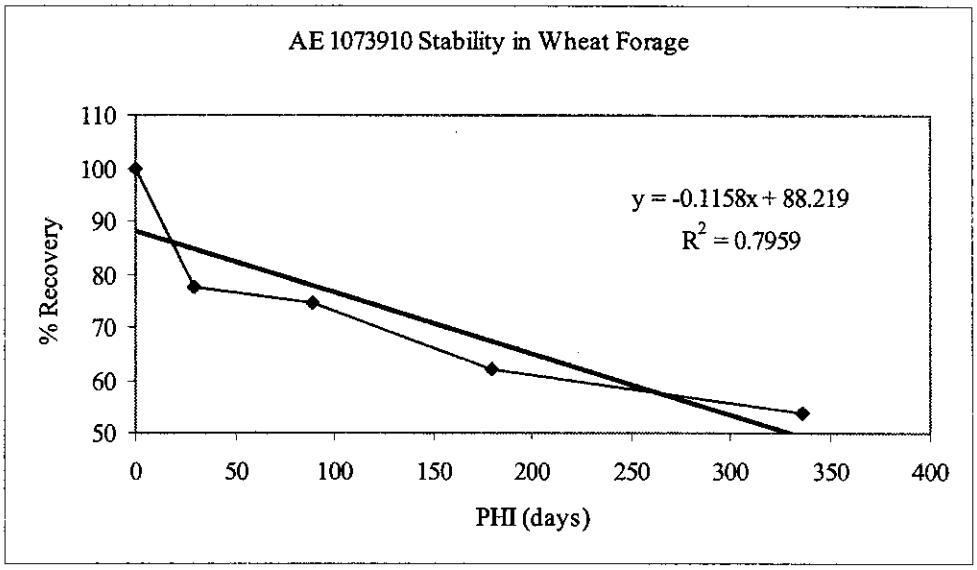
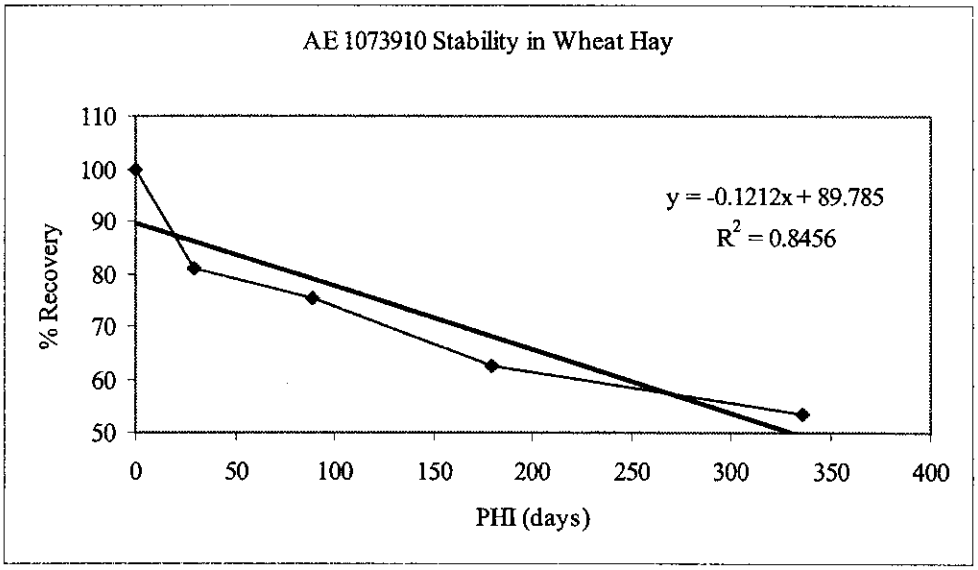
APPENDIX 2





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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORT:

MRID No. 46801832 Milo, J. and Harbin, A.M. 30 January 2006. AE 0317309 02 SE06 A1 - Magnitude of the Residue in/on Wheat Aspirated Grain Fractions and Wheat Processed Commodities. Unpublished Bayer CropScience Study Number: RAAIM003. 226 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience conducted a field trial to measure the potential for concentration of pyrasulfotole (AE 0317309), pyrasulfotole-benzoic acid (AE B197555), and pyrasulfotole-desmethyl (AE 1073910) related residues in wheat grain, aspirated grain fractions and the processed wheat commodities of bran, flour, middling, shorts and germ. Spring wheat was grown at a single test site in Sabin, MN (NAFTA Region 5). The test substance, AE 0317309 02 SE06 A1, is a suspo-emulsion formulation nominally containing the active ingredient (a.i.) pyrasulfotole at 50 g a.i./L (0.045 lb a.i./gal) and the safener mefenpyr-diethyl at 12.5 g/L. A single broadcast foliar spray application of AE 0317309 02 SE06 A1 was made to wheat plants at flag leaf stage (BBCH 39) at a rate of 0.230 lb a.i./A (0.258 kg a.i./ha) using a spray volume of 12.8 gal/A (120 L/ha). No adjuvants were used in the tank mixture.

Subsamples of the wheat grain were removed for analysis. The remainder of the wheat grain was used to generate aspirated grain fractions, bran, flour, middling, shorts, and germ using batch procedures that simulated commercial processing practices.

The individual analyte residues of pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl in each matrix was quantitated by high-performance liquid chromatography-electrospray ionization/tandem mass spectrometry (HPLC-MS/MS) using isotopically labeled internal standards. The limit of quantitation (LOQ) was 0.010 ppm for each analyte in wheat grain and all wheat processed products, and 0.020 ppm in wheat aspirated grain fractions.

Wheat grain samples in this study were frozen a maximum of 5.5 months (164 days) prior to extraction. Wheat aspirated grain fractions and all processed wheat commodities were analyzed within 30 days of storage. A freezer storage stability study on representative cereal crop matrices indicated that pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl residues are stable in wheat grain during 11 months of frozen storage.

The residues of pyrasulfotole and pyrasulfotole-desmethl only concentrated in the aspirated wheat grain fractions (32.8-fold), and in wheat bran (1.6-fold). The residues did not concentrate in wheat flour (0.3-fold), middlings (0.4-fold), shorts (0.6-fold), and germ (0.7-fold).

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the processing data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

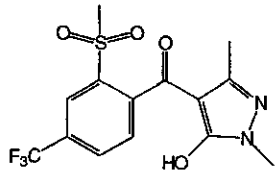
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; suspo-emulsion AE 0317309 02 SE06 A1

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Application and Crop Information

The test crop was grown and maintained according to typical agricultural practices for the region.

TABLE B.1.1. Trial Site Conditions.

Trial Identification (City, State/Year)	Soil characteristics				Meteorological data	
	Type	%OM	pH	CEC meq/g	Daily Rainfall / Irrigation (First Application To Last Sampling) cm	Average Minimum/Maximum Temperature Range, °C
RAAIM003-A1034-04P NAFTA Region 5 Sabin, MN 2004	Data not presented in report.				July 2004 – September 2004: 34.2 Historical: 19.3	July 2004 – September 2004: 11.7-23.9 Historical: 12.2-20.6

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TABLE B.1.2. Study Use Pattern.

Location: City, State, NAFTA Region	Trial Number (RAAIM003-)	Year	End-Use Product	Application							Tank Mix Adjuvant
				Method	Timing[a]	Plot Name	Rate lb ai/A (kg ai/ha)	RTI[b] (days)	Spray Volume GPA(L/ha)	Total Rate lb a.i./A (kg a.i./ha)	
Sabin, MN Region 5	A1034-04P	2004	SE06 A1	Foliar	Flag Leaf Stage	5X	0.230 (0.258)	NA	12.8 (120)	0.230 (0.258)	No

[a] Flag Leaf Stage = BBCH 39
[b] RTI = Retreatment Interval. Only one application was made to the plot.

B.2. Sample Handling and Processing Procedures

Control and treated wheat were grown and harvested in the same manner. One control and one treated bulk wheat grain sample were collected at normal commercial harvest (57 days after the last application). Each sample consisted of 300 kg of wheat grain. The samples were put into labeled containers in the field and transported to a freezer within 1.5 hour of harvest. The samples were shipped by freezer truck to the processing facility, the GLP Food Processing Center at Texas A&M University.

Upon arrival at the processing facility, the wheat grain samples were immediately transferred to frozen storage and remained there until samples were subsampled or processed. Subsamples of wheat grain from both the control and treated plot were taken from the bulk samples before the aspirated grain fractions were generated and the remainder of each sample was processed.

The procedure for this laboratory-scale wheat processing was designed to mimic a large-scale commercial operation and is described in FIGURES 1 and 2. The processed commodities were immediately transferred to frozen storage and remained there at all times except during subsampling for analysis. Samples of aspirated wheat grain fractions were obtained from four terminal commercial grain elevators. The ash content of each sample was determined. The samples were fractionated into five different particle size ranges, and the percent of the total sample mass was calculated for each fraction. The average ash content of these samples was 8%. The average percent mass of the individual particle size fractions was 10% (>2030 µm), 5% (>1180 µm), 5% (>850 µm), 28% (>425 µm), and 52% (<425 µm).

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FIGURE 1. Processing Flow Chart for Aspirated Grain Fractions from Wheat.

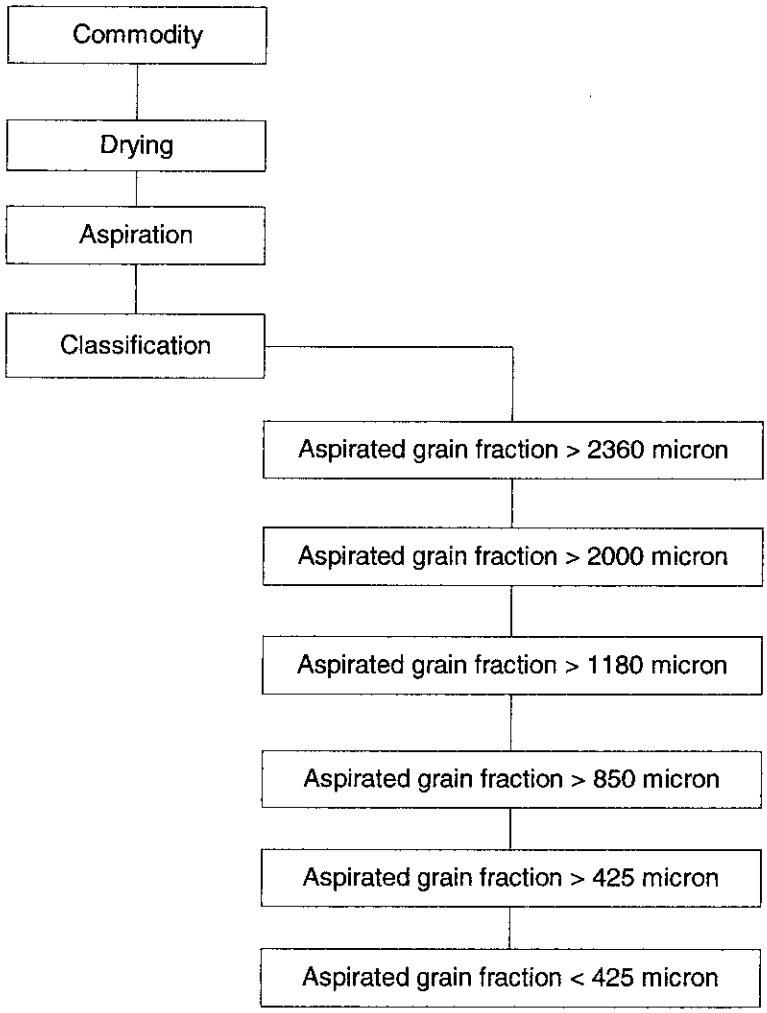

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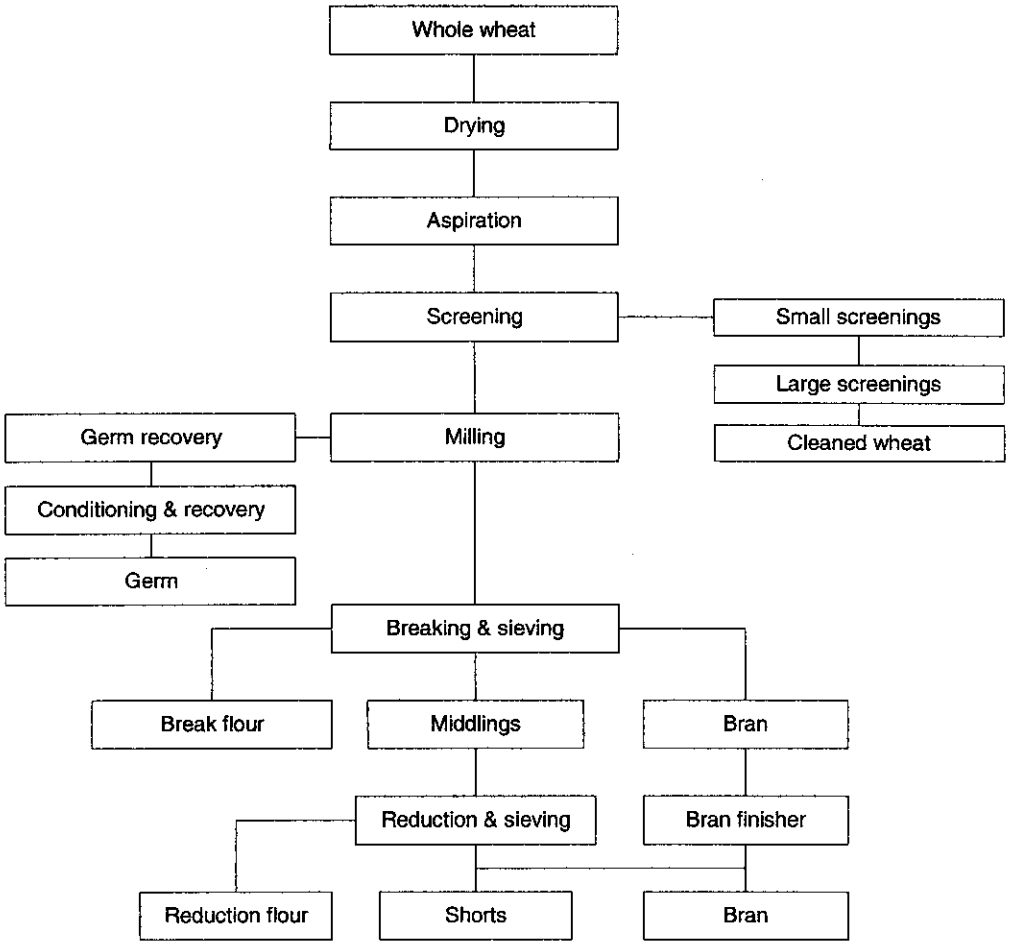
FIGURE 2. Processing Flow Chart for Commodity Fractions from Wheat.



B.3. Analytical Methodology

An analytical method was developed to measure residues of parent pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl in crop matrices using stable isotopically labeled internal standards and HPLC-MS/MS detection.[10, 11, 12] Residue method validation was performed prior to sample analysis and concurrent recoveries were performed during sample analysis to demonstrate acceptable method performance.

A 1.0-g aliquot of wheat aspirated grain fractions (due to the small amount of sample available) or a 2.0 g aliquot of the wheat grain or processed wheat commodities was weighed into a 60-mL vial, and a mixture of acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) was added. The sample extract was heated to 60°C for at least 30 minutes. The samples were cooled and a mixture of isotopic internal standards (IS) added to the sample extract and mixed (0.1 ppm of each IS). A small aliquot (about 1.25 mL) was purified by C18 solid-phase extraction (SPE). The solvent was removed from the sample and the residue was reconstituted

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for analysis by HPLC-MS/MS, utilizing a Gemini C-18 column (50 x 2.0 mm) with aqueous 10 mM NH_4HCO_3 solution and methanol as the mobile phase components.

The individual analyte residues of pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl were quantitated. The LOQ was 0.010 ppm for each analyte in wheat grain and all wheat processed products; and 0.020 ppm in wheat aspirated grain fractions.

C. RESULTS AND DISCUSSION

Spring wheat at the flag leaf stage (BBCH 39) was treated with a single broadcast foliar spray application of AE 0317309 02 SE06 A1 at a rate of 0.23 lb a.i./A (258 g a.i./ha). No adjuvants were used in the tank mixture. The end-use product, AE 0317309 02 SE06 A1, is a suspo-emulsion formulation nominally containing 50 g a.i./L pyrasulfotole (0.045 lb a.i./gal) and 12.5 g/L of the safener mefenpyr-diethyl.

One control and one treated bulk wheat grain sample were collected at normal commercial harvest (57 days after the last application). There was no unusual weather or meteorological conditions recorded during the conduct of the trial that would cause the results of this study to be questioned.

The procedure for this laboratory scale wheat processing was designed to mimic a large scale commercial operation. Subsamples of the bulk control and treated wheat grain were removed, and aspirated grain fractions were generated. The remainder of each sample was processed into bran, flour, middling, shorts, and germ.

The recovery of pyrasulfotole and the metabolites (pyrasulfotole-benzoic acid, pyrasulfotole-desmethyl) from wheat grain was measured concurrently with the set of samples and demonstrated acceptable method performance during sample analysis. Acceptable recovery of each analyte in the grain matrices was achieved at the lowest spiking level of 0.010 ppm (0.020 ppm in aspirated grain fractions), the LOQ for pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid. Concurrent recovery data are presented in TABLE C.1.

The calculated limit of detection (LOD) for pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid residue in wheat grain, wheat aspirated grain fractions, and all processed wheat commodities is 0.0009 ppm, 0.0008, and 0.0019 ppm, respectively.

The relative response of the detector in the HPLC-MS/MS chromatographic system to pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl was linear over the range of 0.005 to 2.50 ppm. The correlation coefficients were all > 0.998. All control interferences for wheat grain were <0.01 ppm.

A freezer storage stability study on representative cereal crop matrices indicated that pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl residues are stable (< 30% decline) during 11 months. Wheat grain samples in this study were frozen a maximum of 5.5

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months (164 days) prior to extraction. Wheat aspirated grain fractions and processed wheat commodities were stored frozen a maximum of 0.8 months (23 days) prior to extraction. No corrections for any possible decline during frozen storage have been made to the results reported herein. All extracts were analyzed within 2 days of extraction. Acceptable recoveries measured concurrently with each set of samples ensured the integrity of the sample extract during the period of time between extraction and analysis. A summary of the storage intervals and conditions incurred by samples in this study are provided in TABLE C.2.

Control samples were analyzed concurrently with treated samples for each matrix. The results of the analyses indicated that there were no apparent residues in the control bulk wheat grain, wheat aspirated grain fractions, or in the processed commodities greater than the LOQ.

The pyrasulfotole residue data for wheat grain, wheat aspirated grain fractions, and processed wheat commodities (bran, flour, middling, shorts, and germ) are summarized in TABLE C.3. The pyrasulfotole residue is the sum of the individual analytes pyrasulfotole and pyrasulfotole-desmethyl in that sample. The pyrasulfotole-benzoic acid was quantitated for information purposes only. The average total pyrasulfotole residue was 0.0.0186 ppm in wheat grain, 0.6085 ppm in wheat aspirated grain fractions, 0.0297 ppm in bran, 0.0048 ppm in flour, 0.0071 ppm in middlings, 0.0100 ppm in shorts, and 0.013 ppm in germ. Processing factors were calculated by dividing the average total pyrasulfotole residue in the wheat aspirated grain fractions and processed wheat commodities by the average total residues of pyrasulfotole in the wheat grain (RAC).

A great concentration of the total pyrasulfotole residue was seen in aspirated grain fractions (processing factor = 32.8) and a slight concentration in wheat bran (processing factor = 1.6). No concentration (processing factor <1) of total pyrasulfotole residue was seen in wheat flour (processing factor = 0.3), middlings (processing factor = 0.4), shorts (processing factor = 0.6), or germ (processing factor = 0.7).

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TABLE C.1. Summary of Concurrent Recoveries of Pyrasulfotole (AE 0317309), Pyrasulfotole desmethyl (AE 1073910) and Pyrasulfotole-benzoic Acid (AE 197555) from Wheat Grain, Aspirated Grain Fractions and Processed Commodities.

Matrix	Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Wheat Grain	pyrasulfotole-benzoic acid	0.01	4	100, 96, 97, 102	98 ± 2.6
		0.25	3	93, 95, 96	95 ± 1.3
		1.25	3	99, 100, 101	100 ± 0.9
	pyrasulfotole-desmethyl	0.01	4	95, 100, 97, 108	100 ± 5.5
		0.25	3	96, 102, 100	99 ± 2.9
		1.25	3	112, 114, 113	113 ± 0.7
	pyrasulfotole	0.01	4	84, 85, 81, 82	83 ± 2.1
		0.25	3	85, 91, 89	88 ± 3.0
		1.25	3	97, 92, 98	95 ± 3.4
Wheat Aspirated Grain Fractions	pyrasulfotole-benzoic acid	0.02	2	97, 99	98 ± 1.1
		0.75	2	103, 95	99 ± 5.8
	pyrasulfotole-desmethyl	0.02	2	96, 92	94 ± 3.0
		0.75	2	105, 105	105 ± 0.1
	pyrasulfotole	0.02	2	89, 68	79 ± 15.0
		0.75	2	98, 91	95 ± 4.9
Wheat Bran	pyrasulfotole-benzoic acid	0.01	3	120, 101, 110	110 ± 9.3
		1.00	3	103, 101, 100	101 ± 1.4
		2.00	3	110, 105, 103	106 ± 4.1
	pyrasulfotole-desmethyl	0.01	3	93, 85, 91	90 ± 4.5
		1.00	3	110, 106, 107	108 ± 2.1
		2.00	3	110, 110, 110	110 ± 0.2
	pyrasulfotole	0.01	3	89, 83, 86	86 ± 3.2
		1.00	3	100, 96, 99	98 ± 2.4
		2.00	3	89, 89, 91	90 ± 1.0

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Matrix	Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Wheat Flour	pyrasulfotole-benzoic Acid	0.01	3	94, 104, 98	99 ± 5.0
		1.00	3	97, 98, 100	98 ± 1.7
	pyrasulfotole-desmethyl	0.01	3	94, 102, 99	99 ± 4.1
		1.00	3	105, 104, 109	106 ± 2.9
	pyrasulfotole	0.01	3	85, 91, 86	87 ± 3.5
		1.00	3	96, 98, 97	97 ± 0.9
Wheat Germ	Pyrasulfotole-benzoic acid	0.01	3	90, 113, 84	96 ± 15.1
		1.00	3	93, 96, 96	95 ± 1.8
	pyrasulfotole-desmethyl	0.01	3	97, 105, 96	99 ± 4.9
		1.00	3	101, 102, 105	103 ± 2.0
	pyrasulfotole	0.01	3	96, 101, 82	93 ± 9.8
		1.00	3	93, 95, 94	94 ± 1.2
Wheat Middling	Pyrasulfotole-benzoic acid	0.01	3	97, 96, 110	101 ± 7.8
		1.00	3	94, 95, 97	95 ± 1.8
	pyrasulfotole-desmethyl	0.01	3	100, 89, 105	98 ± 8.5
		1.00	3	98, 101, 105	101 ± 3.3
	pyrasulfotole	0.01	3	96, 88, 103	96 ± 7.7
		1.00	3	88, 91, 94	91 ± 2.9
Wheat Shorts	Pyrasulfotole-benzoic acid	0.01	3	92, 94, 104	97 ± 6.4
		1.00	3	100, 102, 99	100 ± 1.4
	pyrasulfotole-desmethyl	0.01	3	95, 103, 92	97 ± 5.8
		1.00	3	107, 110, 107	108 ± 1.4
	pyrasulfotole	0.01	3	96, 89, 84	89 ± 6.1
		1.00	3	105, 104, 98	102 ± 3.6

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TABLE C. 2. Summary of Storage Conditions for Wheat Matrices.

Residue Components	Matrix (RAC)	Storage Temp. (°C)	Actual Sample Storage Duration (days)	Limit of Demonstrated Storage Stability (days)
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Grain	< -12	164	365 [a]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Aspirated Grain Fractions	< -15	23	NA [b]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Bran	< -15	12	NA [b]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Flour	< -15	13	NA [b]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Middling	< -15	10	NA [b]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Shorts	< -15	13	NA [b]
pyrasulfotole pyrasulfotole-benzoic acid pyrasulfotole-desmethyl	Germ	< -15	10	NA [b]

[a] Demonstrated freezer stability in wheat grain indicates <30% decline after 336 days in freezer storage.[13]

[b] Aspirated grain fractions and all processed wheat commodities were analyzed within 30 days of generation; therefore, no stability data is required.

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TABLE C.3. Residue Data and Processing Factors from the Wheat Processing Study with AE 0317309 02 SE06 A1.

RAC	Processed Commodity	Total Rate lb a.i./A (kg a.i./ha)	Pre-Harvest Interval (PHI) days	Percent Dry Matter	AE 0317309 (ppm)	AE 1073910 (ppm)	AE B197555 (ppm)	Processing Factor[a]
Grain	NA[b]	0.230 (0.258)	57	92	0.0009 0.0009 0.0010	0.0178 0.0175 0.0177	0.9721 0.9101 0.9349	NA
Average					**0.0009**	**0.0177**	**0.9490**	
Grain	Aspirated Grain Fractions	NA	NA	86	0.0523 0.0504 0.0478	0.5614 0.5447 0.5689	0.4718 0.4814 0.4809	
Average					**0.0502**	**0.5583**	**0.4780**	32.8
Grain	Bran	NA	NA	NA	0.0012 0.0014 0.0020	0.0266 0.0275 0.0306	1.2455 1.3078 1.4076	
Average					**0.0015**	**0.0282**	**1.3203**	1.6
Grain	Flour	NA	NA	NA	0.0014 0.0010 0.0009	0.0039 0.0036 0.0037	0.4037 0.3997 0.3870	
Average					**0.0011**	**0.0037**	**0.3968**	0.26
Grain	Middlings	NA	NA	NA	0.0009 0.0011 0.0014	0.0062 0.0060 0.0057	0.4400 0.4423 0.4417	
Average					**0.0011**	**0.0060**	**0.4413**	0.38
Grain	Shorts	NA	NA	NA	0.0009 0.0009 0.0009	0.0096 0.0100 0.0091	0.6053 0.5892 0.5828	
Average					**0.0009**	**0.0096**	**0.5924**	0.56
Grain	Germ	NA	NA	NA	0.0009 0.0009 0.0009	0.0144 0.0116 0.0103	0.2029 0.2105 0.2035	
Average					**0.0009**	**0.0121**	**0.2056**	0.70

[a] Processing factor = Average residue (AE 1073910/AE 0317309) in processed sample/residue in unprocessed sample (wheat grain RAC). Pyrasulfotole-benzoic acid was measured for information purposes only.

[b] NA = Not applicable.

D. CONCLUSION

Spring wheat was treated at the flag leaf stage of development (BBCH 39) with AE 0317309 02 SE06 A1 at a rate of 0.230 lb a.i./A (0.258 kg a.i./ha). Mature grain was harvested 57 days after the application. Aspirated grain fractions were generated from the bulk wheat grain, and the remainder was processed into wheat bran, flour, middling, shorts, and germ.

A concentration of the pyrasulfotole and pyrasulfotole-desmethyl residue was seen in aspirated grain fractions (32.8-fold) and wheat bran (1.6-fold). No concentration (processing factor <1) of pyrasulfotole and pyrasulfotole-desmethyl residue was seen in wheat flour, middling, shorts, or germ.

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E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of pyrasulfotole: substance, pure code: pyrasulfotole 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of pyrasulfotole. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). Pyrasulfotole - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of pyrasulfotole at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). pyrasulfotole: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). Pyrasulfotole: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). Pyrasulfotole: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. MRID No. 46801806 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using LC-MS/MS.

11. MRID No. 46801808 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Extraction efficiency of Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using lc/ms/ms. Bayer CropScience Report No. RAAIX011.

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12. MRID No. 46801819 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Storage stability of pyrasulfotole, AE1073910, and AE B197555 in soybean grain, wheat grain, wheat forage, and wheat hay. Bayer CropScience Study No. RAAIX009.

13. MRID No. 46801819 Coopersmith, H. (2006). Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (6 December 2006); George Kramer (6 December 2006)
Petition Number: 6F7059
DP#: 333412

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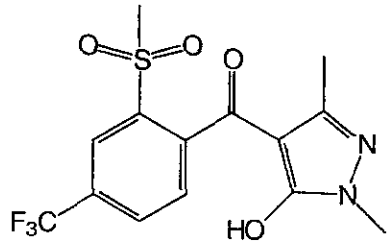
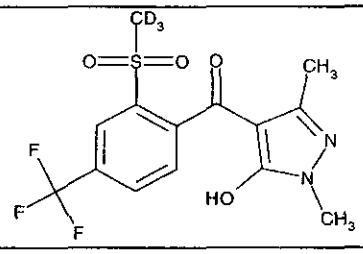
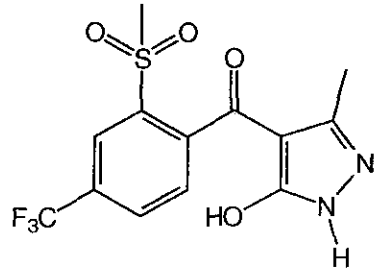
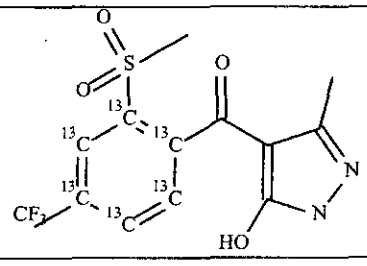
APPENDIX 1

Reference Standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 107391 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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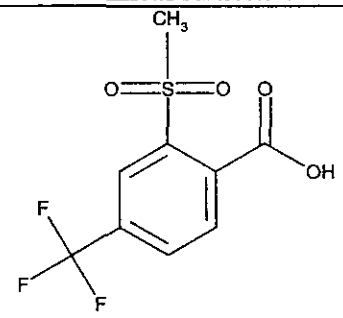
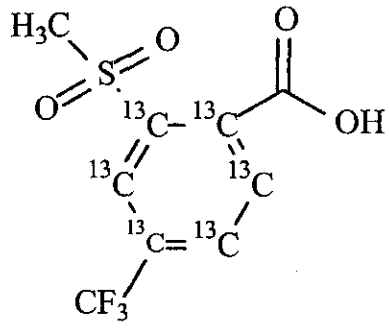
Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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Primary Evaluator	William S Mohan, Ph.D. Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Peer Reviewer	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	April 18/2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 4/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801831 Milo, J., and Harbin, A. M. (2006). AE 0317309 02 SE06 A1 and AE 0317309 EC23 A8: Magnitude of the Residue in/on Oats. Lab Project Number: RAAIM006 Unpublished study prepared by Bayer CropScience, Inc. 1625 p.

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EXECUTIVE SUMMARY:

Bayer CropScience has submitted field trial data for pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone) on oats. During the 2004 and 2005 growing seasons, field trials were conducted in 39 locations to evaluate the magnitude of residues in/on oat forage, hay, grain, and straw following application of either AE 0317309 02 SE06 A1 (SE06) or AE 0317309 03 EC23 A8 (EC23). AE 0317309 02 SE06 A1 is a suspo-emulsion (SE) containing 50 g pyrasulfotole/L and 12.5 g mefenpyr-diethyl/L safener. AE 0317309 03 EC23 A8 is an emulsifiable concentrate (EC) containing 37.5 g pyrasulfotole/L, 210 g bromoxynil/L, and 9.38 g mefenpyr-diethyl/L.

In total, 30 forage and hay, and 25 grain and straw trials were conducted using the SE06 formulation, while 24 forage, hay, grain and straw trials were conducted using the EC23 formulation. Trials for both formulations occurred in regions 1 (PA; 1 trial), 2 (FL; 1 trial), 5 (KS, IL, NE, MN, OH, ON, ND; 9 trials), 5A (ON; 1 trial), 5B (ON; 1 trial), 6 (TX; 1 trial), 7 (ND, SK; 6 trials), 8 (KS; 1 trial) and 14 (SK, AB, MB; 17 trials). At each trial location, SE06 (5% a.i.) or EC23 (3.75 % a.i.) was applied once to pre-emergent oats as a foliar broadcast spray at a rate of 0.042 to 0.047 lb a.i./A (0.048 to 0.053 kg a.i./ha) or 0.031 to 0.037 lb a.i./A (0.035 to 0.041 kg a.i./ha), respectively. For each formulation, two treated plots were used, with the application made at different growth stages BBCH 11 to 23 (forage) BBCH 37 to 61 (hay, grain, and straw). All trials used ammonium sulphate as an adjuvant.

Preharvest intervals (PHIs) for oat raw agricultural commodities (RACs) were 21 to 26 days or 41 to 46 days for forage, 21 to 26 days for hay and 35 to 50 days for grain and straw. In decline trials, forage samples were collected at five intervals (± 1 day) corresponding to PHIs of 15, 25, 35, 45, and 55 days and hay samples were collected at five intervals (± 1 day) corresponding to PHIs of 0, 15, 25, 30, and 35 days. Grain and straw samples were collected at five intervals (± 1 day) corresponding to PHIs of 40, 50, 55, 60, and 70 days.

Residues of pyrasulfotole (AE 0317309) and the metabolites pyrasulfotole-benzoic acid (AE B197555) and pyrasulfotole-desmethyl (AE 1073910) were quantified by high-performance liquid chromatography-electrospray ionization with tandem mass spectrometry (HPLC-MS/MS) using stable isotope labelled analytes as internal standards. The limit of quantitation (LOQ) for each analyte was 0.010 ppm in all oat RACs.

All oat samples (with one exception) were stored frozen for a maximum of 9 months (272 days) prior to analysis. Data from an 11 month (336 days) storage stability study suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all oat matrices. Residues of pyrasulfotole-desmethyl are also stable in oat grain, but decline in oat forage and hay (ca. 0.12 % per day).

The amount of each analyte detected was essentially the same between formulations, with oat hay retaining the highest amounts of analyte residues (≥ 3 times the amount of other oat RACs). The maximum pyrasulfotole-benzoic acid residue levels observed were 0.133 ppm (forage, 25-

day PHI), 0.156 ppm (forage, 45-day PHI), 0.510 ppm (hay), 0.128 ppm (grain), 0.108 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.116 ppm (forage, 25-day PHI), 0.087 ppm (forage, 45-day PHI), 0.623 ppm (hay), 0.089 ppm (grain), 0.156 ppm (straw); and the maximum pyrasulfotole residue levels observed were 0.006 ppm (forage, 25-day PHI), 0.005 ppm (forage, 45-day PHI), 0.105 ppm (hay), 0.022 ppm (grain), 0.014 ppm (straw).

Residue decline data showed decreased amounts of each analyte over time in oat forage and oat hay. In oat grain, pyrasulfotole and pyrasulfotole-desmethyl decreased slightly, while the amount of pyrasulfotole-benzoic acid increased slightly with EC23 treatment and remained unchanged with SE06 treatment. In oat straw, there was no significant decrease in the amount of pyrasulfotole or pyrasulfotole-desmethyl, while the amount of pyrasulfotole-benzoic acid decreased over time.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the field trial residue data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

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TABLE A.1. Test Compound Nomenclature.

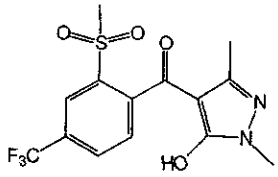
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7×10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0pH 7.0pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Study Site Information

TABLE B.1.1. Trial Site Conditions.

Study Location (City, State)	Trial Number	Year	Soil Characteristics				Meteorological Data	
			Type	% OM	pH	CEC meq/g	Total Rainfall in (cm)	Temp. Range °F (°C)
Germansville, PA	AI060-04H	2004	Clay Loam	2.3	6	8.5	26.89 (68.30)	44–99 (7–37)
Molino, FL	AI061-04H	2005	Sandy Loam	2.2	6.3	7.7	28.34 (71.98)	30–88 (-1–31)
Stilwell, KS	AI062-04D	2005	Silty Clay Loam	2.7	6.5	19.7	14.35 (36.45)	42–101 (6–38)
Seymour, IL	AI063-04H	2005	Silt Loam	3.6	6.2	17.3	6 (15.24)	28–96 (-2–36)
Springfield, NE	AI064-04H	2005	Silty Clay Loam	2.9	6.2	14.1	14.76 (37.49)	31–93 (-1–34)
Sabin, MN	AI065-04HA	2005	Silt Loam	3.5	7.9	25	4.47 (11.35)	44–92 (7–33)
Sabin, MN	AI065-04HB	2005	Silt Loam	3.5	7.9	25	6.66 (16.92)	41–90 (5–32)
Northwood, ND	AI066-04H	2004	Loam	4.4	6.7	23.8	5.33 (13.54)	32–88 (0–31)
New Holland, OH	AI067-04H	2004	Silt Loam	1.4	6.1	12.2	10.75 (27.31)	52–89 (11–32)
Cunningham, KS	AI068-04H	2005	Silt Loam	1	6	10	7 (17.78)	49–101 (9–38)
Guelph, ON	AI069-04H	2004	Loam	4.5	7.8	14.8	6.34 (16.10)	37–86 (3–30)
Metz, ON	AI070-04D	2004	Silt Loam	4.3	7.6	15.7	6.63 (16.84)	37–84 (3–29)
East Bernard, TX	AI071-04H	2005	Sandy Loam	1.1	6.7	7.7	9.97 (25.32)	40–87 (4–31)
Velva, ND	AI072-04H	2004	Loam	5	5.4	22.5	4.68 (11.89)	33–90 (1–32)
New Rockford, ND	AI073-04H	2004	Sandy Loam	1.9	7.9	15.6	5.51 (14.00)	60–92 (16–33)
New Rockford, ND	AI073-04HA	2005	Sandy Loam	2.2	7.7	17	2.36 (5.99)	39–14 (4–46)
Regina, SK	AI074-04H	2004	Clay	4.6	7.7	NA	4.57 (11.61)	32–93 (0–34)
Windthorst, SK	AI074-04HA	2005	Sandy Loam	3.3	8.2	NA	16.63 (42.24)	37–93 (3–34)
Larned, KS	AI075-04H	2005	Silt Loam	1.4	7	9.4	13.49 (34.26)	28–01 (-2–38)
Utterson, ON	AI076-04H	2004	Sandy Loam	4.2	4.4	12.8	5.7 (14.48)	39–86 (4–30)

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TABLE B.1.1. Trial Site Conditions.

Study Location (City, State)	Trial Number	Year	Soil Characteristics				Meteorological Data	
			Type	% OM	pH	CEC meq/g	Total Rainfall in (cm)	Temp. Range °F (°C)
Winchester, ON	AI077-04H	2004	Clay	6.06	6.4	16.4	5.03 (12.78)	39–86 (4–30)
Mundare, AB	AI078-04H	2004	Loam	5.25	6.6	40	5.32 (13.51)	33–86 (1–30)
Mundare, AB	AI078-04HA	2005	Loam	6.6	6.2	NA	3.49 (8.86)	41–82 (5–28)
Fort Saskatchewan, AB	AI079-04H	2004	Silty Clay Loam	7	6.3	NA	5.32 (13.51)	33–86 (1–30)
Fort Saskatchewan, AB	AI079-04HA	2005	Silty Clay Loam	10.2	5.8	NA	2.9 (7.37)	40–86 (4–30)
Penhold, AB	AI080-04H	2004	Clay	1.3	7.5	35	10.17 (25.83)	36–89 (2–32)
Innisfail, AB	AI080-04HB	2005	Clay Loam	7.6	6.2	13	6.79 (17.25)	36–89 (2–32)
Langbank, SK	AI081-04H	2004	NA	NA	NA	NA	6.32 (16.05)	35–84 (2–29)
Indian Head, SK	AI082-04H	2004	Clay	4.5	7.9	NA	6.25 (15.88)	33–84 (1–29)
Regina, SK	AI082-04HA	2005	Clay	2.6	7.9	NA	2.14 (5.44)	38–96 (3–36)
Ituna, SK	AI083-04H	2004	Sandy Clay Loam	5.5	7.5	NA	4.13 (10.49)	36–87 (2–31)
Fort Qu'Appelle, SK	AI084-04H	2004	Loam	4.8	7.9	NA	5.09 (12.93)	33–84 (1–29)
Yorkton, SK	AI085-04H	2004	NA	NA	NA	NA	6.98 (17.73)	41–87 (5–31)
Brookdale, MB	AI086-04H	2004	Loam	5.1	6.3	23.3	7.19 (18.26)	36–88 (2–31)
Brookdale, MB	AI086-04HA	2005	Loam	5.1	6.3	23.3	3.64 (9.25)	39–93 (4–34)
Clanwilliam, MB	AI087-04H	2004	Loam	6.98	8.4	38.2	8.14 (20.68)	36–88 (2–31)
Clanwilliam, MB	AI087-04HA	2005	Loam	6.98	8.4	38.2	1.11 (2.82)	43–90 (6–32)
Rosthern, SK	AI188-04H	2005	Loam	7.2	7.0	27.6	7.06 (17.93)	34–91 (1–33)
Carrington, ND	AI192-05H	2005	Loam	2.7	7.6	19.5	4.06 (10.31)	43–95 (6–35)

OM = Organic Matter; CEC = Cation Exchange Capacity; NA = Not Available.

Temperatures and rainfall data were provided, and some cases above or below normal. Specifically, due to a cold wet fall in 2004, grain and straw commodities in Region 14 did not reach commercial harvest growth stages within the protocol-defined PHI intervals. For this reason many of the 2004 Region 14 trials were reinitiated in 2005. Nevertheless, grain and straw

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samples in some trials did not reach commercial maturity (BBCH 89) when harvested, and as a result were harvested outside the normal percent dry matter ranges. The early harvests in these trials did not appear to affect residue levels compared to those observed in other regions.

TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Germansville, PA AI060-04H 2004 Region 1	SE06	Foliar	1 Appl: Flag leaf stage	19 (178)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	20 (183)	0.035 (0.040)	0.035 (0.040)	Yes
	SE06	Foliar	1 Appl: 2 Leaves unfolded	20 (185)	0.047 (0.053)	0.047 (0.053)	Yes
	EC23	Foliar	1 Appl: 2 Leaves unfolded	19 (182)	0.035 (0.039)	0.035 (0.039)	Yes
Molino, FL AI061-04H 2005 Region 2	SE06	Foliar	1 Appl: Beginning of tillering	15 (140)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	15 (139)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	13 (123)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	13 (121)	0.033 (0.037)	0.033 (0.037)	Yes
Stillwell, KS AI062-04D 2005 Region 5	SE06	Foliar	1 Appl: First awns visible	14 (132)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: First awns visible	14 (134)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: 6 Leaves unfolded	14 (134)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: 6 Leaves unfolded	14 (134)	0.033 (0.037)	0.033 (0.037)	Yes
Seymore, IL AI063-04H 2005 Region 5	SE06	Foliar	1 Appl: Beginning of tillering	16 (148)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	16 (153)	0.034 (0.039)	0.034 (0.039)	Yes
	SE06	Foliar	1 Appl: First leaf unfolded	16 (153)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: First leaf unfolded	16 (152)	0.034 (0.038)	0.034 (0.038)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Springfield, NE AI064-04H 2005 Region 5	SE06	Foliar	1 Appl: Flag leaf stage	14 (127)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	14 (128)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: 2 Leaves unfolded	13 (126)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: 2 Leaves unfolded	13 (126)	0.034 (0.038)	0.034 (0.038	Yes
Sabin, MN AI065-04HA 2005 Region 5	SE06	Foliar	1 Appl: Flag leaf sheath opening	8 (74)	0.042 (0.048)	0.042 (0.048	Yes
	EC23	Foliar	1 Appl: Flag leaf sheath opening	8 (76)	0.033 (0.037)	0.033 (0.037)	Yes
Sabin, MN AI065-04HB 2005 Region 5	SE06	Foliar	1 Appl: Beginning of tillering	16 (149)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	16 (152)	0.034 (0.039)	0.034 (0.039)	Yes
Northwood, ND AI066-04H 2004 Region 5	SE06	Foliar	1 Appl: Flag leaf just visible	15 (138)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: 3 Tillers detectable	15 (140)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: 3 Tillers detectable	15 (140)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	15 (140)	0.034 (0.038)	0.034 (0.038)	Yes
New Holland, OH AI067-04H 2004 Region 5	SE06	Foliar	1 Appl: Flag leaf stage	15 (139)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	15 (141)	0.035 (0.039)	0.035 (0.039)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	16 (152)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	17 (155)	0.033 (0.037)	0.033 (0.037)	Yes
Cunningham, KS AI068-04H 2005 Region 5	SE06	Foliar	1 Appl: Late boot stage	13 (126)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: First awns visible	13 (126)	0.033 (0.037)	0.033 (0.037)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
	SE06	Foliar	1 Appl: Beginning of tillering	13 (126)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	13 (125)	0.033 (0.037)	0.033 (0.037)	Yes
Guelph. ON AI069-04H 2004 Region 5	SE06	Foliar	1 Appl: Flag leaf stage	11 (103)	0.046 (0.052)	0.046 (0.052)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	11 (104)	0.035 (0.039)	0.035 (0.039)	Yes
	SE06	Foliar	1 Appl: 2 Leaves unfolded	11 (101)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: 2 Leaves unfolded	12 (110)	0.037 (0.041)	0.037 (0.041)	Yes
Metz, ON AI070-04D 2004 Region 5	SE06	Foliar	1 Appl: Flag leaf stage	11 (100)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	11 (101)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: 4 Leaves unfolded	11 (100)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: 4 Leaves unfolded	11 (101)	0.034 (0.038)	0.034 (0.038)	Yes
East Bernard, TX AI071-04H 2005 Region 6	SE06	Foliar	1 Appl: Flag leaf stage	15 (141)	0.045 (0.051)	0.045 (0.051)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	15 (140)	0.045 (0.050)	0.045 (0.050)	Yes
Velva, ND AI072-04H 2004 Region 7	SE06	Foliar	1 Appl: Flag leaf stage	19 (182)	0.045 (0.051)	0.045 (0.051)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	20 (184)	0.043 (0.049)	0.043 (0.049)	Yes
New Rockford, ND AI073-04H 2004 Region 7	SE06	Foliar	1 Appl: 2 Tillers detectable	11 (106)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: 2 Tillers detectable	11 (106)	0.034 (0.038)	0.034 (0.038)	Yes
New Rockford, ND AI073-04HA 2005 Region 7	SE06	Foliar	1 Appl: Flag leaf stage	15 (139)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	15 (139)	0.033 (0.038)	0.033 (0.038)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Regina, SK AI074-04H 2004 Region 7	SE06	Foliar	1 Appl: Flag leaf stage	12 (111)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	12 (110)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	12 (109)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	12 (111)	0.034 (0.038)	0.034 (0.038)	Yes
Windthorst, SK AI074-04HA 2005 Region 7	SE06	Foliar	1 Appl: Flag leaf just visible	12 (111)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (111)	0.034 (0.038)	0.034 (0.038)	Yes
Larned, KS AI075-04H 2005 Region 8	SE06	Foliar	1 Appl: Flag leaf stage	18 (168)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	18 (170)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: First leaf unfolded	19 (175)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: First leaf unfolded	19 (173)	0.034 (0.038)	0.034 (0.038)	Yes
Utterson, ON AI076-04H 2004 Region 5A	SE06	Foliar	1 Appl: Flag leaf stage	12 (109)	0.048 (0.054)	0.048 (0.054)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	11 (107)	0.036 (0.040)	0.036 (0.040)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	11 (106)	0.047 (0.053)	0.047 (0.053)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	11 (104)	0.035 (0.039)	0.035 (0.039)	Yes
Winchester, ON AI077-04H 2004 Region 5B	SE06	Foliar	1 Appl: Flag leaf just visible	11 (102)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	11 (103)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	10 (98)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	11 (100)	0.033 (0.037)	0.033 (0.037)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Mundare, AB AI078-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	16 (150)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	11 (100)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: 5 Leaves unfolded	11 (100)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: 5 Leaves unfolded	11 (100)	0.033 (0.037)	0.033 (0.037)	Yes
Mundare, AB AI078-04HA 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (109)	0.034 (0.038)	0.034 (0.038)	Yes
Fort Saskatchewan, AB AI079-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	16 (149)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	16 (149)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: 5 Leaves unfolded	10 (98)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: 5 Leaves unfolded	11 (98)	0.033 (0.037)	0.033 (0.037)	Yes
Fort Saskatchewan, AB AI079-04HA 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (110)	0.034 (0.038)	0.034 (0.038)	Yes
Penhold, AB AI080-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	11 (103)	0.045 (0.050)	0.045 (0.050)	Yes
	SE06	Foliar	1 Appl: 4 Leaves unfolded	11 (104)	0.045 (0.051)	0.045 (0.051)	Yes
Innisfail, AB AI080-04HB 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	11 (103)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	11 (102)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: 4 Leaves unfolded	11 (102)	0.045 (0.051)	0.045 (0.051)	Yes
	EC23	Foliar	1 Appl: 4 Leaves unfolded	11 (102)	0.034 (0.038)	0.034 (0.038)	Yes

US EPA ARCHIVE DOCUMENT

TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Langbank, SK AI081-04H 2004 Region 14	SE06	Foliar	1 Appl: Early boot stage: flag	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	SE06	Foliar	1 Appl: 2 Leaves unfolded	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
Indian Head, SK AI082-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	12 (109)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	12 (110)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	12 (110)	0.033 (0.037)	0.033 (0.037)	Yes
Regina, SK AI082-04HA 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (108)	0.044 (0.050)	0.044 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (108)	0.033 (0.037)	0.033 (0.037)	Yes
Ituna, SK AI083-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (113)	0.046 (0.051)	0.046 (0.051)	Yes
	SE06	Foliar	1 Appl: 3 Leaves unfolded	12 (110)	0.044 (0.050)	0.044 (0.050)	Yes
Fort Qu'Appelle, SK AI084-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	12 (109)	0.044 (0.049)	0.044 (0.049)	Yes
	SE06	Foliar	1 Appl: 3 Leaves unfolded	12 (111)	0.044 (0.050)	0.044 (0.050)	Yes
Yorkton, SK AI085-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	12 (111)	0.045 (0.051)	0.045 (0.051)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	12 (111)	0.045 (0.051)	0.045 (0.051)	Yes
Brookdale, MB AI086-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (114)	0.046 (0.051)	0.046 (0.051)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (113)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: Beginning of tillering	12 (112)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Beginning of tillering	12 (112)	0.033 (0.037)	0.033 (0.037)	Yes

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TABLE B.1.2. Study Use Pattern.

City, State Trial ID Year Region	EP[1]	Method	Timing	Volume[2] GPA (L/ha)	Rate lb a.i./A (kg a.i./ha)	Total Rate lb a.i./A (kg a.i./ha)	Tank Mix/ Adjuvants
Brookdale, MB AI086-04HA 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (109)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	11 (104)	0.031 (0.035)	0.031 (0.035)	Yes
Clanwilliam, MB AI087-04H 2004 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	12 (113)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	12 (113)	0.034 (0.038)	0.034 (0.038)	Yes
	SE06	Foliar	1 Appl: 3 Leaves unfolded	12 (112)	0.045 (0.050)	0.045 (0.050)	Yes
	EC23	Foliar	1 Appl: 3 Leaves unfolded	12 (111)	0.033 (0.037)	0.033 (0.037)	Yes
Clanwilliam MB AI087-04HA 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf just visible	11 (103)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: Flag leaf just visible	11 (103)	0.033 (0.037)	0.033 (0.037)	Yes
Rosthern, SK AI188-04H 2005 Region 14	SE06	Foliar	1 Appl: Flag leaf stage	11 (107)	0.046 (0.052)	0.046 (0.052)	Yes
	EC23	Foliar	1 Appl: Flag leaf stage	11 (103)	0.033 (0.037)	0.033 (0.037)	Yes
	SE06	Foliar	1 Appl: 2 Leaves unfolded	11 (98)	0.044 (0.049)	0.044 (0.049)	Yes
	EC23	Foliar	1 Appl: 2 Leaves unfolded	10 (98)	0.033 (0.037)	0.033 (0.037)	Yes
Carrington, ND AI192-05H 2005 Region 7	EC23	Foliar	1 Appl: Flag leaf stage	15 (138)	0.033 (0.037)	0.033 (0.037)	Yes
	EC23	Foliar	1 Appl: No tillers	15 (141)	0.034 (0.038)	0.034 (0.038)	Yes

Tank mix adjuvant = ammonium sulphate at a nominal rate of 0.45 lb a.i./acre (500 g a.i./ha).
[1]EP = End-use Product.
[2]GPA = Gallons per acre.

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TABLE B.1.3. Trial Numbers and Geographical Locations.

NAFTA Growing Region	SE06 Formulation		EC23 Formulation	
	Submitted	NAFTA[a]	Submitted	NAFTA[a]
1	1	1	1	1
1A				
2	1	1	1	1
3				
4				
5	9	9	9	9
5A	1	1	1	1
5B	1	1	1	1
6	1	1	0 [c]	1
7	3	3	3	3
7A				
8	1	1	1	1
9				
10				
11				
12				
13				
14	17 (12 [d])	10	12 (8 [f])	10
Total	35 (30 [e])	28	29 (24 [g])	28

[a] NAFTA registration requirements for oats request a total of 28 trials distributed as indicated.
[c] The additional trial requested by USEPA in Region 6 data for the EC23 formulation will be reported later.
[d] A total of 12 forage and hay trials, 7 grain and straw trials were successfully completed in Region 14 for the SE06 formulation.
[e] A total of 30 forage and hay trials were successfully completed for the SE06 formulation, and 25 grain and straw trials.
[f] A total of 8 forage and hay trials, 7 grain and straw trials were successfully completed in Region 14 for the EC23 formulation.
[g] A total of 24 forage and hay, grain, and straw trials were successfully completed for the EC23 formulation.

B.2. Sample Handling and Preparation

Composite samples for all matrices were collected and placed into labelled cloth bags for storage. Control and treated samples were a composite from at least 12 areas of the plot and weighed a minimum of 1 kg for forage and grain and 0.5 kg for hay and straw. Treated samples were frozen within 8 hours of collection with the exception of the grain and straw samples from trial AI066-04H. In this trial, samples were left in the field for 9 days to dry prior to threshing and placing in frozen storage. All samples remained in frozen storage until shipment (via freezer truck) to BRP. Upon arrival at BRP, oat RAC samples were homogenized with dry ice in a chopper then immediately returned to frozen storage.

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B.3. Analytical Methodology

Residue data for pyrasulfotole in/on oat RACs were obtained using the analytical method (AI-001-P04-01) for determining total pyrasulfotole (pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl) residue in plant matrices.[10, 11]

This HPLC-MS/MS analytical method quantifies residues of pyrasulfotole and the metabolites from a single sample using isotope labelled internal standards.[10] Briefly, residues are extracted from homogenized oat samples with acetonitrile (ACN)/water/concentrated hydrochloric acid (HCl; 30:15:3, v/v) at 60°C for at least 30 minutes. After cooling, a mixture of isotope labelled internal standards is added to the sample extract and mixed. A small aliquot (about 1.25 mL) is purified by C18 solid-phase extraction (SPE), followed by chromatographic analysis involving gradient elution from a Gemini C-18 (50 x 2.0 mm) with aqueous 10 mM NH_4HCO_3 solution and methanol as the mobile phase components. An electrospray interface in the negative ion mode is used to introduce the sample into the MS.

In this study, detector response was linear over the range of 0.005 ppm to 2.5 ppm for all analytes with associated correlation coefficients all greater than 0.99. The analytical standards for pyrasulfotole and the metabolites were >96% pure. The individual analyte residues were converted to pyrasulfotole molar equivalents and summed to give a total pyrasulfotole residue.

C. RESULTS AND DISCUSSION

Field trials were conducted at 38 locations during the 2004/2005 growing seasons covering 9 US states and 4 Canadian provinces representing a total of 9 NAFTA regions (TABLE B.1.3). For each formulation, a minimum of 24 trials were performed on each oat RAC.

Method validation for pyrasulfotole and its metabolites was performed using various spiking levels on oat RACs (TABLE C.1). Pyrasulfotole standards were corrected for purity and prepared in parent compound molar equivalents during initial standard solution preparation. At the LOQ concurrent recoveries for pyrasulfotole and the metabolites ranged from 79% to 109%. Therefore, the method is deemed suitable for data gathering. The LOQ was 0.010 ppm for residues of pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl in all oat matrices. The limit of detection (LOD) in oat forage was 0.001 ppm for pyrasulfotole, pyrasulfotole-benzoic acid, and pyrasulfotole-desmethyl; in oat hay and oat straw was 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl, and 0.003 ppm for pyrasulfotole-benzoic acid; in oat grain was 0.001 ppm for pyrasulfotole and pyrasulfotole-desmethyl and 0.002 ppm for pyrasulfotole-benzoic acid.

The samples in this study were stored frozen a maximum of 272 days prior to residue analysis, with the exception of oat grain samples (SE06 formulation) from trial AI072-04H, which were stored 489 days prior to analysis (TABLE C.2). Storage stability data were not provided for oat RACs, however, wheat storage stability results were translated to oat RACs.[12, 13] The data suggest that residues of pyrasulfotole and pyrasulfotole-benzoic acid are stable in all oat

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matrices. Residues of pyrasulfotole-desmethyl are also stable in oat grain and straw, but are expected to decline in oat forage and oat hay (ca. 0.12 % per day) during frozen storage. Therefore, residue values for oat hay trials that were stored longer than 163 days, and for oat forage trials that were stored longer than 157 days, were corrected according to the linear regression analyses (APPENDIX 2).

Uncorrected and corrected residue data for the analytes in/on oat RACs are presented in TABLE C.3.1 (SE06 treated) and TABLE C.3.2 (EC23 treated). Representative chromatograms appeared to be symmetrical and well defined at or above the LOD and therefore all values above LOD are reported. Nevertheless, values between LOD and LOQ were considered nonquantitative estimates as they fell below the lower limit of method validation and no information on the linearity of the standard curve at these low levels was provided. Therefore, to calculate total pyrasulfotole residue, analyte values that were reported as <LOD were first assigned a finite value of half the LOQ, then residue values for pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid were summed. The amounts of pyrasulfotole, pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl residues were essentially the same between formulations, with oat hay retaining the highest amounts of analyte residues (≥ 3 times the amount of other oat RACs) (FIGURE C.1).

In order to estimate means and standard deviations, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ or 0.005 ppm (TABLE C.4.1, TABLE C.4.2). The highest average field trial (HAFT) value for pyrasulfotole-benzoic acid in oat forage was 0.124 ppm (25-day PHI) and 0.146 ppm (45-day PHI); oat hay was 0.472 ppm; in oat grain was 0.116 ppm and in oat straw was 0.106 ppm. The HAFT value for pyrasulfotole-desmethyl residue in oat forage was 0.105 ppm (25-day PHI), 0.077 ppm (45-day PHI), in oat hay was 0.606 ppm, in oat grain was 0.088 ppm and in oat straw was 0.144 ppm. The HAFT value for pyrasulfotole residue in oat forage was 0.006 ppm (25-day PHI), 0.005 ppm (45-day PHI), in oat hay was 0.081 ppm, in oat grain was 0.022 ppm and in oat straw was 0.012 ppm.

The maximum pyrasulfotole-benzoic acid residue levels observed were 0.133 ppm (forage, 25-day PHI), 0.156 ppm (forage, 45-day PHI), 0.510 ppm (hay), 0.128 ppm (grain), 0.108 ppm (straw); the maximum pyrasulfotole-desmethyl residue levels observed were 0.116 ppm (forage, 25-day PHI), 0.087 ppm (forage, 45-day PHI), 0.623 ppm (hay), 0.089 ppm (grain), 0.156 ppm (straw); and the maximum pyrasulfotole residue levels observed were 0.006 ppm (forage, 25-day PHI), 0.005 ppm (forage, 45-day PHI), 0.105 ppm (hay), 0.022 ppm (grain), 0.014 ppm (straw).

The amount of each analyte decreased with time in oat forage and oat hay (FIGURE C.2). In oat grain, pyrasulfotole and pyrasulfotole-desmethyl decreased slightly, while the amount of pyrasulfotole-benzoic acid increased slightly with EC23 treatment, but remained unchanged with SE06 treatment. In oat straw, there was no significant decrease in the amount of pyrasulfotole or pyrasulfotole-desmethyl, while the amount of pyrasulfotole-benzoic acid decreased over time.

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TABLE C.1. Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole desmethyl and Pyrasulfotole-benzoic Acid from Oat Matrices.

Matrix	Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
Oat Forage	Pyrasulfotole-benzoic Acid	0.01	3	98, 98, 104	100 ± 3.6
		0.05	23	100, 99, 99, 96, 94, 90, 103, 92, 102, 99, 98, 87, 99, 103, 92, 99, 113, 97, 97, 97, 100, 103, 96	98 ± 5.2
		0.25	3	93, 95, 94	94 ± 0.9
		0.50	3	97, 96, 96	97 ± 0.6
	Pyrasulfotole-desmethyl	0.01	3	91, 89, 94	92 ± 2.2
		0.05	23	111, 112, 110, 113, 100, 92, 117, 110, 106, 102, 114, 101, 106, 105, 104, 118, 99, 95, 102, 110, 117, 118	107 ± 7.6
		0.25	3	99, 103, 102	101 ± 1.7
		0.50	3	111, 113, 114	113 ± 1.7
	Pyrasulfotole	0.01	3	90, 82, 92	88 ± 5.2
		0.05	23	97, 100, 101, 101, 94, 85, 104, 87, 99, 91, 96, 98, 96, 99, 95, 97, 97, 102, 94, 97, 98, 102, 96	97 ± 4.6
		0.25	3	94, 96, 95	95 ± 1.0
		0.50	3	92, 93, 97	94 ± 2.6
Oat Hay	Pyrasulfotole-benzoic Acid	0.01	3	82, 83, 100	88 ± 10.1
		0.05	16	105, 101, 101, 102, 105, 100, 99, 98, 100, 95, 99, 104, 95, 108, 96, 102	101 ± 3.8
		0.25	3	91, 90, 92	91 ± 0.7
		2.00	3	106, 103, 105	104 ± 1.4
		2.50	3	98, 97, 99	98 ± 0.9
	Pyrasulfotole-desmethyl	0.01	3	79, 84, 89	84 ± 5.2
		0.05	16	109, 112, 111, 116, 106, 97, 107, 106, 111, 111, 104, 103, 103, 108, 104, 110	107 ± 4.6
		0.25	3	97, 94, 94	95 ± 1.7
		2.00	3	112, 107, 108	109 ± 2.9
		2.50	3	106, 105, 104	105 ± 0.8
	Pyrasulfotole	0.01	3	87, 94, 84	88 ± 4.9
		0.05	16	94, 95, 98, 101, 106, 95, 94, 96, 101, 98, 91, 97, 96, 101, 96, 97	97 ± 3.5
		0.25	3	93, 90, 91	91 ± 1.6
		2.00	3	97, 95, 96	96 ± 1.0
		2.50	3	93, 97, 91	94 ± 3.2
Oat Grain	Pyrasulfotole-benzoic Acid	0.01	16	96, 97, 101, 104, 101, 101, 106, 99, 89, 101, 95, 109, 100, 102, 91, 96	99 ± 5.2

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TABLE C.1. Summary of Concurrent Recoveries of Pyrasulfotole, Pyrasulfotole desmethyl and Pyrasulfotole-benzoic Acid from Oat Matrices.

Matrix	Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean Recovery ± Standard Deviation
		0.05	4	101, 101, 97, 110	102 ± 5.6
		0.25	3	94, 94, 93	94 ± 0.4
	Pyrasulfotole-desmethyl	0.01	16	95, 108, 92, 91, 99, 104, 105, 99, 79, 97, 96, 101, 104, 100, 100, 103	98 ± 7.0
		0.05	4	114, 115, 115, 110	113 ± 2.6
		0.25	3	98, 99, 101	99 ± 1.5
	Pyrasulfotole	0.01	16	96, 81, 91, 87, 90, 94, 96, 90, 86, 86, 88, 94, 93, 96, 85, 83	90 ± 4.7
		0.05	4	90, 97, 92, 97	94 ± 3.2
		0.25	3	89, 90, 91	90 ± 0.9
Oat Straw	Pyrasulfotole-benzoic Acid	0.01	3	101, 103, 90	98 ± 6.7
		0.05	14	104, 106, 103, 109, 98, 100, 101, 102, 105, 104, 100, 110, 99, 106	103 ± 3.7
		0.25	3	97, 97, 98	97 ± 0.8
	Pyrasulfotole-desmethyl	0.01	3	96, 95, 96	96 ± 0.9
		0.05	14	112, 110, 118, 118, 105, 107, 110, 114, 107, 115, 112, 117, 115, 119	113 ± 4.6
		0.25	3	101, 99, 100	100 ± 0.7
	Pyrasulfotole	0.01	3	87, 90, 87	85 ± 2.3
		0.05	14	90, 96, 86, 103, 94, 98, 91, 95, 98, 96, 93, 100, 95, 98	95 ± 4.3
		0.25	3	94, 94, 95	94 ± 0.5

TABLE C.2. Summary of Storage Conditions for Oat RACs.

Extract		Storage Temperature (°C)	Actual Storage Duration (days)	Interval of Demonstrated Storage Stability(days)
pyrasulfotole-benzoic acid, pyrasulfotole				
Oat	Forage	<-15	266	336
	Grain	<-15	266	336
	Hay	<-15	266	336
	Straw	<-15	266	336
Pyrasulfotole-desmethyl				
Oat	Forage	<-15	266	157
	Grain	<-15	266	336
	Hay	<-15	266	163
	Straw	<-15	266	336

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Forage	0.047 (0.053)	25	0.005 0.004	0.012 0.010	0.016 0.013	<LOD <LOD	0.026 0.022
				45	<LOD <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.017 0.017
Molino, FL AI061-04H 2005 2	Oat/ Citation	Forage	0.045 (0.050)	22	0.025 0.027	0.038 0.053	0.051 0.071	0.004 0.004	0.080 0.102
				46	0.006 0.005	0.001 0.002	0.001 0.003	<LOD <LOD	0.012 0.013
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Forage	0.045 (0.051)	25	0.009 0.008	0.003 0.002	— —	0.002 0.002	0.014 0.012
				42	0.004 0.004	0.001 <LOD	— —	<LOD <LOD	0.010 0.014
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Forage	0.045 (0.050)	25	0.008 0.007	0.002 0.002	— —	0.001 0.002	0.011 0.011
				45	0.003 0.004	<LOD <LOD	— —	0.001 <LOD	0.009 0.014
Sabin, MN AI065-04HB 2005 5	Oat/ Ebeltoft	Forage	0.045 (0.050)	25	0.062 0.057	0.071 0.064	— —	0.003 0.003	0.136 0.124
				43	0.020 0.019	0.017 0.016	— —	0.001 0.001	0.038 0.036
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Forage	0.044 (0.050)	22	0.020 0.021	0.024 0.023	0.032 0.031	0.001 <LOD	0.053 0.057
				45	0.009 0.016	0.008 0.011	0.011 0.015	<LOD <LOD	0.025 0.036
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Forage	0.044 (0.049)	22	0.006 0.006	0.009 0.009	0.012 0.012	0.001 <LOD	0.019 0.023
				42	0.005 0.005	0.003 0.003	0.004 0.004	<LOD <LOD	0.014 0.014
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Forage	0.044 (0.050)	24	0.096 0.133	0.031 0.038	— —	0.006 0.006	0.133 0.177
				45	0.129 0.152	0.004 0.004	— —	0.003 0.002	0.136 0.158
Guelph, ON AI069-04H 2004 6	Oat/ BOB	Forage	0.045 (0.051)	25	0.007 0.006	0.002 0.002	0.003 0.003	<LOD <LOD	0.015 0.014
				45	0.002 0.002	<LOD <LOD	0.007 0.007	<LOD <LOD	0.014 0.014

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
East Bernard, TX AI071-04H 2005 6	Oat/ BOB	Forage	0.044 (0.050)	25	0.085 0.095	0.017 0.020	0.022 0.026	0.002 0.003	0.109 0.124
				45	0.042 0.045	0.001 0.002	— —	<LOD <LOD	0.048 0.052
Velva, ND AI072-04H 2004 7	Oat/ Jerry	Forage	0.043 (0.049)	22	0.009 0.015	0.015 0.022	0.021 0.030	0.001 0.001	0.031 0.046
				44	0.008 0.008	0.004 0.002	0.005 0.003	<LOD <LOD	0.018 0.016
New Rockford, ND AI073-04H 2004 7	Oat/ Morton	Forage	0.045 (0.051)	22	0.021 0.032	0.061 0.085	0.083 0.116	0.003 0.004	0.107 0.152
				41	0.017 0.024	0.045 0.054	0.060 0.072	0.001 0.002	0.078 0.098
Regina, SK AI074-04H 2004 7	Oat/ CDC Boyer	Forage	0.044 (0.050)	26	0.018 0.016	0.032 0.030	0.044 0.041	0.002 0.001	0.064 0.058
				44	0.017 0.014	0.029 0.022	0.039 0.030	0.001 <LOD	0.057 0.049
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Forage	0.045 (0.051)	22	0.042 0.057	0.010 0.010	— —	0.004 0.004	0.056 0.071
				42	0.020 0.019	<LOD <LOD	— —	<LOD <LOD	0.030 0.029
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Forage	0.047 (0.053)	22	0.013 0.030	0.009 0.025	0.012 0.034	0.001 0.004	0.026 0.068
				41	0.034 0.016	0.023 0.011	0.031 0.015	0.003 <LOD	0.068 0.036
Winchester, ON AI077-04H 2004 8	Oat/ Aylmer	Forage	0.044 (0.049)	23	0.021 0.020	0.026 0.023	0.036 0.032	0.001 0.001	0.058 0.053
				45	0.012 0.014	0.005 0.007	0.007 0.010	<LOD <LOD	0.024 0.029
Mundare, AB AI078-04H 2004 14	Oat/ Calibur	Forage	0.044 (0.049)	21	0.022 0.028	0.019 0.023	0.026 0.032	0.003 0.005	0.051 0.065
				41	0.006 0.006	0.005 0.004	0.007 0.005	<LOD <LOD	0.018 0.016
Fort Saskatchewan, AB AI079-04H 2004 14	Oat/ Calibur	Forage	0.044 (0.050)	25	0.022 0.017	0.024 0.019	0.033 0.026	<LOD <LOD	0.060 0.048
				41	0.004 0.005	0.003 0.003	0.004 0.004	<LOD <LOD	0.013 0.014

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Penhold, AB AI080-04H 2004 14	Oat/ Common Oats	Forage	0.045 (0.051)	25	0.008 0.008	0.006 0.006	0.008 0.008	0.001 <LOD	0.017 0.021
				42	0.008 0.007	0.001 0.001	0.001 0.001	<LOD <LOD	0.014 0.013
Innisfail, AB AI080-04HB 2005 14	Oat/ Common Oats	Forage	0.045 (0.051)	21	0.006 0.010	0.006 0.010	— —	0.001 0.002	0.013 0.022
				43	0.002 0.002	<LOD <LOD	— —	<LOD <LOD	0.012 0.012
Langbank, SK AI081-04H 2004 14	Oat/ Triple Crown	Forage	0.045 (0.050)	25	0.010 0.011	0.006 0.006	0.008 0.008	<LOD <LOD	0.023 0.024
				43	0.003 0.006	0.001 0.001	0.001 0.001	<LOD <LOD	0.009 0.012
Indian Head, SK AI082-04H 2004 14	Oat/ Pinnacle	Forage	0.045 (0.050)	23	0.018 0.017	0.008 0.008	— —	0.002 0.002	0.028 0.027
				42	0.016 0.014	0.002 0.002	— —	0.001 <LOD	0.019 0.021
Ituna, SK AI083-04H 2004 14	Oat/ CDC Boyer	Forage	0.044 (0.050)	25	0.006 0.007	0.007 0.010	0.010 0.014	0.002 0.002	0.018 0.023
				41	0.002 0.002	0.002 0.002	0.003 0.003	<LOD <LOD	0.010 0.010
Fort Qu'Appelle, SK AI084-04H 2004 14	Oat/ CDC Boyer	Forage	0.045 (0.050)	23	0.013 0.012	0.003 0.002	0.004 0.003	<LOD <LOD	0.022 0.020
				44	0.012 0.003	0.010 <LOD	0.014 0.001	0.002 <LOD	0.028 0.015
Yorkton, SK AI085-04H 2004 14	Oat/ CDC Boyer	Forage	0.045 (0.051)	22	0.012 0.010	0.007 0.011	0.010 0.015	0.001 0.001	0.023 0.026
				41	0.008 0.005	0.003 0.002	0.004 0.003	<LOD <LOD	0.017 0.013
Brookdale, MB AI086-04H 2004 14	Oat/ AC Assiniboia	Forage	0.044 (0.049)	21	0.007 0.011	0.010 0.015	0.014 0.021	<LOD 0.001	0.026 0.033
				41	0.007 0.006	0.002 0.001	0.003 0.001	<LOD <LOD	0.015 0.012
Clanwilliam, MB AI087-04H 2004 14	Oat/ AC Assiniboia	Forage	0.045 (0.050)	22	0.022 0.016	0.006 0.005	0.008 0.007	0.001 <LOD	0.031 0.028
				44	0.009 0.009	<LOD <LOD	0.007 0.007	<LOD <LOD	0.021 0.021

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Rosthern, SK AI188-04H 2004 14	Oat/ Furlong	Forage	0.044 (0.049)	25	0.005 0.005	0.001 0.002	— —	<LOD <LOD	0.011 0.012
				43	0.003 0.003	<LOD <LOD	— —	<LOD <LOD	0.013 0.013
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Forage	0.044 (0.049)	15	0.268 0.257	0.069 0.072	— —	0.036 0.039	0.373 0.368
				26	0.130 0.117	0.043 0.037	— —	0.004 0.003	0.177 0.157
				35	0.152 0.120	0.038 0.032	— —	0.003 0.002	0.193 0.154
				44	0.156 0.135	0.042 0.036	— —	0.002 0.002	0.200 0.173
				54	0.048 0.053	0.032 0.034	— —	0.002 0.002	0.082 0.089
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Forage	0.044 (0.050)	15	0.005 0.004	0.018 0.016	0.026 0.023	0.005 0.004	0.036 0.031
				24	0.002 0.001	0.004 0.004	0.006 0.006	<LOD <LOD	0.013 0.012
				35	<LOD <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.017 0.017
				44	0.010 <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.022 0.017
				53	<LOD <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.017 0.017
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Hay	0.046 (0.051)	25	0.128 0.133	0.134 0.136	0.185 0.188	0.007 0.007	0.321 0.329
Molino, FL AI061-04H 2005 2	Oat/ Citation	Hay	0.045 (0.050)	21	0.202 0.168	0.221 0.207	— —	0.013 0.010	0.436 0.385
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Hay	0.044 (0.049)	21	0.242 0.238	0.186 0.181	— —	0.050 0.049	0.478 0.468
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Hay	0.044 (0.050)	22	0.084 0.073	0.094 0.089	— —	0.009 0.010	0.187 0.172
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Hay	0.042 (0.048)	21	0.295 0.399	0.222 0.291	— —	0.014 0.018	0.531 0.708

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Hay	0.044 (0.049)	25	0.131 0.138	0.193 0.187	0.257 0.249	0.010 0.011	0.398 0.402
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Hay	0.045 (0.051)	25	0.255 0.206	0.179 0.146	— —	0.016 0.013	0.450 0.365
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Hay	0.045 (0.050)	24	0.133 0.125	0.103 0.124	— —	0.007 0.009	0.243 0.258
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Hay	0.046 (0.052)	21	0.039 0.049	0.050 0.063	0.068 0.085	0.010 0.011	0.117 0.146
East Bernard, TX AI071-04H 2005 6	Oat/ BOB	Hay	0.037 (0.041)	24	0.204 0.190	0.100 0.104	0.133 0.141	0.018 0.019	0.355 0.350
Velva, ND AI072-04H 2004 7	Oat/ Jerry	Hay	0.045 (0.051)	22	0.037 0.045	0.027 0.035	0.036 0.048	0.005 0.006	0.078 0.099
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Hay	0.044 (0.050)	22	0.199 0.188	0.097 0.096	— —	0.003 0.002	0.299 0.286
Regina, SK AI074-04H 2004 7	Oat/ CDC Boyer	Hay	0.045 (0.051)	23	0.073 0.067	0.085 0.074	0.115 0.101	0.007 0.007	0.195 0.175
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Hay	0.044 (0.050)	21	0.354 0.372	0.216 0.224	— —	0.012 0.011	0.582 0.607
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Hay	0.045 (0.050)	21	0.509 0.353	0.422 0.335	0.587 0.467	0.090 0.073	1.186 0.893

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Hay	0.046 (0.051)	21	0.068 0.080	0.099 0.108	0.139 0.152	0.011 0.010	0.218 0.242
Mundare, AB AI078-04H 2004 14	Oat/ Calibur	Hay	0.045 (0.050)	22	0.071 0.129	0.055 0.091	0.075 0.125	0.013 0.021	0.159 0.275
Fort Saskatchewan, AB AI079-04H 2004 14	Oat/ Calibur	Hay	0.046 (0.051)	22	0.026 0.036	0.039 0.053	0.053 0.073	0.004 0.003	0.083 0.112
Penhold, AB AI080-04H 2004 14	Oat/ Common Oats	Hay	0.045 (0.050)	25	0.065 0.077	0.078 0.096	0.108 0.133	0.005 0.006	0.178 0.216
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Hay	0.045 (0.051)	23	0.089 0.095	0.112 0.093	— —	0.006 0.006	0.207 0.194
Langbank, SK AI081-04H 2004 14	Oat/ Triple Crown	Hay	0.045 (0.050)	25	0.383 0.410	0.142 0.181	0.194 0.250	0.015 0.018	0.592 0.678
Indian Head, SK AI082-04H 2004 14	Oat/ Pinnacle	Hay	0.045 (0.050)	25	0.042 0.039	0.034 0.032	0.047 0.045	0.003 0.003	0.092 0.087
Ituna, SK AI083-04H 2004 14	Oat/ CDC Boyer	Hay	0.046 (0.051)	21	0.191 0.186	0.198 0.203	0.272 0.281	0.037 0.031	0.500 0.498
Fort Qu'Appelle, SK AI084-04H 2004 14	Oat/ CDC Boyer	Hay	0.044 (0.050)	21	0.145 0.163	0.107 0.165	0.147 0.228	0.105 0.044	0.397 0.435
Yorkton, SK AI085-04H 2004 14	Oat/ CDC Boyer	Hay	0.045 (0.051)	25	0.146 0.157	0.125 0.131	0.171 0.181	0.005 0.005	0.322 0.343

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Brookdale, MB AI086-04H 2004 14	Oat/ AC Assiniboia	Hay	0.046 (0.051)	23	0.325 0.327	0.308 0.302	0.423 0.418	0.017 0.019	0.765 0.764
Clanwilliam, MB AI087-04H 2004 14	Oat/ AC Assiniboia	Hay	0.045 (0.050)	21	0.162 0.167	0.122 0.117	0.167 0.162	0.011 0.010	0.340 0.339
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Hay	0.046 (0.052)	24	0.282 0.290	0.187 0.190	— —	0.011 0.011	0.480 0.491
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Hay	0.044 (0.049)	0	0.206 0.185	0.246 0.253	— —	2.173 2.089	2.625 2.527
			0.044 (0.049)	15	0.129 0.137	0.073 0.078	— —	0.017 0.017	0.219 0.232
			0.044 (0.049)	26	0.123 0.087	0.064 0.041	— —	0.008 0.009	0.195 0.137
			0.044 (0.049)	30	0.116 0.102	0.052 0.048	— —	0.008 0.008	0.176 0.158
			0.044 (0.049)	35	0.104 0.092	0.048 0.046	— —	0.006 0.006	0.158 0.144
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Hay	0.044 (0.049)	0	0.162 0.140	1.755 1.564	2.513 2.225	0.710 0.592	3.385 2.957
			0.044 (0.049)	15	0.070 0.072	0.102 0.103	0.144 0.145	0.019 0.018	0.233 0.235
			0.044 (0.049)	24	0.047 0.027	0.069 0.050	0.097 0.070	0.007 0.006	0.151 0.103
			0.044 (0.049)	30	0.043 0.026	0.071 0.055	0.099 0.077	0.005 0.004	0.147 0.107
			0.044 (0.049)	35	0.042 0.037	0.074 0.064	0.103 0.089	0.006 0.007	0.151 0.133
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Grain	0.046 (0.051)	44	0.004 0.004	0.008 0.008	— —	<LOD <LOD	0.017 0.017
Molino, FL AI061-04H 2005 2	Oat/ Citation	Grain	0.045 (0.050)	43	0.004 0.004	0.009 0.009	— —	0.003 0.001	0.016 0.014
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Grain	0.044 (0.049)	38	0.081 0.085	0.083 0.083	— —	0.022 0.022	0.186 0.190

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Grain	0.044 (0.050)	45	0.018 0.017	0.002 0.002	— —	0.001 <LOD	0.021 0.024
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Grain	0.042 (0.048)	45	0.017 0.016	0.010 0.009	— —	<LOD <LOD	0.032 0.030
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Grain	0.044 (0.049)	44	0.004 0.002	0.002 0.002	— —	<LOD <LOD	0.011 0.009
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Grain	0.045 (0.051)	44	0.074 0.060	0.021 0.018	— —	0.003 0.003	0.098 0.081
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Grain	0.045 (0.050)	50	0.067 0.062	0.014 0.016	— —	0.002 0.002	0.083 0.080
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Grain	0.046 (0.052)	44	0.006 0.008	0.015 0.019	— —	0.004 0.005	0.025 0.032
East Bernard, TX AI071-04H 2005 6	Oat/BOB	Grain	0.037 (0.041)	45	0.015 0.014	0.002 0.001	— —	<LOD <LOD	0.022 0.020
Velva, ND AI072-04H 2004 7	Oat/Jerry	Grain	0.045 (0.051)	45	0.005 0.014	0.004 0.004	— —	0.001 0.001	0.010 0.019
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Grain	0.044 (0.050)	42	0.013 0.013	0.001 0.001	— —	0.001 0.002	0.015 0.016
Windthorst, SK AI074-04HA 2005 7	Oat/ AC Boyer	Grain	0.045 (0.050)	46	0.018 0.016	0.016 0.014	— —	0.003 0.003	0.037 0.033

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Grain	0.044 (0.050)	45	0.010 0.010	0.003 0.003	— —	<LOD <LOD	0.018 0.018
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Grain	0.045 (0.050)	41	0.019 0.021	0.030 0.033	— —	0.011 0.012	0.060 0.066
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Grain	0.046 (0.051)	35	0.006 0.006	0.010 0.012	— —	0.002 0.003	0.018 0.021
Mundare, AB AI078-04HA 2005 14	Oat/ Common	Grain	0.045 (0.050)	40	0.002 0.003	0.004 0.006	— —	0.001 <LOD	0.007 0.014
Fort Saskatchewan, AB AI079-04HA 2005 14	Oat/ Common	Grain	0.046 (0.051)	42	0.005 0.006	0.004 0.003	— —	0.006 0.006	0.015 0.015
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Grain	0.045 (0.051)	45	0.004 0.003	0.007 0.008	— —	<LOD <LOD	0.016 0.016
Regina, SK AI082-04HA 2005 14	Oat/ Mustang	Grain	0.044 (0.050)	45	0.006 0.007	<LOD 0.001	— —	<LOD <LOD	0.016 0.013
Brookdale, MB AI086-04HA 2005 14	Oat/ Common Triple Crown	Grain	0.044 (0.049)	45	0.005 0.004	0.004 0.004	— —	0.001 0.001	0.010 0.009
Clanwilliam, MB AI087-04HA 2005 14	Oat/ Ronald	Grain	0.044 (0.049)	41	0.003 0.003	0.002 0.002	— —	<LOD 0.001	0.010 0.006
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Grain	0.046 (0.052)	45	0.005 0.006	0.004 0.003	— —	<LOD <LOD	0.014 0.014

US EPA ARCHIVE DOCUMENT

TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Grain	0.044 (0.049)	26	0.010 0.008	0.015 0.013	— —	0.003 0.003	0.028 0.024
			0.044 (0.049)	35	0.016 0.016	0.012 0.013	— —	0.001 0.001	0.029 0.030
			0.044 (0.049)	45	0.015 0.011	0.012 0.012	— —	0.002 0.002	0.029 0.025
			0.044 (0.049)	56	0.010 0.006	0.010 0.012	— —	0.001 0.001	0.021 0.019
			0.044 (0.049)	65	0.009 0.007	0.011 0.010	— —	0.002 0.001	0.022 0.018
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Grain	0.044 (0.049)	24	0.003 0.003	0.014 0.013	— —	0.009 0.008	0.026 0.024
			0.044 (0.049)	35	0.003 0.003	0.009 0.009	— —	0.006 0.007	0.018 0.019
			0.044 (0.049)	45	0.003 0.003	0.007 0.009	— —	0.002 0.002	0.012 0.014
			0.044 (0.049)	55	0.002 0.002	0.010 0.009	— —	0.003 0.003	0.015 0.014
			0.044 (0.049)	65	0.003 0.003	0.009 0.008	— —	0.007 0.006	0.019 0.017
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Straw	0.046 (0.051)	44	0.018 0.020	0.065 0.071	— —	0.004 0.005	0.087 0.096
Molino, FL AI061-04H 2005 2	Oat/ Citation	Straw	0.045 (0.050)	43	0.011 0.013	0.072 0.066	— —	0.003 0.003	0.086 0.082
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Straw	0.044 (0.049)	38	0.105 0.104	0.069 0.073	— —	0.010 0.013	0.184 0.190
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Straw	0.044 (0.050)	45	0.019 0.018	0.026 0.028	— —	0.002 0.001	0.047 0.047
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Straw	0.042 (0.048)	45	0.026 0.014	0.065 0.050	— —	0.003 0.002	0.094 0.066
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Straw	0.044 (0.049)	44	0.030 0.031	0.052 0.048	— —	0.003 0.003	0.085 0.082

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Straw	0.045 (0.051)	44	0.057 0.050	0.156 0.131	— —	0.014 0.011	0.227 0.192
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Straw	0.045 (0.050)	50	0.107 0.087	0.099 0.099	— —	0.004 0.004	0.072 0.117
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Straw	0.046 (0.052)	44	0.013 0.019	0.049 0.084	— —	0.010 0.014	0.062 0.053
East Bernard, TX AI071-04H 2005 6	Oat/	Straw	0.037 (0.041)	45	0.040 0.038	0.017 0.014	— —	<LOD 0.001	0.062 0.067
Velva, ND AI072-04H 2004 7	Oat/	Straw	0.045 (0.051)	45	0.032 0.033	0.028 0.032	— —	0.002 0.002	0.046 0.052
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Straw	0.044 (0.050)	42	0.035 0.036	0.010 0.011	— —	0.001 <LOD	0.192 0.232
Windthorst, SK AI074-04HA 2005 7	Oat/ AC Boyer	Straw	0.045 (0.050)	46	0.089 0.105	0.098 0.121	— —	0.005 0.006	0.120 0.103
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Straw	0.044 (0.050)	45	0.072 0.059	0.047 0.042	— —	0.001 0.002	0.177 0.128
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Straw	0.045 (0.050)	41	0.077 0.056	0.094 0.067	— —	0.006 0.005	0.080 0.074
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Straw	0.046 (0.051)	35	0.024 0.022	0.054 0.050	— —	0.002 0.002	0.062 0.070

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State *Trial ID* Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Mundare, AB AI078-04HA 2005 14	Oat/ Common	Straw	0.045 (0.050)	40	0.032 0.028	0.029 0.041	— —	0.001 0.001	0.080 0.066
Fort Saskatchewan, AB AI079-04HA 2005 14	Oat/ Common	Straw	0.046 (0.051)	42	0.038 0.033	0.035 0.026	— —	0.007 0.007	0.084 0.094
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Straw	0.045 (0.051)	45	0.036 0.039	0.046 0.054	— —	0.002 0.001	0.092 0.060
Regina, SK AI082-04HA 2005 14	Oat/ Mustang	Straw	0.044 (0.050)	45	0.039 0.028	0.048 0.027	— —	<LOD <LOD	0.076 0.078
Brookdale, MB AI086-04HA 2005 14	Oat/ Common Triple Crown	Straw	0.044 (0.049)	45	0.018 0.018	0.053 0.058	— —	<LOD 0.002	0.027 0.026
Clanwilliam, MB AI087-04HA 2005 14	Oat/ Ronald	Straw	0.044 (0.049)	41	0.009 0.010	0.017 0.015	— —	0.001 0.001	0.153 0.153
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Straw	0.046 (0.052)	45	0.092 0.090	0.060 0.061	— —	0.001 0.002	0.101 0.104
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Straw	0.044 (0.049)	26	0.060 0.064	0.036 0.034	— —	0.005 0.006	0.114 0.114
			0.044 (0.049)	35	0.072 0.071	0.038 0.039	— —	0.004 0.004	0.097 0.082
			0.044 (0.049)	45	0.047 0.041	0.045 0.038	— —	0.005 0.003	0.077 0.082
			0.044 (0.049)	56	0.027 0.028	0.045 0.048	— —	0.005 0.006	0.056 0.050
			0.044 (0.049)	65	0.016 0.015	0.036 0.032	— —	0.004 0.003	0.034 0.030
Metz, *ON* AI070-04D 2004 5	Oat/ AC Stewart	Straw	0.044 (0.049)	24	0.005 0.005	0.024 0.024	— —	<LOD 0.001	0.037 0.042
			0.044 (0.049)	35	0.007 0.008	0.025 0.029	— —	<LOD <LOD	0.045 0.047
			0.044 (0.049)	45	0.010 0.009	0.031 0.035	— —	0.004 0.003	0.038 0.041

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TABLE C.3.1. Residue Data from Crop Field Trials Conducted with AE 0317309 02 SE06 A1.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
			0.044 (0.049)	55	0.009 0.009	0.028 0.030	— —	0.001 0.002	0.028 0.026
			0.044 (0.049)	65	<LOD <LOD	0.022 0.020	— —	0.001 0.001	0.026 0.022

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation Total pyrasulfotole.

TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				Total Pyrasulfotole[3] (ppm)
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	
						Uncorrected	Corrected		
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Forage	0.035 (0.039)	25	0.004 0.004	0.007 0.007	0.009 0.009	<LOD <LOD	0.018 0.018
				45	<LOD <LOD	<LOD <LOD	— —	<LOD <LOD	0.016 0.016
Molino, FL AI061-04H 2005 2	Oat/ Citation	Forage	0.033 (0.037)	22	0.025 0.030	0.016 0.025	0.021 0.034	0.003 0.004	0.049 0.068
				46	0.005 0.006	<LOD <LOD	0.007 0.007	<LOD <LOD	0.017 0.018
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Forage	0.034 (0.038)	25	0.004 0.005	0.006 0.006	— —	0.002 0.001	0.012 0.012
				42	0.002 0.002	<LOD <LOD	— —	<LOD <LOD	0.012 0.012
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Forage	0.034 (0.038)	25	0.005 0.005	0.001 0.002	— —	0.001 0.001	0.007 0.008
				42	0.002 0.002	<LOD <LOD	— —	<LOD <LOD	0.012 0.012
Sabin, MN AI065-04HB 2005 5	Oat/ Ebeltoft	Forage	0.034 (0.039)	25	0.082 0.080	0.104 0.093	— —	0.003 0.004	0.189 0.177
				43	0.012 0.014	0.013 0.015	— —	<LOD 0.001	0.030 0.030
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Forage	0.033 (0.038)	22	0.028 0.027	0.026 0.023	0.035 0.031	<LOD <LOD	0.068 0.063
				45	0.019 0.017	0.013 0.013	0.017 0.017	<LOD <LOD	0.041 0.039

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Forage	0.033 (0.037)	22	0.005 0.006	0.006 0.014	0.008 0.019	<LOD 0.001	0.018 0.026
				42	0.005 0.004	0.004 0.003	0.005 0.004	<LOD <LOD	0.015 0.013
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Forage	0.033 (0.037)	24	0.131 0.078	0.035 0.025	— —	0.005 0.005	0.171 0.108
				45	0.107 0.123	0.004 0.003	— —	<LOD <LOD	0.116 0.131
Guelph, ON AI069-04H 2004 6	Oat/ BOB	Forage	0.037 (0.041)	25	0.005 0.004	0.002 0.001	0.003 0.001	<LOD <LOD	0.013 0.010
				45	0.002 0.002	<LOD <LOD	0.007 0.007	<LOD <LOD	0.014 0.014
New Rockford, ND AI073-04H 2004 7	Oat/ Morton	Forage	0.034 (0.038)	22	0.031 0.032	0.079 0.076	0.107 0.103	0.002 0.004	0.140 0.139
				41	0.021 0.029	0.049 0.065	0.066 0.087	0.001 0.001	0.088 0.117
Regina, SK AI074-04H 2004 7	Oat/ CDC Boyer	Forage	0.034 (0.038)	26	0.015 0.015	0.024 0.025	0.033 0.034	0.001 0.001	0.049 0.050
				44	0.008 0.006	0.005 0.005	0.007 0.007	<LOD <LOD	0.020 0.018
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Forage	0.034 (0.038)	22	0.038 0.048	0.017 0.022	— —	0.002 0.003	0.057 0.073
				42	0.019 0.017	<LOD <LOD	— —	<LOD <LOD	0.029 0.027
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Forage	0.035 (0.039)	22	0.036 0.029	0.025 0.021	0.034 0.029	0.002 0.003	0.072 0.061
				41	0.011 0.008	0.004 0.004	0.005 0.005	<LOD <LOD	0.021 0.018
Winchester, ON AI077-04H 2004 8	Oat/ Aylmer	Forage	0.033 (0.037)	23	0.018 0.016	0.033 0.021	0.047 0.030	0.001 0.001	0.066 0.047
				45	0.010 0.009	0.003 0.003	0.004 0.004	<LOD <LOD	0.019 0.018
Mundare, AB AI078-04H 2004 14	Oat/ Calibur	Forage	0.033 (0.037)	21	0.029 0.041	0.032 0.039	0.044 0.054	0.002 0.002	0.075 0.097
				41	0.013 0.014	0.008 0.008	0.011 0.011	<LOD <LOD	0.029 0.030

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Fort Saskatchewan, AB AI079-04H 2004 14	Oat/ Calibur	Forage	0.033 (0.037)	25	0.011 0.010	0.018 0.015	0.025 0.021	<LOD <LOD	0.041 0.036
				41	0.005 0.004	0.005 0.003	0.007 0.004	<LOD <LOD	0.017 0.013
Innisfail, AB AI080-04HB 2005 14	Oat/ Common Oats	Forage	0.034 (0.038)	21	0.009 0.008	0.011 0.011	— —	0.002 0.002	0.022 0.021
				43	0.002 0.002	<LOD <LOD	— —	<LOD <LOD	0.012 0.012
Indian Head, SK AI082-04H 2004 14	Oat/ Pinnacle	Forage	0.033 (0.037)	23	0.019 0.024	0.014 0.017	— —	0.002 0.002	0.035 0.043
				42	0.012 0.010	0.002 0.002	— —	<LOD <LOD	0.019 0.017
Brookdale, MB AI086-04H 2004 14	Oat/ AC Assiniboia	Forage	0.033 (0.037)	21	0.008 0.008	0.011 0.012	0.015 0.017	<LOD 0.001	0.028 0.026
				41	0.005 0.003	0.001 0.001	0.001 0.001	<LOD <LOD	0.011 0.009
Clanwilliam, MB AI087-04H 2004 14	Oat/ AC Assiniboia	Forage	0.033 (0.037)	22	0.011 0.011	0.007 0.008	0.010 0.011	<LOD <LOD	0.026 0.027
				44	0.004 0.005	<LOD <LOD	0.007 0.007	<LOD <LOD	0.016 0.017
Rosthern, SK AI188-04H 2004 14	Oat/ Furlong	Forage	0.033 (0.037)	25	0.003 0.003	0.001 0.001	— —	<LOD <LOD	0.009 0.009
				43	0.002 0.002	<LOD <LOD	— —	<LOD <LOD	0.012 0.012
Carrington, ND AI192-04H 2005 7	Oat/ Morton	Forage	0.033 (0.037)	21	0.006 0.004	0.006 0.006	— —	<LOD 0.001	0.017 0.011
				42	0.003 0.004	0.002 0.002	— —	<LOD <LOD	0.010 0.011
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Forage	0.033 (0.037)	15	0.206 0.190	0.062 0.058	— —	0.013 0.013	0.281 0.261
				26	0.098 0.102	0.028 0.029	— —	0.002 0.003	0.128 0.134
				35	0.156 0.143	0.037 0.037	— —	0.003 0.003	0.196 0.183
				44	0.090 0.146	0.019 0.036	— —	0.001 0.002	0.110 0.184

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
				54	0.048 0.048	0.021 0.020	— —	0.001 0.002	0.070 0.070
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Forage	0.034 (0.038)	15	0.011 0.012	0.025 0.029	0.036 0.041	0.004 0.004	0.051 0.057
				24	0.003 0.003	0.008 0.006	0.011 0.008	0.002 0.001	0.016 0.012
				35	0.001 0.001	0.001 0.001	0.001 0.001	<LOD <LOD	0.007 0.007
				44	0.001 <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.013 0.017
				53	<LOD <LOD	<LOD <LOD	0.007 0.007	<LOD <LOD	0.017 0.017
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Hay	0.035 (0.040)	25	0.164 0.171	0.189 0.200	0.248 0.262	0.006 0.007	0.418 0.440
Molino, FL AI061-04H 2005 2	Oat/ Citation	Hay	0.034 (0.038)	21	0.180 0.162	0.141 0.128	— —	0.014 0.014	0.335 0.304
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Hay	0.034 (0.039)	21	0.230 0.225	0.190 0.175	— —	0.040 0.040	0.460 0.440
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Hay	0.034 (0.038)	22	0.131 0.144	0.196 0.196	— —	0.011 0.012	0.338 0.352
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Hay	0.033 (0.037)	21	0.444 0.412	0.355 0.349	— —	0.013 0.014	0.812 0.775
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Hay	0.033 (0.037)	25	0.130 0.108	0.164 0.134	0.219 0.179	0.011 0.011	0.360 0.298
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Hay	0.035 (0.039)	25	0.223 0.222	0.206 0.210	0.282 0.287	0.013 0.015	0.518 0.524

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Hay	0.033 (0.037)	24	0.109 0.100	0.123 0.107	— —	0.007 0.006	0.239 0.213
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Hay	0.035 (0.039)	21	0.078 0.078	0.121 0.113	0.164 0.153	0.015 0.022	0.257 0.253
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Hay	0.033 (0.038)	22	0.347 0.305	0.167 0.154	— —	0.008 0.007	0.522 0.466
Regina, SK AI074-04H 2004 7	Oat/ CDC Boyer	Hay	0.034 (0.038)	23	0.035 0.061	0.056 0.092	0.076 0.125	0.002 0.005	0.113 0.191
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Hay	0.034 (0.038)	21	0.435 0.510	0.270 0.305	— —	0.012 0.014	0.717 0.829
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Hay	0.033 (0.037)	21	0.417 0.398	0.393 0.353	0.548 0.492	0.050 0.043	1.015 0.933
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Hay	0.034 (0.038)	21	0.086 0.119	0.129 0.209	0.181 0.294	0.016 0.013	0.283 0.426
Mundare, AB AI078-04H 2004 14	Oat/ Calibur	Hay	0.033 (0.037)	22	0.113 0.091	0.066 0.058	0.090 0.079	0.012 0.012	0.215 0.182
Fort Saskatchewan, AB AI079-04H 2004 14	Oat/ Calibur	Hay	0.034 (0.038)	22	0.044 0.035	0.062 0.051	0.085 0.070	0.004 0.004	0.133 0.109
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Hay	0.033 (0.037)	23	0.101 0.088	0.098 0.092	— —	0.007 0.009	0.244 0.224

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Indian Head, Saskatchewa AI082-04H 2004 14	Oat/ Pinnacle	Hay	0.033 (0.037)	25	0.041 0.037	0.036 0.031	0.050 0.043	0.003 0.002	0.094 0.082
Brookdale, MB AI086-04H 2004 14	Oat/ AC Assiniboia	Hay	0.034 (0.038)	23	0.331 0.360	0.427 0.452	0.589 0.623	0.016 0.019	0.936 1.002
Clanwilliam, MB AI087-04H 2004 14	Oat/ AC Assiniboia	Hay	0.034 (0.038)	21	0.238 0.300	0.275 0.326	0.376 0.446	0.020 0.022	0.635 0.769
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Hay	0.033 (0.037)	24	0.231 0.207	0.187 0.166	— —	0.013 0.012	0.431 0.385
Carrington, ND AI192-04H 2005 7	Oat/ Morton	Hay	0.033 (0.037)	22	0.241 0.206	0.161 0.148	— —	0.004 0.009	0.406 0.363
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Hay	0.033 (0.037)	0	0.181 0.169	0.177 0.180	— —	1.473 1.221	1.831 1.570
				15	0.219 0.229	0.120 0.121	— —	0.017 0.017	0.356 0.367
				26	<LOD 0.179	<LOD 0.090	— —	<LOD 0.008	0.015 0.277
				30	0.136 0.180	0.059 0.069	— —	0.007 0.006	0.202 0.255
				35	0.148 0.141	0.055 0.058	— —	0.006 0.006	0.209 0.205
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Hay	0.034 (0.038)	0	0.133 0.167	0.831 0.849	1.191 1.216	0.358 0.346	1.682 1.729
				15	0.145 0.191	0.197 0.235	0.279 0.333	0.029 0.034	0.453 0.558
				24	0.076 0.063	0.104 0.102	0.146 0.143	0.009 0.009	0.231 0.215
				30	0.062 0.076	0.096 0.112	0.134 0.157	0.006 0.007	0.202 0.240

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
				35	0.046 0.046	0.068 0.067	0.095 0.093	0.006 0.006	0.147 0.145
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Grain	0.035 (0.040)	44	0.004 0.003	0.005 0.005	— —	<LOD <LOD	0.014 0.013
Molino, FL AI061-04H 2005 2	Oat/ Citation	Grain	0.034 (0.038)	43	0.003 0.003	0.003 0.003	— —	0.002 <LOD	0.008 0.011
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Grain	0.034 (0.039)	38	0.109 0.105	0.086 0.089	— —	0.021 0.022	0.216 0.216
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Grain	0.034 (0.038)	45	0.026 0.024	0.004 0.004	— —	<LOD <LOD	0.035 0.033
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Grain	0.033 (0.037)	45	0.017 0.015	0.011 0.009	— —	<LOD 0.001	0.033 0.025
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Grain	0.033 (0.037)	44	0.061 <LOD	0.024 0.002	— —	0.004 <LOD	0.089 0.012
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Grain	0.035 (0.039)	44	<LOD 0.055	0.002 0.020	— —	<LOD 0.003	0.012 0.078
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Grain	0.033 (0.037)	50	0.128 0.104	0.013 0.010	— —	0.001 0.001	0.142 0.115
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Grain	0.035 (0.039)	44	0.010 0.011	0.023 0.023	— —	0.004 0.005	0.037 0.039

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Grain	0.033 (0.038)	42	0.013 0.018	0.001 0.002	— —	<LOD 0.001	0.019 0.021
Windthorst, SK AI074-04HA 2005 7	Oat/ AC Boyer	Grain	0.034 (0.038)	46	0.015 0.013	0.021 0.021	— —	0.004 0.004	0.040 0.038
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Grain	0.034 (0.038)	45	0.008 0.012	0.002 0.003	— —	<LOD <LOD	0.015 0.020
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Grain	0.033 (0.037)	41	0.017 0.015	0.019 0.017	— —	0.007 0.006	0.043 0.038
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Grain	0.034 (0.038)	35	0.008 0.009	0.008 0.009	— —	0.001 0.001	0.017 0.019
Mundare, AB AI078-04HA 2005 14	Oat/ Common	Grain	0.034 (0.038)	40	0.006 0.004	0.003 0.002	— —	<LOD <LOD	0.014 0.011
Fort Saskatchewan, AB AI079-04HA 2005 14	Oat/ Common	Grain	0.034 (0.038)	42	0.005 0.006	0.003 0.003	— —	<LOD 0.002	0.013 0.011
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Grain	0.033 (0.037)	45	0.004 0.004	0.003 0.003	— —	<LOD <LOD	0.012 0.012
Regina, SK AI082-04HA 2005 14	Oat/ Mustang	Grain	0.033 (0.037)	45	0.006 0.005	0.001 <LOD	— —	<LOD <LOD	0.012 0.015
Brookdale, MB AI086-04HA 2005 14	Oat/ Common Triple Crown	Grain	0.031 (0.035)	45	0.005 0.004	0.003 0.003	— —	<LOD <LOD	0.013 0.012

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Clanwilliam, MB AI087-04HA 2005 14	Oat/ Ronald	Grain	0.033 (0.037)	41	0.003 0.004	0.001 0.001	— —	<LOD <LOD	0.009 0.010
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Grain	0.033 (0.037)	45	0.004 <LOD	0.003 <LOD	— —	<LOD <LOD	0.012 0.015
Carrington, ND AI192-04H 2005 7	Oat/ Morton	Grain	0.033 (0.037)	42	0.006 0.006	0.002 0.002	— —	<LOD <LOD	0.013 0.013
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Grain	0.033 (0.037)	26	0.011 0.012	0.009 0.010	— —	0.002 0.001	0.022 0.023
				35	0.018 0.015	0.010 0.009	— —	0.002 0.002	0.030 0.026
				45	0.014 0.015	0.009 0.010	— —	0.002 0.001	0.025 0.026
				56	0.015 0.014	0.008 0.009	— —	<LOD <LOD	0.028 0.028
				65	0.018 0.013	0.009 0.008	— —	<LOD 0.001	0.032 0.022
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Grain	0.034 (0.038)	24	0.002 0.003	0.008 0.008	— —	0.006 0.007	0.016 0.018
				35	<LOD <LOD	0.005 0.006	— —	0.001 0.001	0.011 0.012
				45	<LOD <LOD	0.006 0.006	— —	0.002 0.001	0.013 0.012
				55	0.002 0.003	0.007 0.007	— —	0.004 0.004	0.013 0.014
				65	0.002 0.002	0.006 0.007	— —	0.003 0.002	0.011 0.011
Germansville, PA AI060-04H 2004 1	Oat/ Blaze	Straw	0.035 (0.040)	44	0.018 0.017	0.047 0.047	— —	0.002 0.002	0.067 0.066

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Molino, FL AI061-04H 2005 2	Oat/ Citation	Straw	0.034 (0.038)	43	0.007 0.015	0.020 0.029	— —	0.002 0.002	0.029 0.046
Seymour, IL AI063-04H 2005 5	Oat/ unknown	Straw	0.034 (0.039)	38	0.105 0.108	0.070 0.068	— —	0.010 0.011	0.185 0.187
Springfield, NE AI064-04H 2005 5	Oat/ Jerry	Straw	0.034 (0.038)	45	0.028 0.025	0.039 0.034	— —	0.002 0.002	0.069 0.061
Sabin, MN AI065-04HA 2005 5	Oat/ Ebeltoft	Straw	0.033 (0.037)	45	0.023 0.028	0.060 0.063	— —	0.003 0.003	0.086 0.094
Northwood, ND AI066-04H 2004 5	Oat/ Morton	Straw	0.033 (0.037)	44	0.023 0.028	0.037 0.041	— —	0.002 0.003	0.062 0.072
New Holland, OH AI067-04H 2004 5	Oat/ Armor	Straw	0.035 (0.039)	44	0.039 0.037	0.084 0.082	— —	0.006 0.006	0.129 0.125
Cunningham, KS AI068-04H 2005 5	Oat/ Jerry	Straw	0.033 (0.037)	50	0.078 0.056	0.123 0.081	— —	0.003 0.002	0.204 0.139
Guelph, ON AI069-04H 2004 5	Oat/ Ida	Straw	0.035 (0.039)	44	0.020 0.017	0.074 0.060	— —	0.012 0.010	0.106 0.087
New Rockford, ND AI073-04HA 2005 7	Oat/ Morton	Straw	0.033 (0.038)	42	0.050 0.049	0.015 0.016	— —	<LOD 0.001	0.070 0.066
Windthorst, SK AI074-04HA 2005 7	Oat/ AC Boyer	Straw	0.034 (0.038)	38	0.100 0.102	0.132 0.137	— —	0.006 0.006	0.238 0.245

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Larned, KS AI075-04H 2005 8	Oat/ Loyal	Straw	0.034 (0.038)	45	0.047 0.042	0.028 0.026	— —	0.001 0.001	0.076 0.069
Utterson, ON AI076-04H 2004 8	Oat/ Manotick	Straw	0.033 (0.037)	41	0.046 0.039	0.057 0.052	— —	0.003 0.003	0.106 0.094
Winchester, ON AI077-04H 2004 8	Oat/ AC Aylmer	Straw	0.034 (0.038)	35	0.043 0.046	0.104 0.107	— —	0.003 0.003	0.150 0.156
Mundare, AB AI078-04HA 2005 14	Oat/ Common	Straw	0.034 (0.038)	40	0.021 0.022	0.028 0.018	— —	<LOD 0.001	0.054 0.041
Fort Saskatchewan, AB AI079-04HA 2005 14	Oat/ Common	Straw	0.034 (0.038)	42	0.044 0.043	0.045 0.048	— —	0.002 0.002	0.091 0.093
Innisfail, AB AI080-04HB 2005 14	Oat/ AC Lu	Straw	0.033 (0.037)	45	0.057 0.051	0.062 0.050	— —	0.003 0.002	0.122 0.103
Regina, SK AI082-04HA 2005 14	Oat/ Mustang	Straw	0.033 (0.037)	45	0.033 0.031	0.033 0.029	— —	<LOD <LOD	0.071 0.065
Brookdale, MB AI086-04HA 2005 14	Oat/ Common Triple Crown	Straw	0.031 (0.035)	45	0.013 0.015	0.046 0.051	— —	0.001 0.001	0.060 0.067
Clanwilliam, MB AI087-04HA 2005 14	Oat/ Ronald	Straw	0.033 (0.037)	41	0.009 0.010	0.013 0.012	— —	0.001 0.001	0.023 0.023
Rosthern, SK AI188-04H 2005 14	Oat/ Furlong	Straw	0.033 (0.037)	45	0.091 0.084	0.075 0.076	— —	0.002 0.002	0.168 0.162

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TABLE C.3.2. Residue Data from Crop Field Trials Conducted with AE 0317309 03 EC23 A8.

City, State Trial ID Year Region	Crop/ Variety	Matrix	Total Rate lb a.i./A (kg a.i./ha)	PHI[1] (days)	Individual Analyte Residue (ppm)				
					Pyrasulfotole-benzoic Acid	Pyrasulfotole-desmethyl[2]		Pyrasulfotole	Total Pyrasulfotole[3] (ppm)
						Uncorrected	Corrected		
Carrington, ND AI192-04H 2005 7	Oat/ Morton	Straw	0.033 (0.037)	42	0.020 0.017	0.016 0.015	— —	<LOD <LOD	0.041 0.037
Stilwell, KS AI062-04D 2005 5	Oat/ Local Variety	Straw	0.033 (0.037)	26	0.065 0.064	0.041 0.043	— —	0.003 0.003	0.109 0.110
				35	0.097 0.086	0.052 0.044	— —	0.004 0.004	0.153 0.134
				45	0.057 0.050	0.048 0.044	— —	0.005 0.004	0.110 0.098
				56	0.031 0.028	0.044 0.041	— —	0.005 0.004	0.080 0.073
				65	0.017 0.018	0.029 0.036	— —	0.003 0.004	0.049 0.058
Metz, ON AI070-04D 2004 5	Oat/ AC Stewart	Straw	0.034 (0.038)	24	0.004 0.005	0.039 0.043	— —	0.003 0.003	0.046 0.051
				35	0.013 0.013	0.039 0.044	— —	0.003 0.003	0.055 0.060
				45	0.019 0.018	0.040 0.037	— —	0.002 0.002	0.061 0.057
				55	0.004 0.003	0.023 0.023	— —	0.002 0.002	0.029 0.028
				65	0.005 0.006	0.038 0.044	— —	0.003 0.003	0.046 0.053

[1] PHI = Preharvest interval.
[2] Residue values for pyrasulfotole-desmethyl hay samples that were stored longer than 163 days were corrected for storage dissipation.
[3] Total pyrasulfotole is the sum of pyrasulfotole, pyrasulfotole-desmethyl and pyrasulfotole-benzoic acid. Residue values that were reported as <LOD were assigned a finite value of 0.005 ppm (half the LOQ) for the purpose of calculation Total pyrasulfotole.

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TABLE C.4.1 Summary of Residue Data from Crop Field Trials with AE 0317309 02 SE06 A1.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			N	Min.	Max.	HAFT*	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	0.001	0.133	0.124	0.014	0.026	0.031
		41-46	60	<LOD	0.156	0.146	0.008	0.019	0.035
Grain		35-50	54	0.002	0.085	0.080	0.006	0.016	0.021
Hay		21-26	60	0.026	0.509	0.431	0.142	0.168	0.115
Straw		35-50	54	0.007	0.107	0.097	0.033	0.041	0.029
Pyrasulfotole-desmethyl									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	0.001	0.116	0.100	0.014	0.023	0.023
		41-46	60	<LOD	0.072	0.066	0.005	0.010	0.014
Grain		35-50	54	0.001	0.083	0.080	0.008	0.011	0.016
Hay		21-26	60	0.036	0.587	0.527	0.147	0.167	0.107
Straw		35-50	54	0.010	0.156	0.144	0.048	0.053	0.031
Pyrasulfotole									
Forage	0.040–0.049 (0.046–0.055)	21-26	60	<LOD	0.006	0.006	0.003	0.003	0.002
		41-46	60	<LOD	0.005	0.005	0.005	0.004	0.001
Grain		35-50	54	<LOD	0.022	0.020	0.005	0.004	0.004
Hay		21-26	60	0.002	0.105	0.081	0.010	0.016	0.020
Straw		35-50	54	<LOD	0.014	0.012	0.004	0.004	0.003

HAFT is the highest average field trial.
For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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TABLE C.4.2 Summary of Residue Data from Crop Field Trials with AE 0317309 03 EC23 A8.

Commodity	Total Applic. Rate lb a.i./A (kg a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT*	Median (STMdR)	Mean (STMR)	Std. Dev.
Pyrasulfotole-benzoic Acid									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	0.003	0.131	0.105	0.013	0.025	0.030
		41-46	48	<LOD	0.146	0.118	0.005	0.017	0.032
Grain		35-50	52	0.003	0.128	0.116	0.007	0.019	0.029
Hay		21-26	48	<LOD	0.510	0.472	0.163	0.188	0.129
Straw		35-50	52	0.007	0.108	0.106	0.035	0.041	0.028
Pyrasulfotole-desmethyl									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	0.001	0.107	0.105	0.018	0.026	0.027
		41-46	48	0.001	0.087	0.077	0.005	0.010	0.016
Grain		35-50	52	0.001	0.089	0.088	0.005	0.010	0.017
Hay		21-26	48	<LOD	0.623	0.606	0.167	0.209	0.143
Straw		35-50	52	0.012	0.137	0.134	0.046	0.052	0.030
Pyrasulfotole									
Forage	0.031–0.038 (0.035–0.042)	21-26	48	<LOD	0.005	0.005	0.003	0.003	0.002
		41-46	48	<LOD	0.005	0.005	0.005	0.005	0.001
Grain		35-50	52	<LOD	0.022	0.022	0.005	0.004	0.004
Hay		21-26	48	<LOD	0.050	0.046	0.012	0.013	0.010
Straw		35-50	52	<LOD	0.012	0.011	0.003	0.004	0.003

HAFT is the highest average field trial.
For the purposes of calculation, individual analyte residues that were reported as <LOD were assigned a finite value of half the LOQ.

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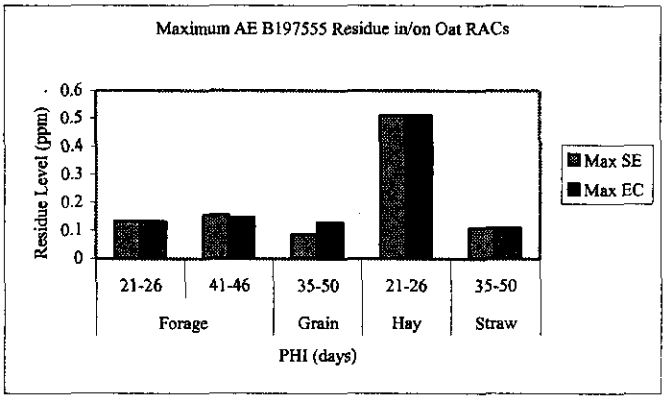
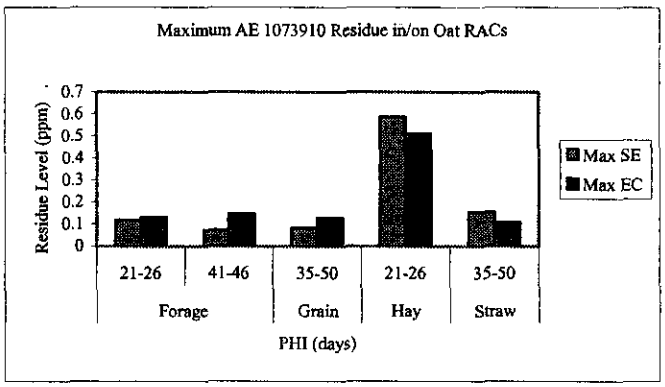
FIGURE C.1. Maximum Residue Detected in/on Oat RACs





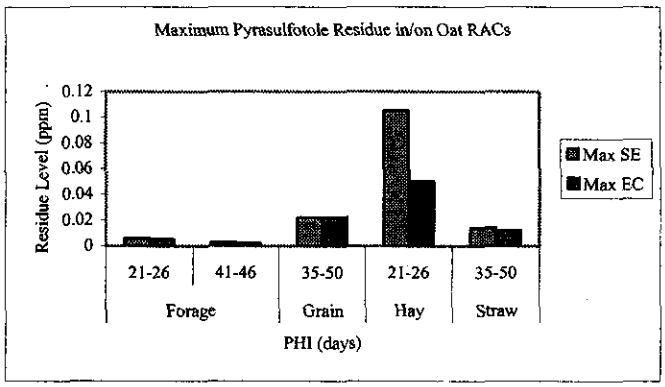


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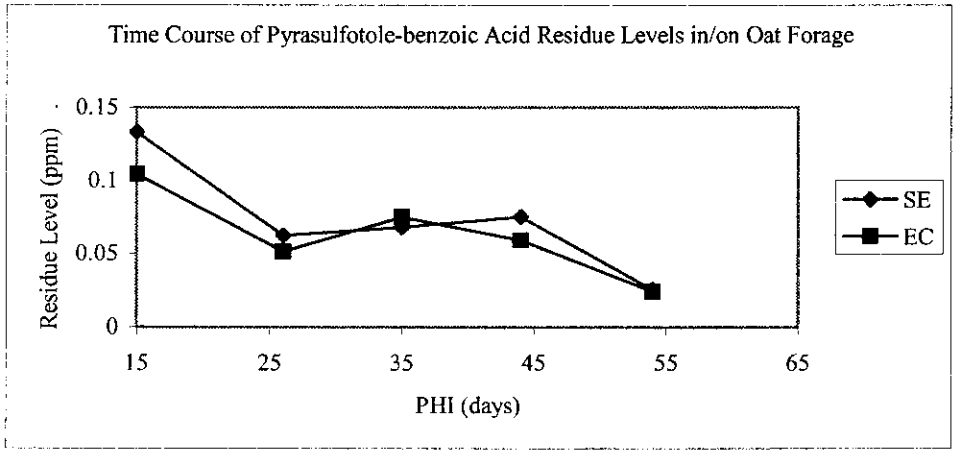
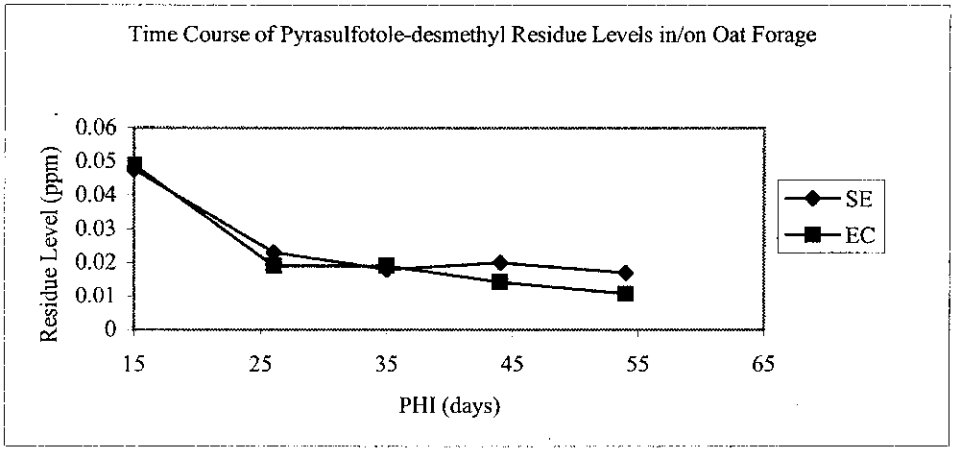
FIGURE C.2. Time Course of Residue Data from Decline Trials in/on Oat RACs





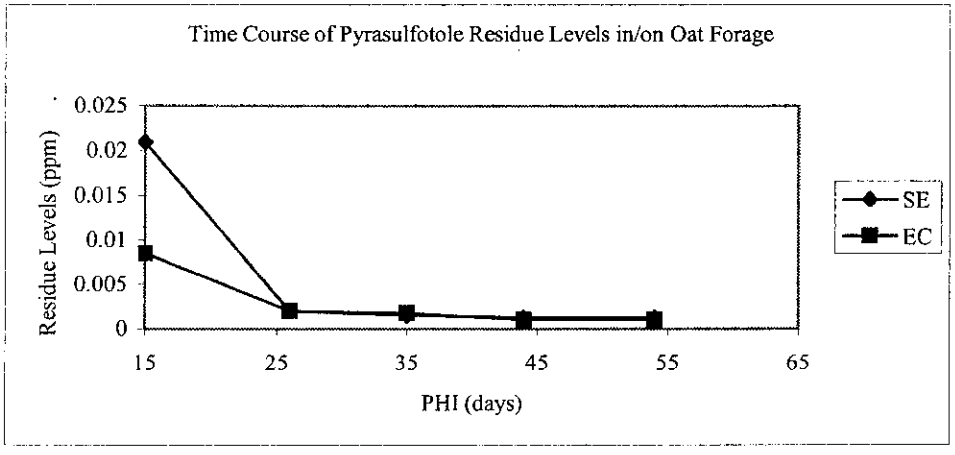


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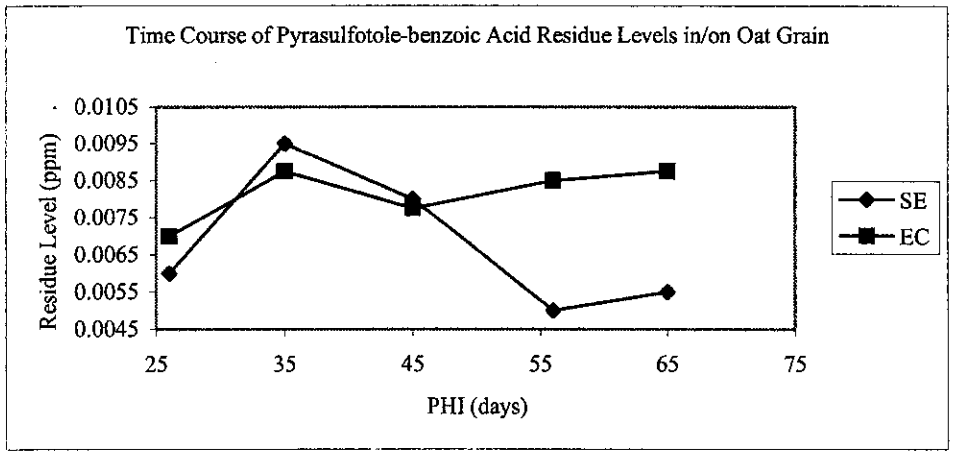
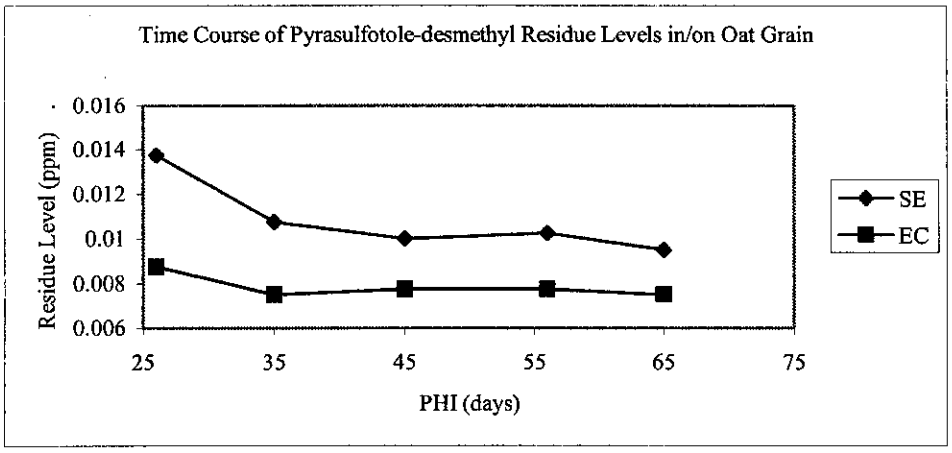
FIGURE C.2. Continued





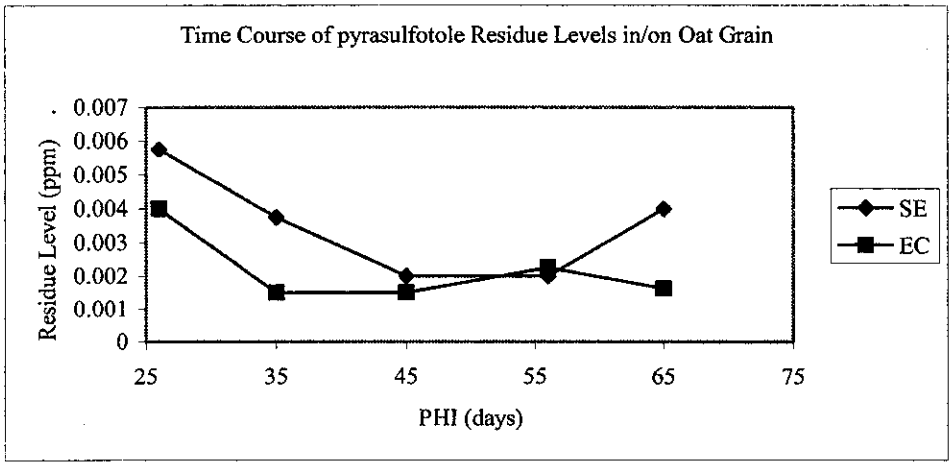


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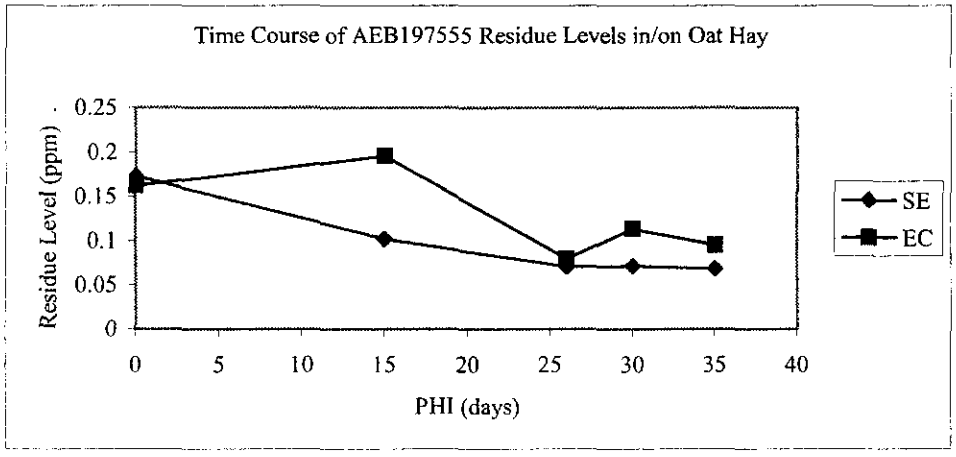
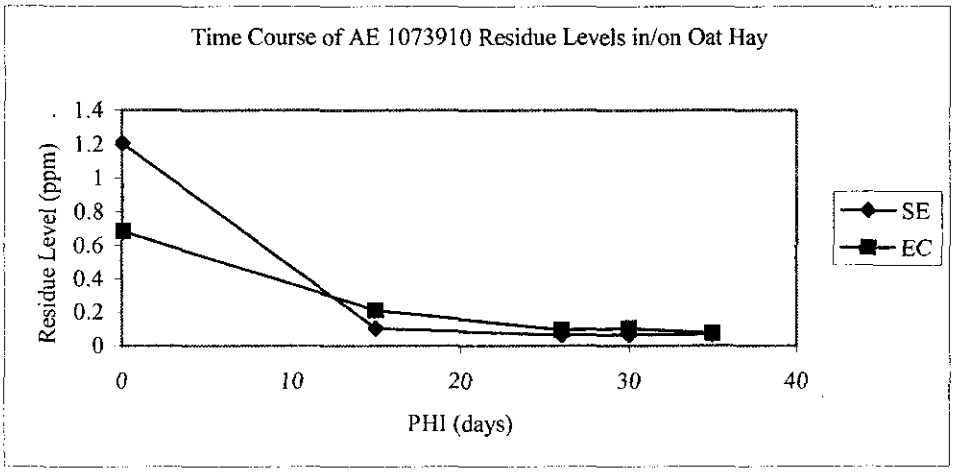
FIGURE C.2. Continued





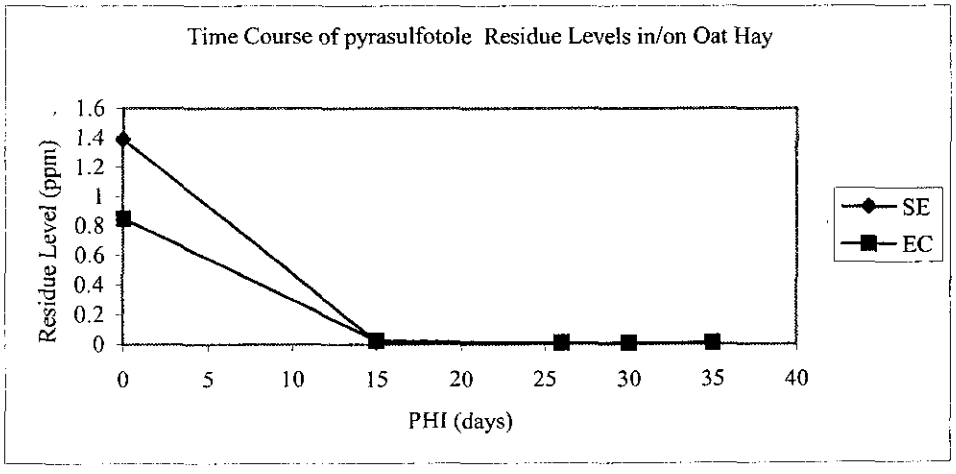


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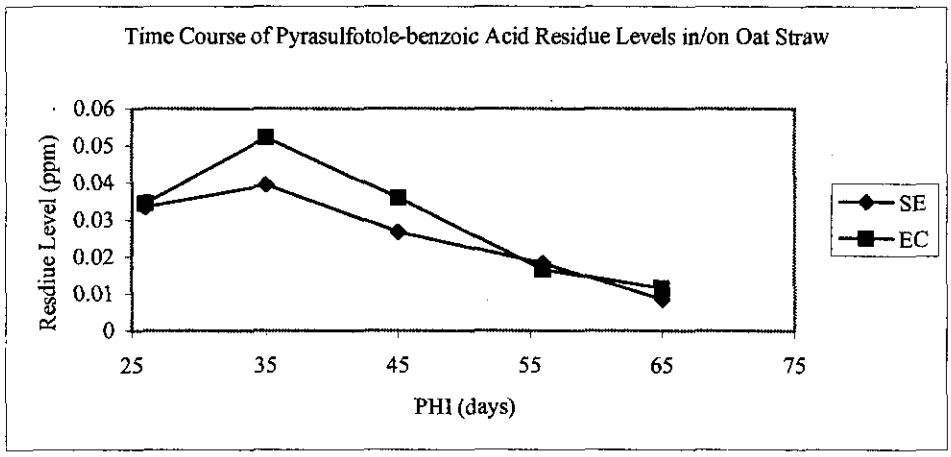
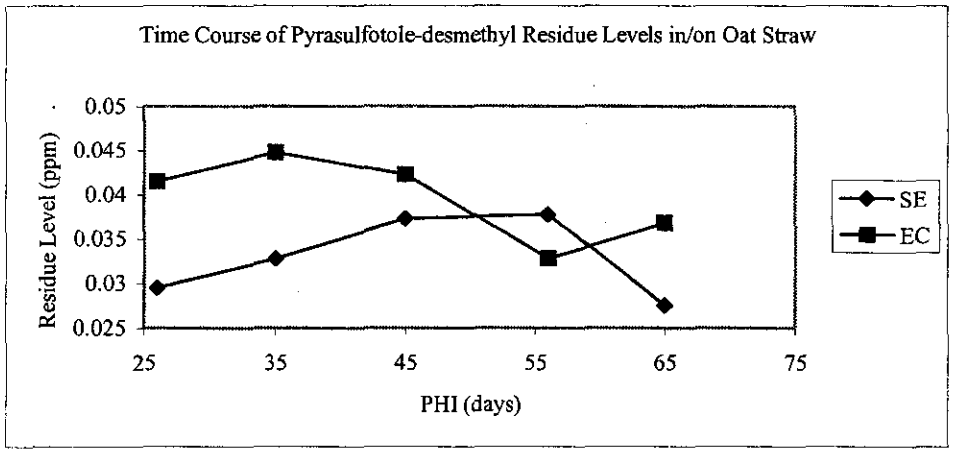
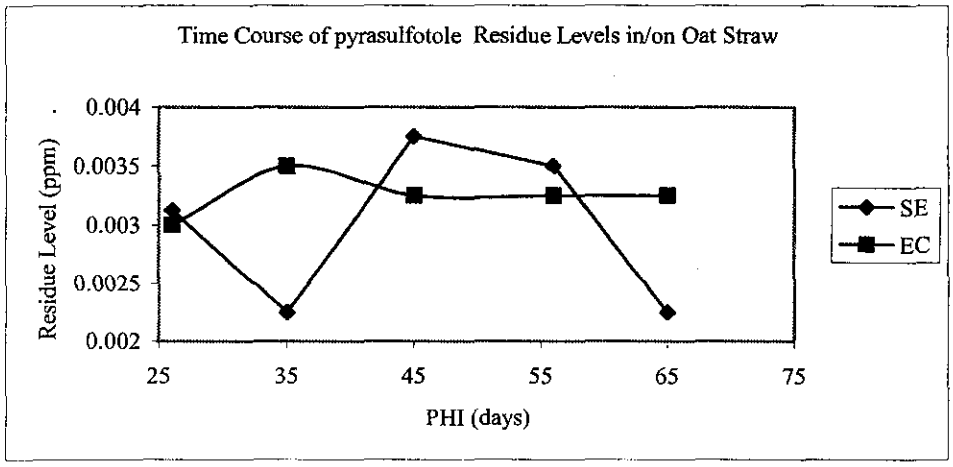
FIGURE C.2. Continued







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D. CONCLUSION

The crop field data on oat RACs (forage, grain, hay and straw) were deemed acceptable for the determination of the magnitude of the residues of pyrasulfotole and the metabolites pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl when using either the SE or EC foliar formulations. The study use pattern had a maximum seasonal application rate of 0.042 to 0.047 lb a.i./A (0.048 to 0.053 kg a.i./ha) for AE 017309 02 SE06 or 0.031 to 0.037 lb a.i./A (0.035 to 0.041 kg a.i./ha) for AE 017309 03 EC23 on oat forage, grain, hay, straw (PHI of 18 to 25 days for forage, 21 to 25 days for hay, 40 to 56 days for straw and grain).

The amounts of pyrasulfotole, pyrasulfotole-benzoic acid and pyrasulfotole-desmethyl residues were essentially the same between formulations, with oat hay retaining the highest amounts of analyte residues ($\geq$ 3 times the amount of other oat RACs). Independent of formulation, and with these use patterns, the pyrasulfotole-benzoic acid residue levels are not expected to exceed 0.133 ppm (forage, 25-day PHI), 0.156 ppm (forage, 45-day PHI), 0.510 ppm (hay), 0.128 ppm (grain), 0.107 ppm (straw); the pyrasulfotole-desmethyl residue levels are not expected to exceed 0.116 ppm (forage, 25-day PHI), 0.087 ppm (forage, 45-day PHI), 0.623 ppm (hay), 0.089 ppm (grain), 0.156 ppm (straw); and the pyrasulfotole residue levels are not expected to exceed 0.006 ppm (forage, 25-day PHI), 0.005 ppm (forage, 45-day PHI), 0.105 ppm (hay), 0.022 ppm (grain), 0.014 ppm (straw).

The amount of each analyte decreased with time in oat forage and oat hay. In oat grain, pyrasulfotole and pyrasulfotole-desmethyl decreased slightly, while the amount of pyrasulfotole-benzoic acid increased slightly with EC23 treatment and remained unchanged with SE06 treatment. In oat straw, there was no significant decrease in the amount of pyrasulfotole or pyrasulfotole-desmethyl, while the amount of pyrasulfotole-benzoic acid decreased over time.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of pyrasulfotole: substance, pure code: pyrasulfotole 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of pyrasulfotole. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). Pyrasulfotole - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of pyrasulfotole at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

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5. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). pyrasulfotole: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). Pyrasulfotole: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). Pyrasulfotole: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). Pyrasulfotole: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. MRID No. 46801806 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2004). Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using LC-MS/MS.

11. MRID No. 46801808 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Extraction efficiency of Bayer Method AI-001-P04-01. An analytical method for the determination of residues of pyrasulfotole, AE 1073910, and AE B197555 in wheat, corn, and soybean matrices using lc/ms/ms. Bayer CropScience Report No. RAAIX011.

12. MRID No. 46801819 Gould, T. J., Timberlake, B. C. and Brungardt, J. N. (2005). Storage stability of pyrasulfotole, AE1073910, and AE B197555 in soybean grain, wheat grain, wheat forage, and wheat hay. Bayer CropScience Study No. RAAIX009.

13. MRID No. 46801819 Coopersmith, H. (2006). Storage Stability of AE 0317309, AE 1073910, and AE B197555 in Soybean and Wheat Matrices (Data to 11 Months of Storage)" Bayer CropScience Report Number RAAIX009. Unpublished study prepared by Bayer CropScience. 290 pages.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (20 December 2006); George Kramer (20 December 2006)
Petition Number: 6F7059
DP#: 333412

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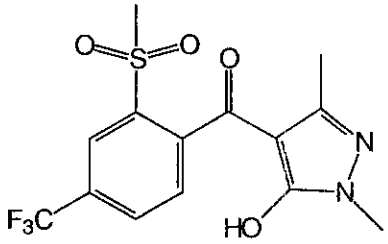
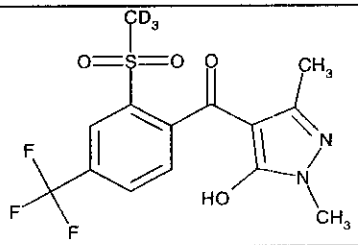
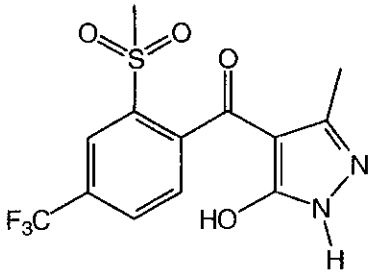
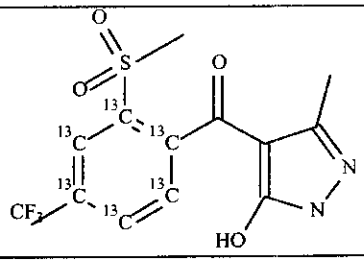
EPA's Records Disposition Schedule PEST 361 Scientific Data Reviews HED Records Center - File R153474 - Page 308 of 428

Template Version June 2005.

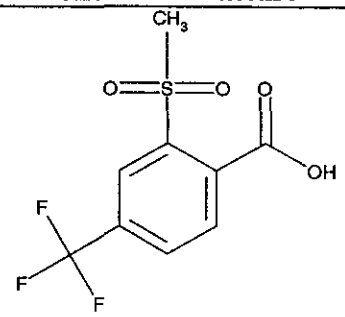
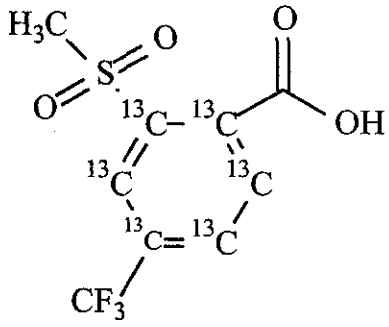
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 1073910 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

US EPA ARCHIVE DOCUMENT

Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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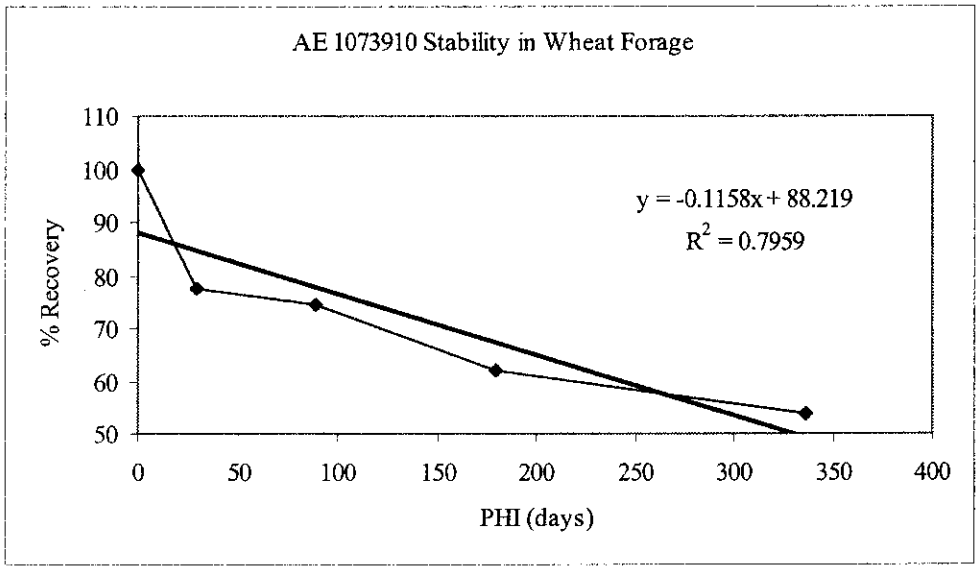
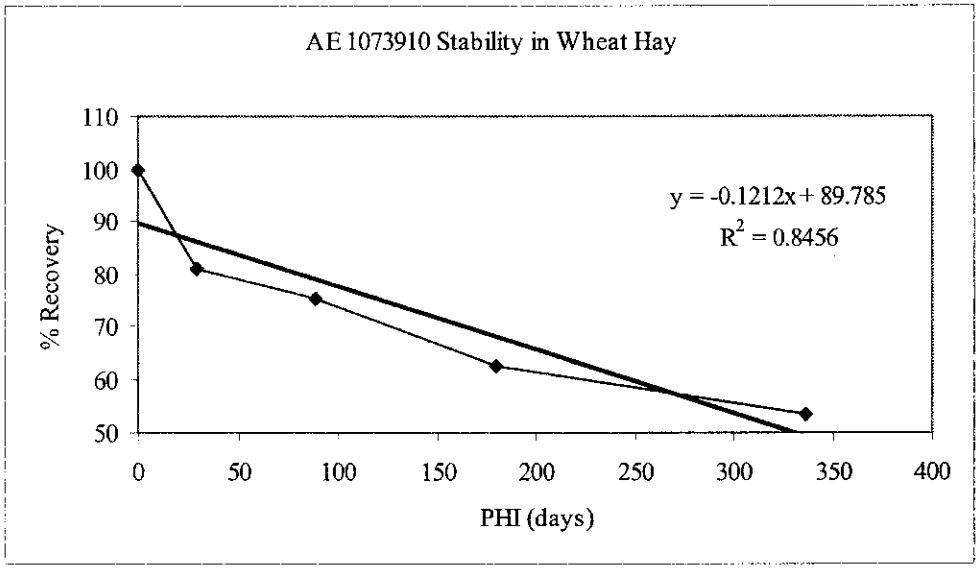
APPENDIX 2





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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 4/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801801 Koehn, D. and Haas, M. (November 5, 2004). Metabolism of [phenyl-U-^{14}C]-AE 0317309 in Wheat Following Treatment at an Application Rate of 100 g/ha with and without Safener. Lab Project Number: M1731265-5. Unpublished study prepared by Bayer CropScience AG. 126 pages.

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EXECUTIVE SUMMARY:

The metabolism of the herbicide pyrasulfotole [(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)(2-methylsulfonyl)-4-(trifluoromethylphenyl)methanone] was investigated in spring wheat following spray application. [Phenyl-U-^{14}C]-labelled pyrasulfotole (AE 0317309) was formulated as an oil based suspension (OD 5) and applied by spraying at a nominal rate of 100 g a.i./ha. A corresponding application including the safener mefenpyr-diethyl (AE F107892) was performed in parallel, in order to investigate the influence of the safener on the metabolism of pyrasulfotole. Mefenpyr-diethyl was added to the formulation at a ratio of 1:1.4 (mefenpyr-diethyl:pyrasulfotole). The wheat was treated at growth stage 21 (early tillering) according to BBCH code. Following growth under semi-field conditions, samples were taken at stage 39 (forage, 21 days after treatment, DAT), stage 73 (hay, 44 DAT), and stage 92 (harvest, 79 DAT). Grain and straw were analysed separately.

The total radioactive residue (TRR) was determined by liquid scintillation counting (LSC). Identification and characterization of the residues was achieved by high performance liquid chromatography (radio-HPLC) and thin layer chromatography (radio-TLC). The amount of non-extractable residues was determined by combustion. Aliquots of the solids were subjected to successive microwave extraction with ACN/water (1/1, v/v) and ACN/0.1 N NaOH (1/1, v/v).

The total radioactive residue levels in the trial with safener were 2.40 ppm in forage, 3.14 ppm in hay, 2.90 ppm in straw, and 0.16 ppm in grain. Without the safener, the total radioactive residues were 2.44 ppm in forage, 3.12 ppm in hay, 2.80 ppm in straw, and 0.24 ppm in grain. Therefore, the overall distribution of the radioactive residues was quantitatively similar in the trial with and without safener.

In both experiments, in the non-edible raw agricultural commodities (RACs), a total of 92.4-97.6% of the TRR (2.33-2.99 ppm) was extractable. Approximately 70 to 83% of the TRR was identified in non-edible RACs, and 14 to 23% of the TRR (0.33-0.63 ppm) was characterized. Several unknown metabolite fractions and regions were detected, none of which exceeded 4.3% (0.10 ppm) of the TRR in forage, 5.4% (0.17 ppm) of the TRR in hay and 4.4% (0.12 ppm) of the TRR in straw. Non-extractable solids comprised 2.5-7.7% of the TRR (0.06-0.22 ppm). The overall accountability of the radioactive residue was 99.3-100.3%.

In the trial with safener, the predominant residue in wheat forage, hay and straw was comprised of the metabolites pyrasulfotole-benzoic acid (16.3-30.5% of the TRR; 0.39-0.88 ppm) and pyrasulfotole-desmethyl-*O*-glucoside (27.9-43.5% of the TRR; 0.81-1.16 ppm). Minor components were pyrasulfotole (4.4-7.3% of the TRR; 0.13-0.18 ppm), and pyrasulfotole-sulfinyl-lactate (7.8-9.6% of the TRR; 0.19-0.28 ppm).

In the trial without safener, the predominant residues in non-edible wheat RACs were pyrasulfotole-benzoic acid (20.1-37.2% of the TRR; 0.49-1.06 ppm), pyrasulfotole-desmethyl-*O*-glucoside (19.6-30.2% of the TRR; 0.55-0.80 ppm) and pyrasulfotole (7.5-28.7% of the TRR; 0.21-0.71 ppm). Pyrasulfotole-sulfinyl-lactate was a minor metabolite identified at 3.8-5.7% of the TRR (0.09-0.17 ppm).

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Independent of safener use, pyrasulfotole-benzoic acid was the only residue identified in wheat grain (97.6-97.7% of the TRR; 0.15-0.23 ppm). The remaining radioactive residue was non-extractable solids at 2.3-2.4% of the TRR (0.004-0.005 ppm). The overall accountability of the radioactive residue was 96.3-97.9%.

There are two main metabolic pathways for pyrasulfotole in wheat RACs. The first pathway involves the demethylation of pyrasulfotole yielding pyrasulfotole-desmethyl. This intermediate metabolite is glucosylated (pyrasulfotole-desmethyl-*O*-glucoside), or conjugated with glutathione leading to pyrasulfotole-sulfinyl-lactate. The second pathway is the result of cleavage of the pyrazole moiety leaving the pyrasulfotole-benzoic acid and multiple polar constituents.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the plant metabolism data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

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TABLE A.1. Test Compound Nomenclature.

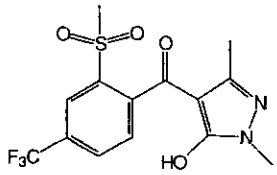
Compound	Chemical Structure
	
Common name	pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point/range	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Test Site and Crop Information

The plants were artificially irrigated, fertilized, and treated with other pesticides if needed, to allow growth under optimal conditions. Natural sunlight had access from the side of the vegetation hall. Between application of the test product and harvest, the air temperature ranged from 5.7 (March) to 20.6°C (July). No meteorological abnormalities impacted the study.

TABLE B.1.1. Test Site Information.

Type	Testing Environment	Soil characteristics			
		Type	%OM	pH	CEC
Foliar Treatment	Outdoor, vegetation hall, surrounded by wire-mesh fencing, covered with a glass roof	Sandy loam	3.41%	6.3 ($CaCl_2$)	10.0 meq/100 g dry soil

TABLE B.1.2. Crop Information.

Crop/crop group	Variety	Application	Growth stage at application	Growth stage at harvest	Harvested RAC	Harvesting procedure
Spring wheat (*Triticum aestivum*)/ Cereals (Group 15)	Triso	1 appl. (one trial with safener and one without safener)	Early tillering (BBCH code: 21 – 22)	Mid boot stage BBCH code: 39 (21 DAT)	Forage	Plants were cut shortly above the soil surface with hand clippers.
				Early milk BBCH code: 73 (44 DAT)	Hay	Plants were cut shortly above the soil surface, and allowed to dry for five days
				Maturity BBCH code: 92 (79 DAT)	Straw Grain	Grain was collected by hand, remaining ears and chaffs were combined with the straw.

DAT= days after treatment RAC = raw agricultural commodity

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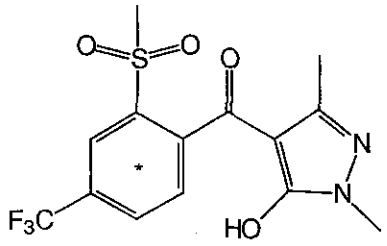
B.2. Test Materials

TABLE B.2.1. Test Material Characteristics.	
Chemical structure	 * position of ^{14}C radiolabel
Radiolabel position	[phenyl-U-^{14}C] AE 0317309
Lot No.	SEL/1006
Purity	99.1%
Specific activity*	3.19 MBq/mg 86.23 µCi/mg 191,400 dpm/µg

B.3. Study Use Pattern

TABLE B.3.1. Use Pattern Information.	
Test product	Formulated as an oil suspension concentrate (5% a.i.)
Application method	*Computer controlled track sprayer, with a flat fan nozzle*
Application rate (with safener) Application rate (without safener)	98 g a.i./ha (4.9 mg a.i./0.5 m^2) + mefenpyr-diethyl (3.4 mg a.i./0.5 m^2) 96 g a.i./ha (4.8 mg a.i./0.5 m^2)
Number of applications	1
Timing of applications	Postemergent, BBCH Stage 21
PHI	79 days

B.4. Identification/ Characterization of Residues

B.4.1. Sample Handling and Preparation

Sample collection:
Samples of forage (21 DAT), hay (44 DAT), straw (79 DAT), and grain (79 DAT) were collected, weighed, and homogenized (liquid nitrogen, Ultra-Turrax homogenizer). Aliquots of each sample were stored in a freezer. Further aliquots of the samples were combusted in an oxidizer or extracted. Work-up was initiated immediately after sampling to ensure the extraction and identification/characterization of the original residues.

Extraction of residues:
Aliquots of the homogenized samples were extracted with ACN/water (4/1, v/v, 4-5 times) at ambient temperature using an Ultra-Turrax. Samples were centrifuged between extractions. Pooled extracts from each crop matrix were cleaned up by solid phase extraction (SPE) and concentrated by rotary evaporation. Aliquots of the extracts were taken in triplicate for radioactivity measurement by LSC.

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Investigation of the non-extractable residues
Non-extractable residues from forage, hay and straw samples were extracted using a microwave apparatus. The extraction was conducted in two runs using ACN/water (1/1 (v/v), 50 mL) and ACN/0.1 N NaOH solution (1/1 (v/v), 50 mL) at 80-100°C for 10 minutes. The extracts were filtered by suction, neutralized with (1 N HCl), and the radioactivity in the filtrates (microwave extracts) was measured by LSC. The non-extractable residues were dried and homogenized. Aliquots of the solids were combusted and the radioactivity determined by LSC.

Isolation of metabolites and further characterization
Metabolites were isolated from straw samples of the trial with safener. After extraction, purification by SPE, and concentration, several aliquots were subjected to semi-preparative HPLC. The combined fractions were evaporated and partitioned with ethyl acetate and purified applying a second HPLC system with a diol column. After concentration, the purified metabolites were identified by co-chromatography with authentic reference standards and/or by elucidating the structure using spectroscopic methods.

For isolation of metabolites that were more polar in nature, the remaining extract of straw (trial with safener) was purified by SPE. The resulting SPE fractions (water, ACN/water 1/1, ACN/water 8/2 (v/v)) were concentrated and subjected to semi-preparative HPLC. The resulting metabolites were collected separately, concentrated and analysed by LC-MS, LC-MS/MS, Fourier transform mass Spectrometry (FT-MS) and in some cases also by nuclear magnetic resonance imaging (NMR).

B.4.2. Analytical Methodology

Aliquots of extracts and non-extractable residues were analyzed for radioactivity by LSC and combustion/LSC. Extracts were cleaned up and concentrated prior to analysis by HPLC and TLC. HPLC was used for quantitation, characterization, and identification of metabolites. Radio-TLC was conducted as second analytical system to confirm the HPLC results. Metabolites were identified by co-chromatography with authentic reference standards and/or by elucidating the structure using spectroscopic methods.

HPLC analyses were conducted using a reversed-phase Luna C18 column and a gradient mobile phase of 0.02 M aqueous ammonium formate (adjusted to pH 2) and ACN. Non-labeled reference standards were detected by UV absorbtion (215 nm), and radioactivity was quantified using a radioactivity flow monitor. Aliquots of extracts were applied to silica gel 60 F_{254} plates (normal phase) and developed using a mobile phase of toluene:ethanol:ammonia solution (25% NH_3, 6:5:1, v/v). Non-labeled reference items were visualized using UV light (254 nm), and radioactivity was detected using a Bio-Imaging Analyzer.

High-performance liquid chromatography/electrospray ionization mass spectroscopy (LC-MS/MS), LC-MS, FT-MS and NMR analyses were used to elucidate the identity of the metabolites. A radioactivity detector was coupled via a flow splitter between the HPLC instrument and the mass spectrometer.

The LOQ for radio-HPLC was reported as 0.003 ppm for all RACs.

C. RESULTS AND DISCUSSION

Residues levels are expressed as parent compound equivalents (ppm) and as a percentage of the TRR. The distribution of total radioactive residues in wheat RACs is reported in TABLE C.2.1 and depicted in FIGURE C.2.1. The characterization and identification of pyrasulfotole and the metabolites in spring wheat when treated with [phenyl-U-^{14}C]-pyrasulfotole in the presence or absence of safener is reported in TABLES C.2.2.1 and C.2.2.2 and these data are summarized in TABLES C.2.3.1 and C.2.3.2 and depicted in FIGURE C.2.2. The identity of analytes was established using both HPLC- and TLC-co-chromatography. All metabolites were classified as medium polar residues by HPLC. Small amounts of pyrasulfotole and pyrasulfotole-benzoic acid were found in the microwave extracts of all non-edible RACs.

With Safener

The TRR in wheat forage was 2.40 ppm, of which 88.3% of the TRR (2.12 ppm) was extracted at ambient temperature, and 9.2% (0.24 ppm) of the TRR was released by microwave extraction with 2.5% of the TRR (0.06 ppm) remaining as non-extractable. The TRR in wheat forage was comprised of pyrasulfotole (6.8% of the TRR; 0.16 ppm), pyrasulfotole-benzoic acid (13.1% of the TRR; 0.31ppm), pyrasulfotole-desmethyl-*O*-glucoside (43.5% of the TRR; 1.04 ppm) and pyrasulfotole-sulfinyl-lactate (7.8% of the TRR; 0.19 ppm). Several unknown metabolite fractions and regions were detected, none of them exceeding 4.3% of the TRR or 0.10 ppm.

The TRR in wheat hay was 3.14 ppm, of which 81.0% (2.55 ppm) was extracted at ambient temperature, and 13.9% (0.43 ppm) of the TRR was released by microwave extraction with 5.2% (0.16 ppm) remaining as non-extractable. The TRR in wheat hay was comprised of pyrasulfotole (3.7% of the TRR; 0.12 ppm), pyrasulfotole-benzoic acid (21.3% of the TRR; 0.67 ppm), pyrasulfotole-desmethyl-*O*-glucoside (36.7% of the TRR; 1.16 ppm) and pyrasulfotole-sulfinyl-lactate (8.9% of the TRR; 0.28 ppm). Several unknown metabolite fractions and regions were detected, none of them exceeding 5.4% of the TRR (0.17 ppm).

The TRR in wheat straw was 2.90 ppm of which 77.1% (2.23 ppm) was extracted at ambient temperature, and 16.6% of the TRR (0.46 ppm) was released by microwave extraction with 6.4% (0.19 ppm) remaining as non-extractable. The TRR in wheat straw was comprised of pyrasulfotole (4.2% of the TRR; 0.12 ppm), pyrasulfotole-benzoic acid (26.6% of the TRR; 0.77 ppm), and pyrasulfotole-desmethyl-*O*-glucoside (27.9% of the TRR; 0.81 ppm). Isomers of pyrasulfotole-sulfinyl-lactate were identified by spectroscopic methods and comprised 9.6% of the TRR (0.28 ppm). Several unknown metabolite fractions and regions were detected, none of them exceeding 3.6% (0.10 ppm) of the TRR. Small amounts of pyrasulfotole and pyrasulfotole-benzoic acid were found in the microwave extracts.

The TRR in wheat grain was 0.16 ppm of which 97.6% (0.15 ppm) was extracted at ambient temperature, with 2.4% of the TRR (0.004 ppm) remaining as non-extractable. In grain samples, pyrasulfotole-benzoic acid was the only metabolite detected.

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Without Safener

The TRR in wheat forage was 2.44 ppm of which 79.6% of the TRR (1.94 ppm) was extracted at ambient temperature, and 7.9% of the TRR (0.20 ppm) was released by microwave extraction, with 3.5% of the TRR (0.08 ppm) remaining as non-extractable. The TRR in wheat forage was comprised of pyrasulfotole (28.7% of the TRR; 0.71 ppm), pyrasulfotole-benzoic acid (20.1% of the TRR; 0.49 ppm), pyrasulfotole-desmethyl-*O*-glucoside (30.2% of the TRR; 0.74 ppm) and pyrasulfotole-sulfinyl-lactate (3.8% of the TRR; 0.09 ppm). Several unknown metabolite fractions and regions were detected, none of them exceeding 4.3% of the TRR or 0.10 ppm.

The TRR in wheat hay was 3.12 ppm of which 70.9% of the TRR (2.21 ppm) was extracted at ambient temperature, and 15% of the TRR (0.47 ppm) was released by microwave extraction, with 6.7% of the TRR (0.21 ppm) remaining as non-extractable. The TRR in wheat hay was comprised of pyrasulfotole (12.1% of the TRR; 0.37 ppm), pyrasulfotole-benzoic acid (33.6% of the TRR; 1.06 ppm), pyrasulfotole-desmethyl-*O*-glucoside (25.7% of the TRR; 0.80 ppm) and pyrasulfotole-sulfinyl-lactate (5.4% of the TRR; 0.17 ppm). Several unknown metabolite fractions and regions were detected, none of them exceeding 3.0% of the TRR (0.09 ppm) of the TRR.

The TRR in wheat straw was 2.80 ppm of which 65.3% of the TRR (1.83 ppm) was extracted at ambient temperature, and 16% of the TRR (0.44 ppm) was released by microwave extraction with 7.7% of the TRR (0.22 ppm) remaining as non-extractable. The TRR in wheat straw was comprised of pyrasulfotole (7.5% of the TRR; 0.21 ppm), pyrasulfotole-benzoic acid (37.2% of the TRR; 1.04 ppm), and pyrasulfotole-desmethyl-*O*-glucoside (19.6% of the TRR; 0.55 ppm). Isomers of pyrasulfotole-sulfinyl-lactate were identified by spectroscopic methods and comprised 5.7% of the TRR (0.16 ppm) of the TRR. Several unknown metabolite fractions and regions were detected, none of them exceeding 4.4% (0.12 ppm) of the TRR.

The TRR in wheat grain was 0.24 ppm of which 97.7% of the TRR (0.23 ppm) was released by microwave extraction and 2.3% of the TRR (0.005 ppm) remaining as non-extractable. In grain, pyrasulfotole-benzoic acid was the only metabolite detected.

The overall distribution of TRR in wheat RACs is qualitatively and quantitatively similar with and without the safener (FIGURE C.2.1). The distribution of pyrasulfotole and the metabolites in wheat RACs treated with and without safener is qualitatively similar. Pyrasulfotole and the metabolite pyrasufotole-benzoic acid were detected in greater amounts in all wheat RACs treated with safener in comparison to the same RACs without safener as depicted in FIGURE C.2.2. Conversely, the metabolites, pyrasulfotole-desmethyl-*O*-glucoside and pyrasulfotole-sulfinyl-lactate, were detected in lesser amounts in the WS wheat RACs in comparison to the WOS RACs.

The extraction of spring wheat RACs, for both experiments (with and without safener), was finished within one week of sampling. The extracts of each RAC were analyzed within 1-2 weeks. Solids 1 were kept frozen until further extraction by microwave and the corresponding extracts were analyzed within 2 weeks. Chromatograms of the extracts recorded later in the course of this study indicated no changes in metabolic distribution after storage of extracts at –

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18°C. Hence, it was concluded that the results of the present study were not influenced by storage effects, and that the data accurately reflected the metabolic pattern in the RACs of spring wheat.

C.1. Storage Stability

TABLE C.1. Summary of Storage Conditions.

RAC	Storage Temperature (°C)	Actual Study Duration (days)	Interval of Demonstrated Storage Stability (days)
Wheat forage	<-18	Extraction: 1 Analysis: 7	Not required
Wheat hay	<-18	Extraction: 6 Analysis: 8	Not required
Wheat straw	<-18	Extraction: 6 Analysis: 9	Not required
Wheat grain	<-18	Extraction: 5 Analysis: 10	Not required

C.2. Identification, Characterization, and Distribution of Residues

TABLE C.2.1. Distribution of Total Radioactive Residues in Wheat RACs.

RAC	Timing and Applic. No.	PHI (days)	[Phenyl-U-^{14}C] -AE 0317309 (ppm)	[Phenyl-U-^{14}C] -AE 0317309 (ppm)
			With safener	Without safener
Forage	One application of 100 g a.i./ha at growth stage 21-22 (according to BBCH code)	21	2.40	2.44
Hay		44	3.14	3.12
Straw		79	2.90	2.80
Grain		79	0.16	0.24

FIGURE C.2.1. Distribution of Total Radioactive Residue in Wheat RACs.

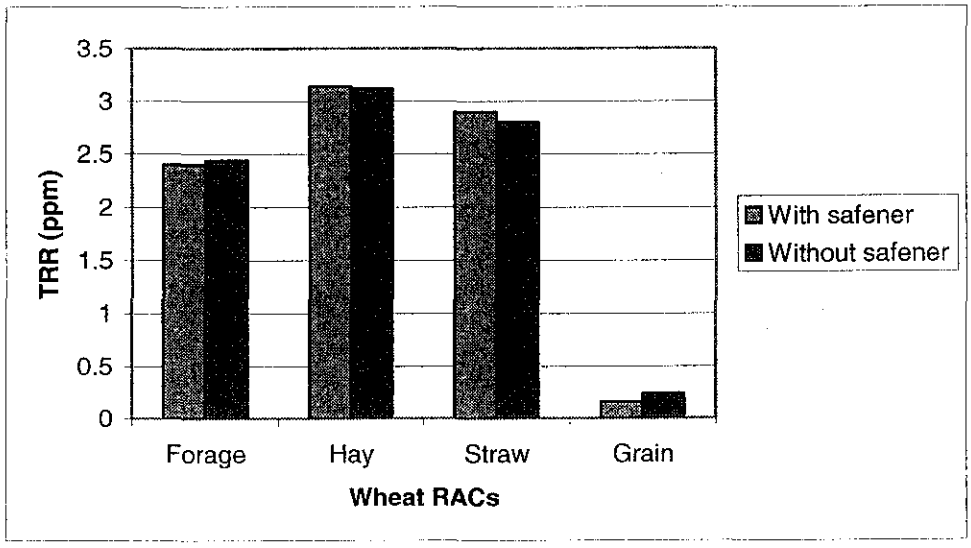

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TABLE C.2.2.1 Characterization and Identification of the Parent and the Metabolites in Spring Wheat when Dosed with [phenyl-U-^{14}C]-Pyrasulfotole ([phenyl-U-^{14}C]AE 0317309) (with Safener).

Metabolite	Forage TRR = 2.40 ppm		Hay TRR = 3.14 ppm		Straw TRR = 2.90 ppm		Grain TRR = 0.16 ppm	
Extract ambient temperature	% of the TRR	ppm	% of the TRR	ppm	% of the TRR	ppm	% of the TRR	ppm
AE 0317309	6.8	0.16	3.7	0.12	4.2	0.12	n.d.	n.d.
AE 0317309-benzoic acid	13.1	0.31	21.3	0.67	26.6	0.77	97.6	0.15
AE 0317309-desmethyl-*O*-glucoside	43.5	1.04	36.7	1.16	27.9	0.81	n.d.	n.d.
AE 0317309-sulfinyl-lactate	7.8	0.19	8.9	0.28	9.6	0.28	n.d.	n.d.
Subtotal identified	***71.2***	***1.70***	***70.6***	***2.23***	***68.3***	***1.98***	***97.6***	***0.15***
Reg#1 (medium polar)	3.2	0.08	5.4	0.17	3.3	0.10	n.d.	n.d.
Reg#4f (medium polar)	1.7	0.04	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Reg#5f, Reg#4h,s (medium polar)	4.3	0.10	2.8	0.09	3.6	0.10	n.d.	n.d.
Reg#6f, Reg#5h,s (medium polar)	2.4	0.06	2.1	0.07	1.9	0.05	n.d.	n.d.
Reg#7 (medium polar)	2.7	0.07	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Reg#10 (medium pol.)	2.9	0.07	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Subtotal extracts	**88.3**	**2.12**	**81.0**	**2.55**	**77.1**	**2.23**	**97.6**	**0.15**
Solids 1	**11.7**	**0.28**	**19.1**	**0.60**	**22.9**	**0.67**	-	-
Microwave extracts								
AE 0317309	0.5	0.02	0.7	0.02	0.4	0.01	n.a.	n.a.
AE 0317309-benzoic acid	3.2	0.08	3.6	0.11	3.9	0.11	n.a.	n.a.
Other regions in microwave extracts	*5.5*	*0.14*	*9.6*	*0.30*	*12.3*	*0.34*	*n.a.*	*n.a.*
Subtotal identified microwave extracts	***3.7***	***0.10***	***4.3***	***0.13***	***4.3***	***0.12***	***n.a.***	***n.a.***
Total bound residues (PES), solids 2	**2.5**	**0.06**	**5.2**	**0.16**	**6.4**	**0.19**	**2.4**	**<0.01**

TABLE C.2.2.2 Characterization and Identification of the Parent and the Metabolites in Spring Wheat when Dosed with [U-^{14}C-phenyl]-Pyrasulfotole ([U-^{14}C-phenyl]-AE 0317309) (without Safener).

Metabolite	Forage TRR = 2.44 ppm		Hay TRR = 3.12 ppm		Straw TRR = 2.80 ppm		Grain TRR = 0.24 ppm	
Extract ambient temperature	% of the TRR	ppm	% of the TRR	ppm	% of the TRR	ppm	% of the TRR	ppm
AE 0317309	28.2	0.69	10.7	0.33	7.5	0.21	n.d.	n.d.
AE 0317309-benzoic acid	17.4	0.42	29.1	0.91	32.5	0.91	97.7	0.23
AE 0317309-desmethyl-*O*-glucoside	30.2	0.74	25.7	0.80	19.6	0.55	n.d.	n.d.
AE 0317309-sulfinyl-lactate	3.8	0.09	5.4	0.17	5.7	0.16	n.d.	n.d.
Subtotal identified	***79.6***	***1.94***	***70.9***	***2.21***	***65.3***	***1.83***	***97.7***	***0.23***
Reg#1 (medium polar)	1.2	0.03	3.0	0.09	4.4	0.12	n.d.	n.d.
Reg#4f (medium polar)	1.7	0.04	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Reg#5f, Reg#4h,s (medium polar)	2.4	0.06	1.5	0.05	2.6	0.07	n.d.	n.d.
Reg#6f, Reg#5h,s (medium polar)	2.0	0.05	1.9	0.06	2.1	0.06	n.d.	n.d.
Reg#7f, Reg#6h,s (medium polar)	1.7	0.04	1.2	0.04	2.1	0.06	n.d.	n.d.
Subtotal extracts	**88.5**	**2.16**	**78.4**	**2.45**	**76.4**	**2.14**	**97.7**	**0.23**
Solids 1	**11.5**	**0.28**	**21.6**	**0.67**	**23.6**	**0.66**	-	-
Microwave extracts								
AE 0317309	0.5	0.02	1.4	0.04	n.d.	n.d.	n.a.	n.a.
AE 0317309-benzoic acid	2.7	0.07	4.5	0.15	4.7	0.13	n.a.	n.a.
Other regions in microwave extracts	*4.7*	*0.11*	*9.1*	*0.28*	*11.3*	*0.31*	*n.a.*	*n.a.*
Subtotal identified microwave extracts	***3.2***	***0.09***	***5.9***	***0.19***	***4.7***	***0.13***	***n.a.***	***n.a.***
Total bound residues (PES), solids 2	**3.5**	**0.08**	**6.7**	**0.21**	**7.7**	**0.22**	**2.3**	**<0.01**

n.d.: not detected; n.a.: not analysed

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FIGURE C.2.2. Distribution of pyrasulfotole and the metabolites in spring wheat treated with safener (WS) and without safener (WOS).

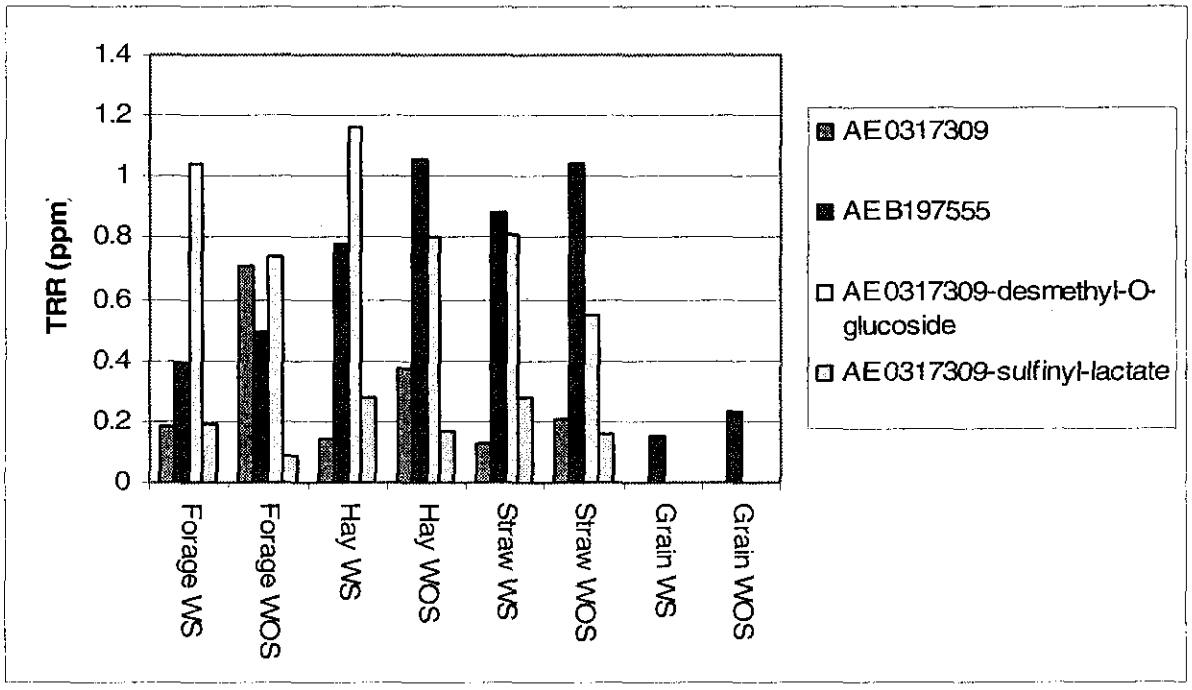

TABLE C.2.3.1 Summary of Characterization and Identification of Radioactive Residues in Plant RACs Following Application of Radiolabeled AE 0317309 at a Rate of 100 g a.i./ha (With Safener)

Compound	Forage		Hay		Straw		Grain	
	TRR = 2.40 ppm		TRR = 3.14 ppm		TRR = 2.90 ppm		TRR = 0.16 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309	7.3	0.18	4.4	0.14	4.6	0.13	n.d.	n.d.
AE 0317309-benzoic acid	16.3	0.39	24.9	0.78	30.5	0.88	97.6	0.15
AE 0317309-desmethyl-*O*-glucoside	43.5	1.04	36.7	1.16	27.9	0.81	n.d	n.d.
AE 0317309-sulfinyl-lactate	7.8	0.19	8.9	0.28	9.6	0.28	n.d	n.d.
Total identified	74.9	1.80	74.9	2.36	72.6	2.10	97.6	0.15
Total characterized	22.7	0.53	19.9	0.63	21.1	0.59	n.d.	n.d.
Total extractable	97.6	2.33	94.8	2.99`	93.7	2.69	97.6	0.15
Total bound	2.5	0.06	5.2	0.16	6.4	0.19	2.4	0.004
% Accountability	99.6		100.3		99.3		96.3	

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TABLE C.2.3.2. Summary of Characterization and Identification of Radioactive Residues in Plant RACs Following Application of Radiolabeled AE 0317309 at a Rate of 100 g a.i./ha (Without Safener).

Compound	Forage		Hay		Straw		Grain	
	TRR = 2.44 ppm		TRR = 3.12 ppm		TRR = 2.80 ppm		TRR = 0.24 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309	28.7	0.71	12.1	0.37	7.5	0.21	n.d.	n.d.
AE 0317309-benzoic acid	20.1	0.49	33.6	1.06	37.2	1.04	97.7	0.23
AE 0317309-desmethyl-*O*-glucoside	30.2	0.74	25.7	0.80	19.6	0.55	n.d.	n.d.
AE 0317309-sulfinyl-lactate	3.8	0.09	5.4	0.17	5.7	0.16	n.d.	n.d.
Total identified	82.8	2.03	76.8	2.40	70.0	1.96	97.7	0.23
Total characterized	13.7	0.33	16.7	0.52	22.5	0.62	n.d.	n.d.
Total extractable	96.5	2.36	93.4	2.92	92.4	2.58	97.7	0.23
Total bound	3.5	0.08	6.7	0.21	7.7	0.22	2.3	0.005
% Accountability	100		100.3		100		97.9	

Accountability = (Total extractable + Total non-extractable)/(TRRs from combustion analysis)* 100.

C.3. Proposed Metabolic Profile

The following main reactions were involved in the metabolic breakdown of pyrasulfotole in spring wheat after spray application:

- cleavage of the pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite
- demethylation yielding pyrasulfotole-desmethyl (AE 1073910), and subsequent glucosylation resulting in pyrasulfotole-desmethyl-*O*-glucoside.
- further conjugation of the pyrasulfotole-desmethyl with glutathione leading to the pyrasulfotole-sulfinyl-lactate

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FIGURE C.3.1. Proposed Metabolic Profile of Pyrasulfotole in Spring Wheat

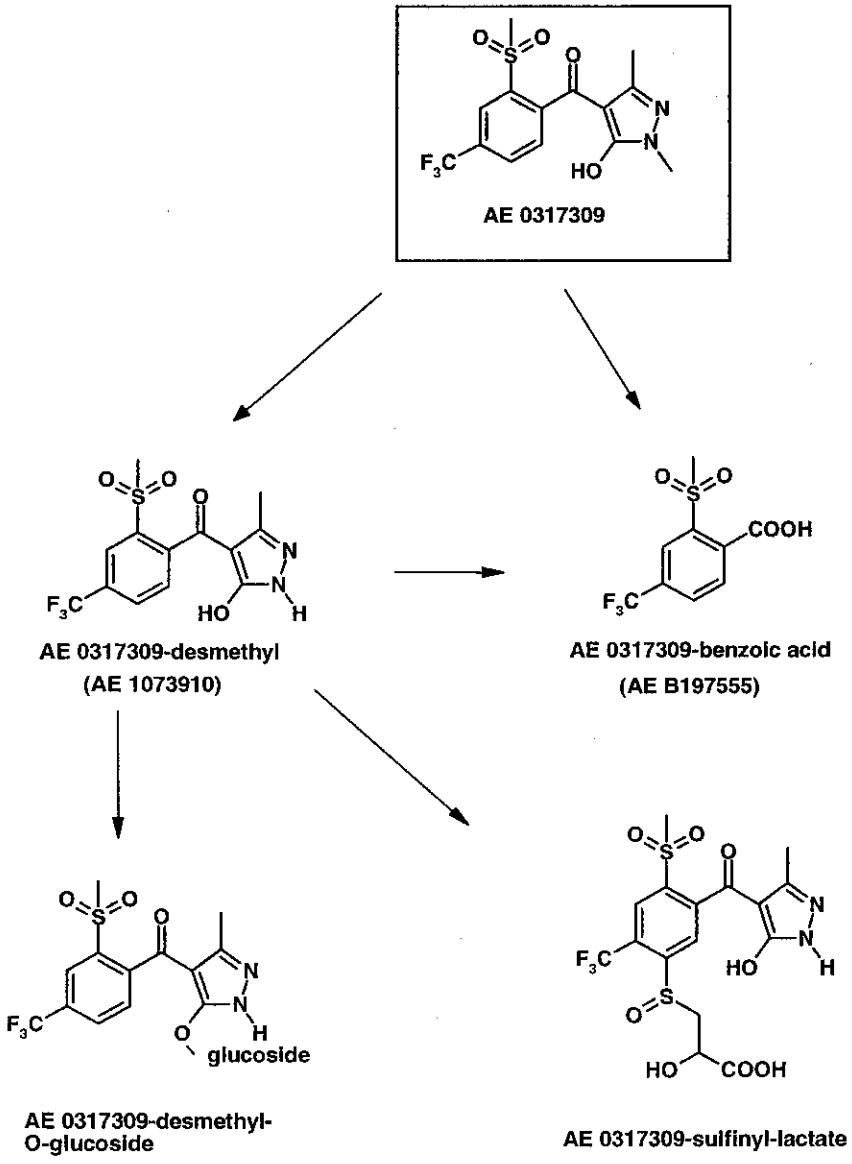

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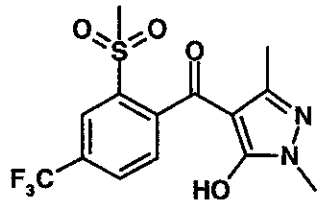
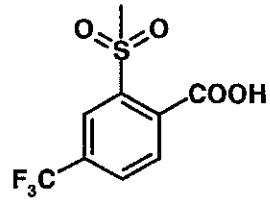
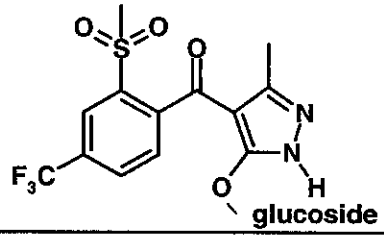
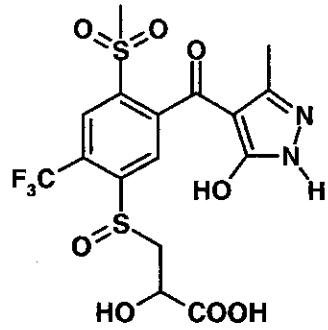
TABLE C.3.1. Identification of Compounds from Metabolism Study

Common name/code Figure C.3.1 ID No.	Chemical name	Chemical structure
pyrasulfotole AE 0317309	5-hydroxy-1,3-dimethylpyrazol-4-yl) (2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-benzoic acid AE B197555	2-mesyl-trifluoromethylbenzoic acid	
pyrasulfotole-desmethyl-O-glucoside	Not provided	
pyrasulfotol-sulfinyl-lactate	Not provided	

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D. CONCLUSION

TRR levels in wheat RACs were quantitatively similar following spray application with [phenyl-U-^{14}C]-pyrasulfotole at a nominal rate of 100 g a.i./ha in the absence or presence of the safener mefenpyr-diethyl (AE F107892). Approximately 70-83% of the TRR was identified in non-edible RACs, whereas 98% (only pyrasulfotole-benzoic acid) was identified in grain. Pyrasulfotole was still a major component of the residues in forage, but was readily degraded in hay and straw, and was not detected in grain. The metabolism of pyrasulfotole in wheat treated with safener resulted in the same metabolites (pyrasulfotole-benzoic acid, pyrasulfotole-desmethyl-*O*-glucoside and pyrasulfotole-sulfinyl-lactate) as those trials without safener.

The metabolic breakdown of pyrasulfotole in spring wheat involves cleavage of the pyrazole moiety leaving the pyrasulfotole-benzoic acid metabolite (AE B197555). Demethylation and subsequent glucosylation of pyrasulfotole results in pyrasulfotole-desmethyl, and pyrasulfotole-desmethyl-*O*-glucoside, respectively. Further conjugation with glutathione yields pyrasulfotole-sulfinyl-lactate.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

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8. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

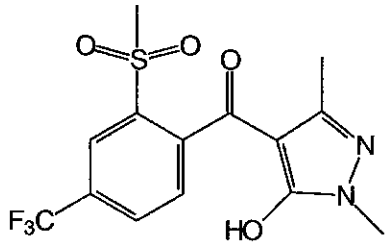
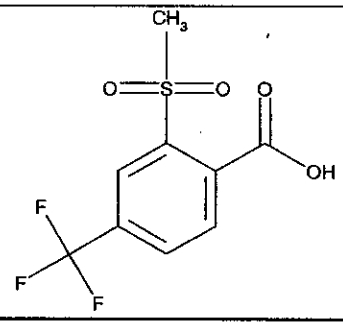
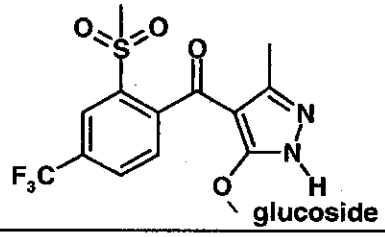
F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (8 November 2006); George Kramer (8 November 2006);
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

APPENDIX 1

Reference Standards

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
pyrasulfotole-desmethyl-O-glucoside 2WI27P5	Not provided	

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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F. Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORT:

MRID No. 46801802 Rupprecht, J. K. (2006) Metabolism of [phenyl-U-^{14}C]-AE 0317309 in the Laying Hen: Bayer CropScience Study Identification: MEAIM012. Unpublished Bayer CropScience Report Number: MEAIM012. January 16, 2006. 93 pages.

MRID No. 46801803 Rupprecht, J. K. (2006) Metabolism of [pyrazole-3-^{14}C]-AE 0317309 in the Laying Hen: Bayer CropScience Lab Project Number: 04MEAIM011. Unpublished Bayer CropScience Report Number: MEAIM011. January 25, 2006. 91 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience has submitted two studies investigating the metabolism of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole (AE 0317309) in laying hens. Six laying hens were dosed orally once daily for 14 consecutive days at a dose level equal to 8.6 ppm [phenyl-U-^{14}C]-pyrasulfotole equivalents (specific activity of 62.4 µCi/mg) in the diet, based on the weight of feed, corresponding to 0.82 mg/kg body weight per day. Also six laying hens were dosed with 10.5 ppm [pyrazole-3-^{14}C]-pyrasulfotole equivalents (specific activity of 65.4 µCi/mg) in the diet, based on the weight of feed, corresponding to 0.81 mg/kg body weight per day.

Eggs were collected twice a day during the treatment period and excreta were collected daily during the treatment period. Approximately 30 minutes after the last dose, the hens were sacrificed and the edible tissues (liver, muscle, and composite fat) were collected for analysis. Identification and quantitation of the metabolites in the extractable residue was accomplished by using reverse phase high performance liquid chromatography (HPLC) and high performance liquid chromatography with electrospray ionization and tandem mass spectrometry (LC-MS/MS).

In the phenyl-label study, the total radioactive residues (TRR, expressed as pyrasulfotole equivalents) were 1.560 ppm in liver, 0.066 ppm in fat, 0.038 ppm in muscle and <0.001-0.002 ppm in eggs. The majority of the residue in the tissues and eggs was extractable (83.8-99.8% of the TRR). The majority of the residue was identified in the liver, fat and muscle matrices (97.5-99.8 % of the TRR). The predominant residue was pyrasulfotole, with lesser amounts of the pyrasulfotole-desmethyl metabolite (AE 1073910). More than 97% of the administered dose was recovered in the excreta, with less than 0.4% in tissues and eggs.

In the pyrazole-label study, TRR (expressed as pyrasulfotole equivalents) were 1.285 ppm in liver, 0.015 ppm in fat, 0.020 ppm in muscle and 0.001-0.004 ppm in eggs. The majority of the residue in the tissues was extractable (96.8-99.4% of the TRR) and approximately half of the egg residue was extractable (47.4% of the TRR). The majority of the residue was identified in the liver and muscle matrices (95.1 –99.4 % of the TRR). The predominant residue was pyrasulfotole, with lesser amounts of the pyrasulfotole-desmethyl metabolite (AE 1073910). Most of the radioactivity (>85%) was recovered in excreta, with less than 0.2% remaining in the tissues and eggs.

The metabolic fate of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in laying hens involved the *N*-demethylation of pyrasulfotole to yield the pyrasulfotole-desmethyl metabolite (AE 0317310).

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STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the laying hen metabolism data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

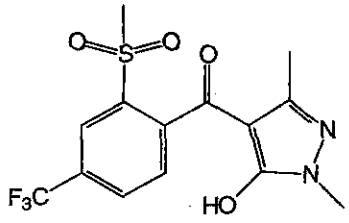
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/EP	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Livestock

B.1.1 *Test System, Animal Handling and Dosing*

The biological phase of this metabolism study was conducted at Southwest Bio-Labs, Inc. Six laying hens (*Gallus domesticus*, var. Leghorn) were dosed with [pyrazole-3-^{14}C]-pyrasulfotole (0.81 mg/kg body weight) and [phenyl-U-^{14}C]-pyrasulfotole (0.82 mg/kg body weight) on each of 14 consecutive days at Southwest Bio-Labs, Inc.. The treatments were administered orally via gelatin capsule using a balling gun each morning. The animals were allowed *ad libitum* access to feed and water throughout the study. General test animal information, test animal dietary regime and test animal dosing regime are given in TABLES B.1.1, B.1.2 and B.1.3.

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TABLE B.1.1. General Test Animal Information.

Species	Breed	Age	Weight at study initiation (kg)		Health Status	Description of housing/holding area
			Phenyl	Pyrazole		
Gallus domesticus	Leghorn	Ca. 45 weeks	1.311	1.635	Overall, the animals appeared healthy throughout the course of the study as evidenced by observance of feed consumption, egg production, daily observations, body weights, and observations of tissues at necropsy.	Animals were housed in metabolism cages. The minimum/maximum temperatures and relative humidity were recorded daily throughout the study. The lighting control was set to a photoperiod of 16 hours light and 8 hours dark and was utilized throughout of the study.
			1.586	1.485		
			1.667	1.720		
			1.727	1.690		
			1.682	1.350		
			1.662	1.645		

TABLE B.1.2. Test Animal Dietary Regime.

Composition of Diet	Feed consumption (kg/day)	Water	Acclimation period	Predosing
Ad libitum access to Nutrena® Naturewise™ Layer 16 Complete Crumbs	Phenyl label: 0.148[a] Pyrazole label: 0.122[a]	*Ad libitum*	Animals were brought onto the study from SBL's flock and therefore only two days were needed for acclimation in order to obtain baseline data prior to dosing.	None

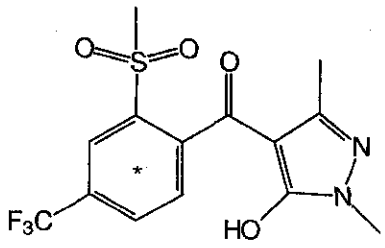
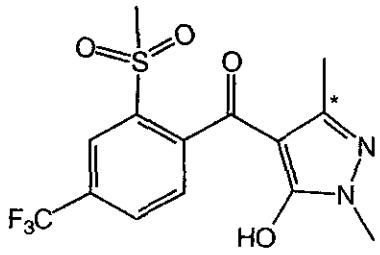
[a] This represents the average daily feed consumption (kg/day) for all the hens in this study.

TABLE B.1.3. Test Animal Dosing Regime.

Treatment Type	Feeding Level (ppm test material in food)	Vehicle	Timing/Duration
Oral	Phenyl label: 8.6 Pyrazole label: 10.5	Gelatin capsule filled with alpha-lactose	14 days

B.2. Test Materials

TABLE B.2.1. Test Material Characteristics.

Chemical structure	 * position of radiolabel	 * position of radiolabel
Radiolabel position	[phenyl-U-^{14}C]-AE 0317309	[pyrazole-3-^{14}C]-AE 0317309
Lot No.	SEL 1319	SEL 1320
Purity	100.0%	100.0%
Dosing solutionSpecific activity	62.4µCi/mg 138,528 dpm/µg	64.5µCi/mg 143,190 dpm/µg

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B.3. Sampling Information

Eggs were collected twice daily beginning at receipt and continued until the scheduled termination for each animal. Starting on Study Day 1, eggs from the afternoon and the following morning were collected, shells removed and the contents composited to form one day's sample. Excreta was collected for analysis beginning on Study Day 1 and continued until the scheduled termination for each animal. Excreta specimens collected were composited and weighed.

The animals were humanely terminated approximately 28-29 minutes following the fourteenth dose. At necropsy, tissues were dissected and examined for gross pathology or other abnormalities. Following the examination, liver, majority of muscle (a composite of leg and breast), and majority of fat (subcutaneous) were collected. Internal hard-shelled eggs were collected for the day 14-egg production. Sampling collection information and dates for treatment, sampling, extraction, and analysis of hen tissues, eggs and excreta are given in TABLE B.3.1.

TABLE B.3.1. Sample Collection Information.

Eggs collected[a]	Excreta	Interval from last dose to sacrifice	Tissues harvested and analysed
Phenyl-label study			
5.7 eggs daily post-treatment 5.5 eggs daily pre-treatment	1295 g daily	29-31 minutes	Liver, Fat and Muscle
Pyrazole-label study			
4.8 eggs daily post-treatment 4 eggs daily pre-treatment	1021 g daily	28-29 minutes	Liver, Fat and Muscle

[a] This represents the average daily egg production for all the hens in this study.

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B.4. Identification/ Characterization of Residues

B.4.1. Sample Handling and Preparation

B.4.1.1. Sample Processing and Shipping

Each tissue from each animal was cubed, composited into one tissue sample per tissue type, weighed, double bagged and stored frozen. Each composited tissue sample was homogenized and shipped frozen to the Bayer Research Park. All samples for analysis arrived still thoroughly frozen on dry ice and were immediately placed in a freezer and stored frozen prior to analysis. Upon arrival, aliquots (0.05 to 0.6 g) of the eggs, tissues and excreta were oxidized to determine the TRR levels (TABLE C.2.1). All remaining eggs and tissues were stored frozen for later analysis.

B.4.1.2 Extraction and Analysis of Samples

Specific details related to the extraction of radioactive residues in liver, muscle, fat and eggs are given below and in FIGURE B.4.1.2.1. All solvents (HPLC grade) and reagent chemicals were obtained from commercial suppliers and were used without additional purification. Water was deionized and purified using a MILLI-Q Water System.

B.4.1.2.1 Liver

Extraction of the liver is outlined in FIGURE B.4.1.2.1. An aliquot of liver was weighed into a 200 mL centrifuge bottle. The sample was blended with 100 mL of acetonitrile/water (4:1) for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile/water (4:1). The combined acetonitrile/water (4:1) extract was radioassayed.

The remaining solids were blended with 100 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile. The combined acetonitrile extract was radioassayed.

Aliquots of the acetonitrile/water extract and the acetonitrile extract were combined and concentrated to dryness using a gentle stream of nitrogen gas. The residual solids were reconstituted in acetonitrile/aqueous 0.1% trifluoroacetic acid (TFA) (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC.

The remaining acetonitrile extracted solids were suspended in acetonitrile/water (4:1, 150 mL),

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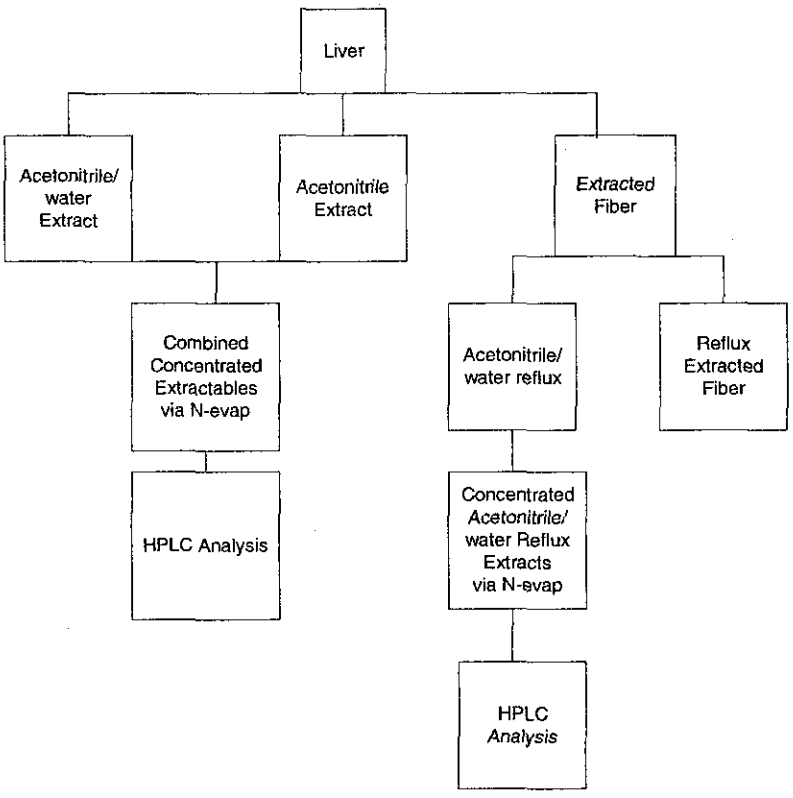
stirred and refluxed at 70 to 80°C for 24 hours. The suspension was cooled to room temperature and filtered through a sinter funnel into a graduated cylinder. The resulting filter cake was rinsed three times with acetonitrile/water (4:1). The filtrate and rinses were combined and radioassayed.

An aliquot of the acetonitrile/water (4:1) reflux extract was concentrated to dryness using a gentle stream of nitrogen gas. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC. Aliquots of the pre-weighed acetonitrile/water (4:1) reflux extracted liver were taken for combustion analysis.

FIGURE B.4.1.2.1. Summary of Extraction of Liver



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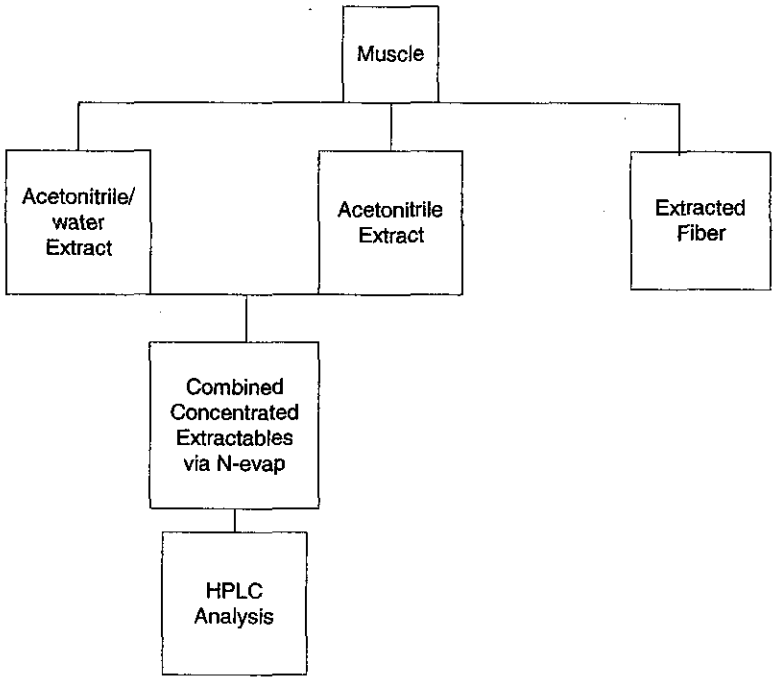
B.4.1.2.2 Muscle

Extraction of the muscle is outlined in FIGURE B.4.1.2.2. Four aliquots of muscle were weighed into separate 200 mL centrifuge bottles. Each sample was blended with 100 mL of acetonitrile/water (4:1) for 3 minutes using the Ultra Turrex. The samples were centrifuged at 2500 rpm for 10 minutes. The supernatants were decanted from the solids into a graduated cylinder. For each centrifuge bottle, the extraction and centrifugation were repeated twice with a fresh 75 mL portion of acetonitrile/water (4:1). The combined acetonitrile/water (4:1) extract was radioassayed.

An aliquot of the acetonitrile/water extract was concentrated to dryness using a gentle stream of nitrogen gas. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC.

The remaining solids were blended with 100 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh portions of acetonitrile. The combined acetonitrile extract was radioassayed. Aliquots of the pre-weighed extracted muscle were taken for combustion analysis.

FIGURE B.4.1.2.2 Summary of Extraction of Muscle



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B.4.1.2.3 Fat

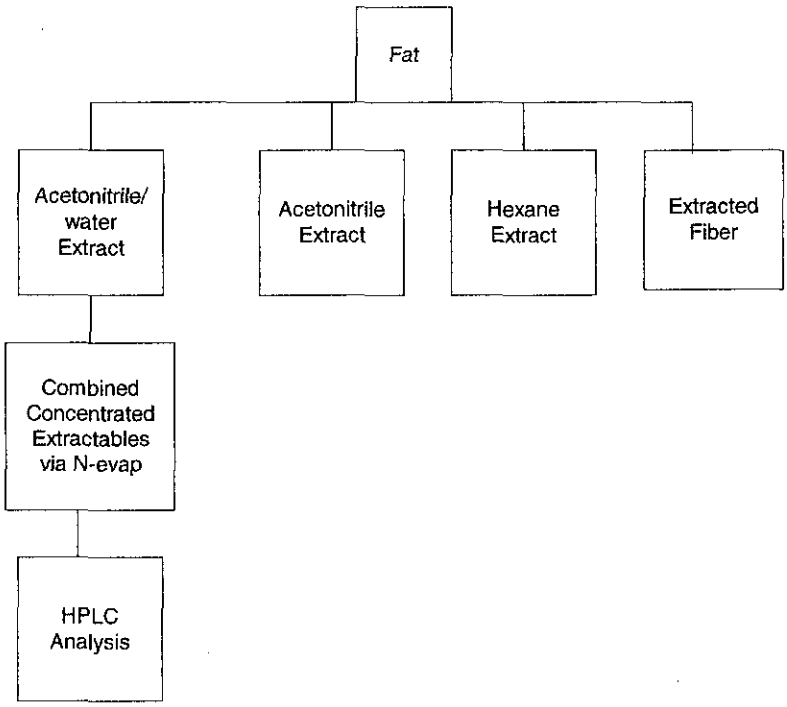
The extraction of fat is outlined in FIGURE B.4.1.2.3. An aliquot of fat was weighed into a 200 mL centrifuge bottle. The sample was blended with 100 mL of acetonitrile/water (4:1) for 3 minutes using the Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated twice with a fresh portion of acetonitrile/water (4:1). The combined acetonitrile/water (4:1) extract was radioassayed.

The remaining solids were blended with 100 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 100 mL portions of acetonitrile. The combined acetonitrile extract was radioassayed.

An aliquot of the acetonitrile/water extract was concentrated to dryness using a gentle stream of nitrogen gas. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC.

Aliquots of the pre-weighed extracted fat were taken for combustion analysis.

FIGURE B.4.1.2.3 Summary of Extraction of Fat



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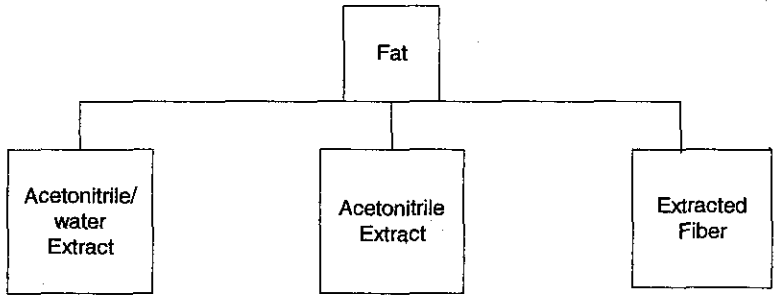
B.4.1.2.4 Eggs

The extraction of the Day 14 egg sample is summarized in FIGURE B.4.1.2.4. An aliquot of the Day 14 egg sample was weighed into a 200 mL centrifuge bottle. The sample was blended with 100 mL of acetonitrile/water (4:1) for 3 minutes using the Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated twice with a fresh 75 mL portion of acetonitrile/water (4:1). The combined acetonitrile/water (4:1) extract was radioassayed.

The remaining solids were blended with 100 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh portions of acetonitrile. The combined acetonitrile extract was radioassayed. Aliquots of the pre-weighed extracted egg were taken for combustion analysis.

FIGURE B.4.1.2.4 Summary of Extraction of Eggs



B.4.1.2.5 Excreta

Aliquots of the pre-weighed excreta were taken for combustion analysis.

B.4.2. Analytical Methodology

B.4.2.1 Measurement of Radioactivity

Liquid samples (0.010 mL to 2.00 mL) were mixed with 6 or 20 mL of Ultima Gold™ scintillation fluid and radioassayed in a Beckman Model LS6000LL, or LS6500 liquid scintillation counter (LSC). Data were processed with Beckman data reduction software. Aliquots of solid samples were oxidized and radioassayed.

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B.4.2.2 Chromatography

B.4.2.2.1 Radio-High Performance Liquid Chromatography (HPLC)

HPLC analysis was performed with a Beckman System Gold Chromatographic system consisting of a Beckman Model 128 solvent module and a Beckman Model 166 variable wavelength detector. The chromatographic system was connected to a radioactivity detector. Data were collected and analyzed by a Beckman Gold Nouveau Chromatography Workstation. Samples were dissolved in acetonitrile/0.1% aqueous acetic acid (1:9), except as noted, prior to HPLC analysis.

TABLE B.4.2. Limits of Detection and Quantitation.

Study	Background	Counting Efficiency		Specific Activity	Sample Volume	Aliquot Size	LSC LOQ	Combustion LOQ	HPLC LOD
		Combustion	LSC	dpm/µg	mL	g	ng	ppm	ng
Phenyl-label	25 dpm	81%	84%	138,528	1	0.1	0.43 ng	0.00049	4.1
Pyrazole-label	25 dpm	81%	84%	143,190	1	0.1	0.42ng	0.00043	4.0

B.4.2.2.2 Mass Spectrometry

Mass spectral analyses were performed with a TSQ 7000 mass spectrometer. The spectrometer was connected to an HPLC system consisting of a P4000 quaternary gradient solvent pump, an autosampler, and a Zorbax Rx C8 (5µ, 250 mm x 4.6mm) reverse phase column. For negative ion electrospray LC-MS analyses, solvent A (0.1% formic acid) and solvent B (methanol) were used in combination as the mobile phase at a flow rate of 0.8 mL/min. The flow from the column was split to deliver 0.2 mL/min to the electrospray interface and 0.6 mL/min to a radiodetector. The solvent gradient program was a linear ramp from 5% solvent B to 100% solvent B over 11 minutes.

Daughter ion spectra were produced by liquid chromatography/mass spectrometry/mass spectrometry (LC-MS/MS). The first quadrapole of the TSQ 7000 was used to isolate a precursor ion, which, in the negative ion mode, was a deprotonated $(M-1)^+$ ion. The second stage of the instrument was used to induce fragmentation of the precursor ion by collision with argon gas at approximately 2.3-mTorr and collision energy of about 20 eV. The second quadrapole of the instrument was used to measure the mass spectra of the resultant molecular fragments.

C. RESULTS AND DISCUSSION

TRR in hen egg and tissues is reported in TABLE C.2.1. The pharmacokinetics of the radiolabels in excreta and eggs are depicted in FIGURES C.2.1 and C.2.1.1. The distribution of radioactivity in hen commodities is reported in TABLE C.2.2. Characterization and identification of radioactive residues is summarized in TABLE C.2.3.

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Distribution of total radioactive residues:

A total of 97.5% and 85.2% of the administered dose was recovered for [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole studies, respectively. The majority of the recovered radioactivity was in the excreta at 97.2% (phenyl-label) and 85.2% (pyrazole-label). Over the course of the 14-day treatment period, the pharmacokinetics of the phenyl and pyrazole-label studies were within normal biological deviations. The TRRs in eggs plateaued after 8 days of treatment at 0.002 ppm (phenyl-label) and 0.003 ppm (pyrazole-label). The TRR reported for the [phenyl-U-^{14}C] study in liver, fat and muscle were 1.560 ppm, 0.066 ppm and 0.038 ppm, respectively. Residue levels in the eggs sampled daily ranged from 0.000 to 0.002 ppm, for a total of 0.019 ppm. The TRR reported for the [pyrazole-3-^{14}C] study in liver, fat and muscle were 1.285 ppm, 0.015 ppm, and 0.020 ppm, respectively. Residue levels in the eggs sampled daily ranged from 0.000 ppm to 0.004 ppm, for a total of 0.033 ppm.

Characterization and identification of TRRs:

The major component of the combined acetonitrile/water, acetonitrile, and acetonitrile/water reflux extracts was isolated by preparative HPLC and subjected to mass spectrometry. Negative ion LC-MS showed a parent ion at m/z 361 $(M-1)^+$. The negative ion LC-MS/MS daughter ion spectrum of the m/z 361 and HPLC retention time were both identical to an authentic pyrasulfotole standard (MW=362). The pyrasulfotole-desmethyl (AE 1073910) metabolite was identified based on its HPLC retention time relative to an authentic standard of AE 1073910. Also, the negative ion LC-MS showed an ion at m/z 347 $(M-1)^+$. The negative ion LC-MS/MS daughter ion spectrum of m/z 347 and HPLC retention time were both identical to an authentic AE 1073910 standard (MW=348).

Phenyl-label study. Extraction of liver with acetonitrile/water (4:1) and acetonitrile released 92.9% of the TRR (1.449 ppm). Acetonitrile/water reflux released an additional 6.9% of the TRR (0.107 ppm). The remaining solids contained 0.2 % of the TRR (0.004 ppm). The major component of the combined acetonitrile/water (4:1) and acetonitrile liver extract was positively identified as pyrasulfotole (86.5% of the TRR, 1.350 ppm). The minor component was identified as the pyrasulfotole-desmethyl metabolite (6.4 % of the TRR, 0.099 ppm). The acetonitrile/water reflux liver extract was comprised of pyrasulfotole (6.9% of the TRR, 0.107 ppm) and pyrasulfotole-desmethyl (0.1 % of the TRR, 0.002 ppm). Total identification of the radioactive residues in liver was pyrasulfotole at 93.3% (1.456 ppm) with an additional 6.5% of the TRR (0.101 ppm) identified as pyrasulfotole-desmethyl.

Extraction of muscle with acetonitrile/water released 97.5% of the TRR (0.037 ppm). Acetonitrile extraction released an additional 1.3% of the TRR (0.001 ppm) and was not analyzed further. The remaining solids contained 1.2% of the TRR (<0.001 ppm). The major component (95.3% of the TRR, 0.036 ppm) of the combined acetonitrile/water (4:1) muscle extract was identified as pyrasulfotole. The minor component (2.2 % of the TRR, 0.001 ppm) was identified as pyrasulfotole-desmethyl. Total identification of the radioactive residues in

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muscle was pyrasulfotole at 95.3% (0.018 ppm) with an additional 2.2% of the TRR (0.001 ppm) as pyrasulfotole-desmethyl.

Extraction of fat with acetonitrile/water released 98.9% of the TRR (0.065 ppm). Acetonitrile and hexane extraction released only an additional 0.5% of the TRR (<0.001 ppm) and was not analyzed further. The remaining solids contained 0.6% of the TRR (<0.001 ppm). The component of the acetonitrile/water (4:1) fat extract was identified as pyrasulfotole (97.1% of the TRR, 0.064 ppm), with the minor component (1.8 % of the TRR, 0.001 ppm) identified as the pyrasulfotole-desmethyl. Total identification of the radioactive residues in fat was pyrasulfotole at 97.1% (0.064 ppm) with an additional 1.8% of the TRR (0.001 ppm) as pyrasulfotole-desmethyl.

Extraction of eggs with acetonitrile/water released 80.9% of the TRR (<0.001 ppm). Further extraction with acetonitrile released an additional 2.9% of the TRR (< 0.001 ppm). The total extractable residue was < 0.01 ppm; therefore the acetonitrile/water and acetonitrile extracts were not analyzed further for identification purposes. The remaining solids contained 16.2% of the TRR (< 0.001 ppm).

The overall accountability of the TRR in tissues and eggs was 100%.

Pyrazole-label study: Extraction of liver with acetonitrile/water (4:1) and acetonitrile released 90.1% of the TRR (1.158 ppm). Acetonitrile/water reflux released an additional 9.3% of the TRR (0.119 ppm). The remaining solids contained 0.6% of the TRR (0.008 ppm). The major component of the combined acetonitrile/water (4:1) and acetonitrile liver extract was identified as pyrasulfotole (85.3% of the TRR, 1.096 ppm) with a minor component (4.8% of the TRR, 0.062 ppm) identified as the pyrasulfotole-desmethyl metabolite. The single component of the acetonitrile/water reflux liver extract (9.3% of the TRR, 0.119 ppm) was identified as the parent ion. A total of 94.6% (1.215 ppm) of the TRR in liver was identified as pyrasulfotole, with an additional 4.8% of the TRR (0.062 ppm) as pyrasulfotole-desmethyl.

Extraction of muscle with acetonitrile/water released 95.1% of the TRR (0.019 ppm). Acetonitrile extraction released only an additional 1.7% of the TRR (<0.001 ppm) and was not analyzed further. The remaining solids contained 3.2% of the TRR (0.001 ppm). The major component of the combined acetonitrile/water (4:1) muscle extract was identified as pyrasulfotole (92.9% of the TRR, 0.018 ppm), with a minor component (2.2 % of the TRR, <0.001 ppm) as the pyrasulfotole-desmethyl.

Extraction of fat with acetonitrile/water (87% of the TRR, 0.013 ppm) and acetonitrile (1.8% of the TRR, < 0.001 ppm) and hexane (8.9% of the TRR, 0.001 ppm) released a total of 97.7% of the TRR (0.014 ppm), of which was predominantly identified as pyrasulfotole (AE 0317309). The remaining solids contained only 2.3% of the TRR (<0.001 ppm).

Extraction of eggs with acetonitrile/water and acetonitrile released 47.4% of the TRR (0.002

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EPA's Records Disposition Schedule PEST 361 Scientific Data Reviews HED Records Center - File R153474 - Page 342 of 428

ppm). Since the total extractable residue was <0.01 ppm, the sample was not analyzed further for identification purposes. The remaining solids contained 52.6% of the TRR (0.002 ppm).

The overall accountability of the TRR was 100% in tissues and 133% in eggs.

C.1. Storage Stability

Animal tissues were frozen immediately after dissection. Eggs and excreta samples were frozen after collection. Samples were stored frozen prior to analysis. The tissues were shipped to Bayer CropScience on dry ice. Upon arrival at Bayer CropScience, the samples remained frozen solid and were stored frozen prior to analysis. All tissues were extracted and the metabolic profile determined within 2 to 6 months (TABLE C.1). Metabolites in the extractable residue of liver and muscle were profiled within 3 to 4 months (123 days) of necropsy. The high accountability of the TRR as identified metabolites and the similarity of the profile between tissues support stability over the short storage period.

TABLE C.1. Summary of Storage Conditions.

Matrix	Storage Temp.(°C)	Actual Storage Duration (days)		Interval of Demonstrated Storage Stability (days)
		Phenyl	Pyrazole	
Excreta	<-20	97	132	Not required [a]
Liver	<-20	64	123	Not required
Muscle	<-20	62	61	Not required
Fat	<-20	62	90	Not required
Eggs	<-20	28	61	Not required

[a]. Storage stability data should not normally be required for samples analyzed within 4 to 6 months of collection.[10]

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C.2. Identification, Characterization, and Distribution of Residues

TABLE C.2.1. Total Radioactive Residues (TRR) in Eggs, Tissue and Excreta.

Matrix	Collection Timing	[Phenyl-U-^{14}C]-AE 0317309		[Pyrazole-3-^{14}C]-AE 0317309	
		ppm	% AD	ppm	% AD
Excreta	Day 1	5.049	6.903	5.695	4.984
	Day 2	5.230	7.515	10.896	7.448
	Day 3	5.245	7.332	7.518	6.860
	Day 4	5.643	7.616	7.650	7.485
	Day 5	5.151	7.282	6.743	7.626
	Day 6	4.953	7.237	6.272	7.583
	Day 7	5.529	6.633	6.228	6.921
	Day 8	6.546	7.664	6.309	6.730
	Day 9	6.401	7.292	7.613	7.612
	Day 10	6.016	7.000	3.903	4.327
	Day 11	6.589	7.923	4.884	4.992
	Day 12	7.033	9.067	4.262	4.559
	Day 13	6.174	7.459	6.970	7.312
	Day 14	4.075	0.235	6.828	0.795
Excreta	Total	79.634	97.158	91.771	85.234
Muscle	At sacrifice	0.038	0.050	0.020	0.048
Fat	At sacrifice	0.066	0.005	0.015	0.016
Liver	At sacrifice	1.560	0.307	1.285	0.108
Eggs	Day 1, pm + am	0.000	< 0.001		< 0.001
	Day 2, pm + am	0.000	< 0.001	0.000	< 0.001
	Day 3, pm + am	0.001	< 0.001	0.001	< 0.001
	Day 4, pm + am	0.001	< 0.001	0.001	< 0.001
	Day 5, pm + am	0.001	< 0.001	0.002	< 0.001
	Day 6, pm + am	0.001	< 0.001	0.002	< 0.001
	Day 7, pm + am	0.001	< 0.001	0.003	< 0.001
	Day 8, pm + am	0.002	< 0.001	0.002	< 0.001
	Day 9, pm + am	0.002	< 0.001	0.003	< 0.001
	Day 10, pm + am	0.002	< 0.001	0.003	< 0.001
	Day 11, pm + am	0.002	< 0.001	0.003	< 0.001
	Day 12, pm + am	0.002	< 0.001	0.003	< 0.001
	Day 13, pm + am	0.002	< 0.001	0.004	< 0.001
	Day 14, pm + am	0.002	< 0.001	0.003	< 0.001
				0.003	
	Total	0.019	0.006	0.033	0.005
Upper GI tract	Not Applicable	Not Applicable		Not Applicable	
Lower GI tract	Not Applicable	Not Applicable		Not Applicable	
Other	Not Applicable	Not Applicable		Not Applicable	
Sum of % Administered Dose		97.526%		85.411%	

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FIGURE C.2.1. Pharmacokinetics of [Phenyl-U-^{14}C]-AE 0317309 and [Pyrazole-3-^{14}C]- AE 0317309 in Excreta of the Laying Hen

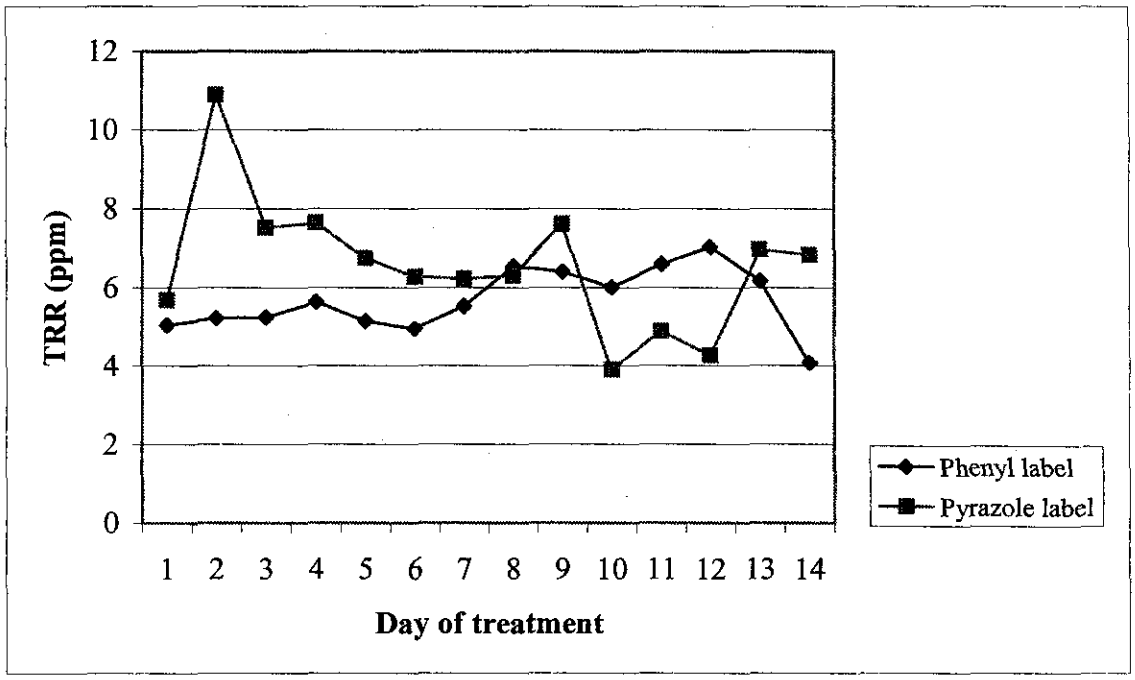

FIGURE C.2.1.1. Pharmacokinetics of [Phenyl-U-^{14}C]-AE 0317309 and [Pyrazole-3-^{14}C]-AE 0317309 in Eggs of the Laying Hen

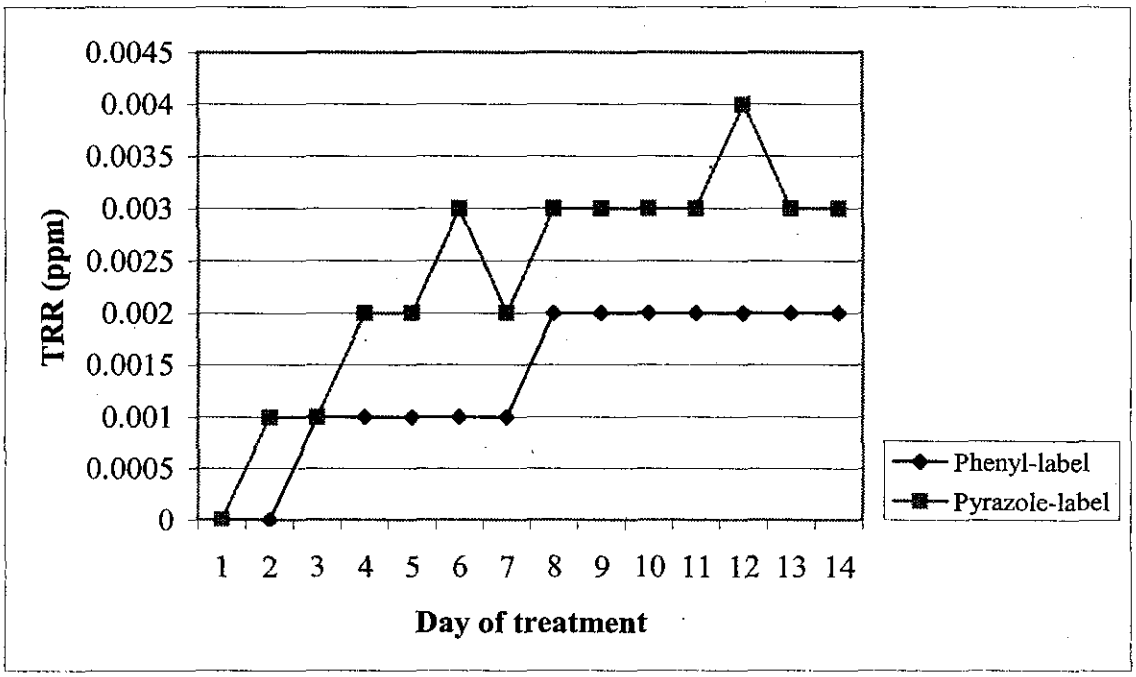

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TABLE C.2.2. Distribution of the Parent and the Metabolites in Livestock Matrices when Dosed with [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-AE 0317309.

Metabolite Fraction	Excreta		Muscle		Fat		Liver		Eggs	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
Phenyl-label study										
ACN/Water Ext.[a]	NA	NA	97.5	0.037	98.9	0.065	92.9	1.449	80.9	0.001
AE 0317309	-	-	95.3	0.036	97.1	0.064	86.5	1.350	-	-
AE 1073910	-	-	2.2	0.001	1.8	0.001	6.4	0.099	-	-
Hexane Extract	NA	NA	NA	NA	0.2	<0.001	NA	NA	NA	NA
AE 0317309	-	-			-	-	-	-	-	-
Acetonitrile Reflux	NA	NA	NA	NA	NA	NA	6.9	0.107	2.9	<0.001
AE 0317309	-	-	-	-	-	-	6.8	0.106	-	-
AE 1073910	-	-	-	-	-	-	0.1	0.002	-	-
Pyrazole-label study										
ACN/Water Ext.[a]	NA	NA	95.1	0.019	88.8	0.013	90.1	1.158	47.4	0.002
AE 0317309	-	-	92.9	0.018	88.8	0.013	85.3	1.096	-	-
AE 1073910	-	-	2.2	<0.001	NA	NA	4.8	0.062	-	-
Hexane extract	NA	NA			8.9	0.001				
AE 0317309	-	-			8.9	0.001				
Acetonitrile Reflux	NA	NA	-	-	-	-	9.3	0.119	-	-
AE 0317309	-	-	-	-	-	-	9.3	0.119	-	-

[a] ACN/Water extract or combined ACN/Water + ACN extract
NA = not analyzed

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TABLE C.2.3. Summary of Characterization and Identification of Radioactive Residues in Livestock Matrices Following Application of Radiolabeled AE 0317309 at a rate of 8.6 ppm [phenyl-U-^{14}C]-AE 0317309 equivalents in the diet and 10.5 ppm [pyrazole-3-^{14}C]-AE 0317309 equivalents in the diet.

Phenyl-label study								
Compounds	Muscle TRR = 0.038 ppm		Fat TRR = 0.066 ppm		Liver TRR = 1.560 ppm		Eggs TRR = 0.002 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309	95.3	0.036	97.1	0.064	93.3	1.456	-	-
AE 1073910	2.2	0.001	1.8	0.001	6.5	0.101	-	-
Total identified	97.5	0.037	98.9	0.065	99.8	1.557	-	-
Total characterized	1.3	0.001	0.5	< 0.001			83.8	<0.001
Total extractable	98.8	0.037	99.4	0.065	99.8	1.557	83.8	<0.001
Nonextractable (PES)[a]	1.2	< 0.001	0.6	< 0.001	0.2	0.004	16.2	< 0.001
Accountability[b]	100		100		100.1		100	
Pyrazole-label study								
Compounds	Muscle TRR = 0.020 ppm		Fat TRR = 0.015 ppm		Liver TRR = 1.285pm		Eggs TRR = 0.003 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309	92.9	0.018	97.7	0.014	94.6	1.215	-	-
AE 1073910	2.2	< 0.001	-	-	4.8	0.062	-	-
Total identified	95.1	0.018	-	-	99.4	1.277	-	-
Total characterized	1.7	< 0.001	-	-	-	-	47.4	0.002
Total extractable	96.8	0.019	97.7	0.014	99.4	1.277	47.4	0.002
Nonextractable (PES)[a]	3.2	0.001	2.3	< 0.001	0.6	0.008	52.6	0.002
Accountability[b]	100		100		100		133.3	

[a] Residues remaining after exhaustive extractions

[b] Accountability = (Total extractable (ppm) + Total unextractable (ppm))÷(TRR (ppm) from combustion analysis)* 100

C.3. Proposed Metabolic Profile

The proposed metabolic pathway for the [phenyl-U-^{14}C]-pyrasulfotole and [pyrazole-3-^{14}C]-pyrasulfotole in laying hens is shown in FIGURE C.3.1. Pyrasulfotole was not metabolized to a great extent in the laying hen. The only metabolic pathway involved the N-demethylation of pyrasulfotole (AE 0317309), resulting in the pyrasulfotole-desmethyl metabolite (AE 1073910).

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FIGURE C.3.1. Proposed Metabolic Pathway of [Phenyl-U-^{14}C] and [Pyrazole-3-^{14}C]-Pyrasulfotole in Laying Hens.

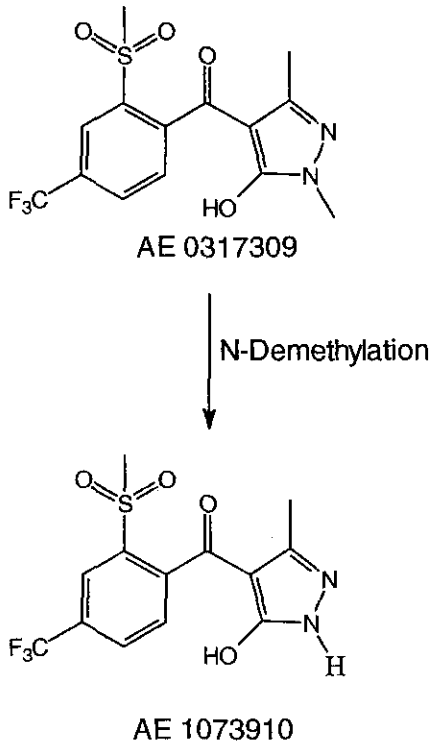
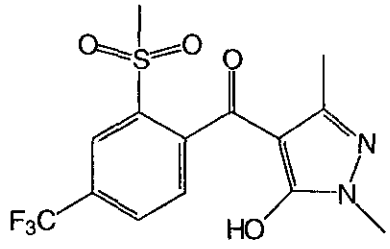
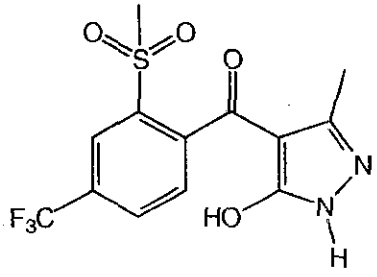


TABLE C.3.1. Identification of Compounds from Metabolism Study.

Common name/code FIGURE C.3.1 ID No.	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	

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D. CONCLUSION

The metabolic fate of pyrasulfotole in tissues and eggs has been studied in laying hens dosed orally for 14 consecutive days with [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole. Pyrasulfotole was the predominant residue in tissues and eggs. Pyrasulfotole is not extensively metabolized in laying hens. The metabolic profile involved N-demethylation of the parent pyrasulfotole to afford the pyrasulfotole-desmethyl metabolite (AE 1073910).

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche, A. and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

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EPA's Records Disposition Schedule PEST 361 Scientific Data Reviews HED Records Center - File R153474 - Page 349 of 428

10. Zager, E. and Edwards, D. (1992). EPA Memorandum: Additional guidance for conducting plant and livestock metabolism studies. Pesticide registration rejection rate analysis for residue chemistry.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (15 November 2006); George Kramer (15 November 2006)
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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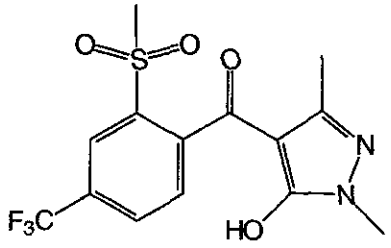
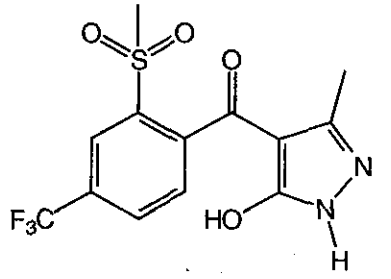
APPENDIX 1

Reference Standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	

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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 4/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801806 Gould, T. Timberlake, B. and Brungardt, J. 2006. Validation of Bayer CropScience Method AI-001-P04-01 An Analytical Method for the Determination of Residues of AE 0317309, AE 1073910, and AE B197555 in Wheat, Corn, and Soybean Matrices Using LC/MS/MS. Unpublished Bayer CropScience Report No.: RAAIX005. 206 pages.

MRID No. 46801807 Billian, B. 2005. Independent Laboratory Validation of the Analytical Method Al-001-P04-01 for the Determination of Residues of AE 0317309, AE 1073910 and AE B197555 in Plant Material. Unpublished Bayer CropScience, Monheim, Germany Study No.: P612050574. Bayer CropScience Report No.: MR-097/05. 72 pages.

MRID No. 46801808 Gould, T. and Brungardt J. 2006. Extraction Efficiency of AE B197555, AE 1073910, and AE 0317309 by Method AI-0001-P04-01. Unpublished Bayer CropScience Report No.: RAAIX011. 60 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience has developed a high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS), Method AI-004-A05-01, as the data collection and enforcement method for residues of pyrasulfotole (AE 0317309), pyrasulfotole-desmethyl (AE 1073910), and pyrasulfotole-benzoic acid (AE B197555) in crop matrices.

Briefly, the crop matrices are extracted with a mixture of acetonitrile (ACN)/water (H_2O)/concentrated hydrochloric acid (HCl) (30:15:3, v/v). The sample extract is heated to 60°C for at least 30 minutes then cooled and a mixture of isotopic internal standards is added to the sample extract. A small aliquot is purified by C18 solid phase extraction (SPE). The solvent is removed from the sample and the residue is reconstituted for analysis by HPLC-MS/MS.

The limit of quantitation (LOQ) is 0.010 ppm for each analyte in each matrix. The proposed enforcement method was adequately validated in soybean grain, corn grain, corn stover, wheat forage, barley hay, and barley grain. A successful independent laboratory validation (ILV) was completed with samples of wheat grain and soybean grain. Extraction efficiency data demonstrated that the enforcement method can account for incurred residues of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in plant matrices.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the analytical method test data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase), and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature

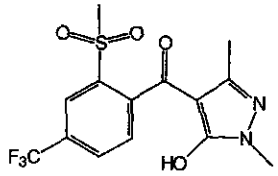
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. MATERIALS AND METHODS

B.1. Data-Gathering Method

B.1.1. Principle of the Method:

A 2.0 g aliquot of the crop matrix was weighed into a 60-mL vial and a mixture of ACN/H_2O/concentrated HCl (30:15:3, v/v) was added. The sample extract was heated to 60°C for at least 30 minutes. The samples were cooled and a mixture of isotopically labeled internal standards (IS) was added to the sample extract and mixed (0.10 ppm of each IS). A small aliquot (about 1.25 mL) was purified by C18 SPE. The solvent was removed from the sample and the residue was reconstituted for analysis by HPLC-MS/MS.

TABLE B.1.1. Summary Parameters for the Analytical Method Used for the Quantitation of AE 0317309 Derived Residues in Plants.

Method ID	AI-001-P04-01		
Analyte(s)	Pyrasulfotole (AE 0317309), pyrasulfotole-desmethyl (AE 1073910) and pyrasulfotole-benzoic acid (AE B197555)		
Extraction solvent/technique	Acetonitrile: deionized water: HCL (30:15:3) at 60°C for at least 30 minutes		
Cleanup strategies	Solid phase extraction cartridge (C-18)		
Instrument/Detector	Phenomenex Gemini C-18, 50 x 2.0 mm, 5 µm Thermo Finnigan Quantum Ultra LC-MS/MS with aqueous 0.01 M NH_4OAc and methanol as mobile phases		
Standardization method	Multi-point calibration curve with isotopically labeled internal standards		
Stability of std solutions	Up to 274 days (~ 9 months) in acetonitrile:water (2:1 v/v)		
Retention times (approximate)	AE B197555 2.2 min AE 1073910 2.7 min AE 0317309 3.0 min		
Mass Spectrometer Data - Major daughter ion transitions monitored. AE B197555 was not detected in positive ion mode.	Analyte AE B19755 AE 1073910 AE 0317309	Parent Ion 266.95 346.95 360.95	Daughter Ion 158.95 266.95 78.95

B.2. Enforcement Method

The enforcement method is the same as the data-gathering method.

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C. RESULTS AND DISCUSSION

C.1. Data-Gathering Method

TABLE C.1.1. Recovery Results from Method Validation of Soybean, Corn, Wheat, and Barley using the Data-Gathering Analytical Method.

Matrix	Analyte	Spiking Level (ppm)	Recoveries (%)	Mean Recovery ± SD (%)
Soybean Grain	AE B197555	0.010	96, 91, 93, 87, 99, 96, 94	94 ± 4.0
		0.250	94, 96, 97, 98, 97, 102, 98	97 ± 2.5
	AE 1073910	0.010	92, 91, 93, 88, 93, 98, 90	92 ± 3.1
		0.250	100, 98, 101, 100, 101, 101, 100	100 ± 1.0
	AE 0317309	0.010	88, 86, 80, 82, 75, 85, 89	84 ± 5.8
		0.250	99,104, 99, 98, 100, 100, 98	100 ± 2.0
Corn Grain	AE B197555	0.010	90, 92, 85, 91, 95, 91, 86	90 ± 4.0
		0.250	99, 97, 98, 96, 97, 96, 94	97 ± 1.4
	AE 1073910	0.010	89, 91, 86, 87, 86, 86, 90	88 ± 2.2
		0.250	100, 100, 100, 101, 102, 99, 97	100 ± 1.8
	AE 0317309	0.010	75, 81, 76, 85, 76, 88, 80	80 ± 6.1
		0.250	95, 95, 97, 95, 95, 95, 92	95 ± 1.5
Corn Stover	AE B197555	0.010	90, 98, 81, 97, 90, 93, 88	91 ± 6.3
		0.250	98, 98, 100, 97, 96, 97, 98	98 ± 1.3
	AE 1073910	0.010	89, 92, 90, 98, 85, 91, 93	91 ± 4.3
		0.250	98, 99, 100, 99, 96, 96, 99	98 ± 1.6
	AE 0317309	0.010	84, 86, 84, 90, 79, 84, 83	84 ± 4.0
		0.250	100, 101, 102, 99, 104, 100, 100	101 ± 1.7
Wheat Forage	AE B197555	0.010	93, 98, 94, 96, 93, 91, 90	94 ± 2.8
		0.250	99, 99, 97, 99, 99, 101, 94	98 ± 2.2
	AE 1073910	0.010	89, 95, 92, 94, 95, 93, 92	93 ± 2.3
		0.250	101, 100, 102, 101, 104, 105, 102	102 ± 1.6
	AE 0317309	0.010	80, 87, 89, 86, 85, 84, 88	86 ± 3.3
		0.250	97, 96, 97, 100, 98, 99, 99	98 ± 1.4
Barley Grain	AE B197555	0.010	100, 88, 96, 96, 89, 91, 99	94 ± 5.2
		0.250	96, 95, 99, 97, 99, 98, 99	98 ± 1.9
	AE 1073910	0.010	94, 92, 91, 95, 92, 96, 93	93 ± 1.8
		0.250	102, 104, 104, 101, 102, 104, 103	103 ± 1.2
	AE 0317309	0.010	87, 91, 88, 86, 91, 90, 92	89 ± 2.6
		0.250	97, 97, 100, 96, 99, 97, 98	98 ± 1.2
Barley Hay	AE B197555	0.010	104, 90, 93, 101, 96, 85, 104	96 ± 7.7
		0.250	94, 98, 94, 99, 94, 94, 95	96 ± 2.0
	AE 1073910	0.010	95, 91, 93, 93, 93, 93, 92	93 ± 1.3
		0.250	99, 101, 98, 101, 99, 100, 101	100 ± 1.1
	AE 0317309	0.010	90, 88, 86, 89, 89, 86, 92	89 ± 2.6
		0.250	99, 100, 100, 101, 101, 99, 100	100 ± 0.9

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TABLE C.1.2. Characteristics for the Data-Gathering Analytical Method Used for the Quantitation of AE 0317309, AE 1073910, and AE B197555 in Soybean, Corn, Wheat, and Barley.

Analyte	Soybean Grain	Corn Grain	Corn Stover	Wheat Forage	Barley Grain	Barley Hay
AE 0317309 (Pyrasulfotole)						
LOQ (ppm)	0.010	0.010	0.010	0.010	0.010	0.010
LOD (ppm)	0.0015	0.0020	0.0011	0.0010	0.0009	0.0009
Accuracy/ Precision	75% to 104%	75% to 97%	79% to 104%	80% to 100%	86% to 100%	86% to 101%
AE 1073910 (Pyrasulfotole-desmethyl)						
LOQ (ppm)	0.010	0.010	0.010	0.010	0.010	0.010
LOD (ppm)	0.0014	0.0012	0.0017	0.0008	0.0008	0.0008
Accuracy/ Precision	88% to 101%	86% to 102%	85% to 100%	89% to 105%	91% to 104%	91% to 101%
AE B197555 (Pyrasulfotole-benzoic acid)						
LOQ (ppm)	0.010	0.010	0.010	0.010	0.010	0.010
LOD (ppm)	0.0012	0.0014	0.0020	0.0009	0.0019	0.0029
Accuracy/ Precision	87% to 102%	85% to 99%	81% to 100%	90% to 101%	88% to 100%	85% to 104%
Equipment ID	ThermoFinnigan Surveyor HPLC with Quantum Ultra LC-MS/MS					
Method Reliability	An independent laboratory validation was conducted with wheat grain and soybean grain. Recoveries ranging from 90% to 115% were obtained.					
Linearity	The detector response for all analytes from 0.005 ppm to 2.50 ppm was linear with a correlation coefficient (R^2) of >0.999.					
Specificity	Control samples had residue levels of 0.0012 ppm or below. Peaks for all three analytes were well defined and symmetrical. There appeared to be no carryover to subsequent chromatograms.					

C.2. Enforcement Method

The enforcement method is the same as the data-gathering method. The extraction efficiency of method AI-001-P04-01 for the determination of the total radioactive residue (TRR) of pyrasulfotole was tested using samples obtained from metabolism studies treated with [phenyl-U-^{14}C]-pyrasulfotole[10,11]. The analytical residue method effectively extracted 96%, 110% and 104% of the TRR from aged wheat forage, wheat grain, and wheat hay, respectively.

Concurrent recovery data demonstrated that the method can effectively recover pyrasulfotole equivalent residues spiked from 0.01 to 0.250 ppm. The method adequately bracketed the expected residues in wheat, barley, soybean, and corn commodities. The LC-MS/MS was specific for the analysis of analytes of interest. No interferences were noted above the LOD.

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TABLE C.2.1. Distribution of Residues Found in Wheat Forage, Hay and Grain by Residue Method as Compared with Those Found in Metabolism Studies.

Matrices	Amount of AE 0317309 equivalents				Extraction Efficiency (%)
	Analytical Residue Method		Metabolism Studies		
	% TRR	ppm	% TRR	ppm	
Wheat Forage		1.472, 1.660, 1.488			
Average	59.9	1.540	67.1	1.61[a]	95.7
Wheat Hay		0.0527, 0.0504, 0.0496			
Average	80.3	0.0509	80.2	0.049[b]	103.9
Wheat Grain		0.1915, 0.1661, 0.1389			
Average	79.8	0.1655	97.6	0.15[a]	110.3

a Value from the wheat metabolism study (phenyl-label) with safener.
b Value from the confined rotational crop study (phenyl-label) with safener.

C.3. Independent Laboratory Validation

An ILV was performed using wheat grain and soybean grain. The individual recoveries for all analytes were between 70% and 120%, with a relative standard deviation (RSD) below 20%. The laboratory performing the ILV suggested no modifications to the method.

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TABLE C.3.1. Recovery Results Obtained by an Independent Laboratory Validation of the Enforcement Method for the Determination of AE 0317309, AE B197555, and AE 1073910 in Plant Matrices.

Matrix	Analyte	Spiking Level (ppm)	Recoveries (%)	Mean Recovery ± SD (%)
Wheat Grain	AE B197555	0.010	115, 104, 114, 100, 108	108 ± 5.9
		0.200	112, 104, 101, 98, 107	104 ± 5.2
		0.100	107, 104, 104, 106, 102	105 ± 1.9
	AE 1073910	0.010	103, 105, 107, 109, 99	105 ± 3.7
		0.200	106, 102, 100, 94, 102	101 ± 4.4
		0.100	100, 102, 100, 101, 100	101 ± 0.9
	AE 0317309	0.010	100, 99, 90, 93, 97	96 ± 4.4
		0.200	96, 98, 96, 98, 94	96 ± 1.7
		0.100	97, 95, 101, 97, 98	98 ± 2.2
Soybean Grain	AE B197555	0.010	101, 100, 105, 94, 100	100 ± 3.9
		0.200	103, 104, 97, 101, 104	102 ± 2.9
		0.100	98, 100, 101, 94, 101	99 ± 3.0
	AE 1073910	0.010	99, 97, 97, 96, 93	96 ± 2.3
		0.200	97, 95, 94, 96, 95	95 ± 1.2
		0.100	96, 95, 94, 95, 92	94 ± 1.6
	AE 0317309	0.010	96, 103, 100, 96, 104	100 ± 3.8
		0.200	103, 95, 99, 99, 100	99 ± 2.9
		0.100	102, 98, 98, 99, 100	99 ± 1.7

D. CONCLUSION

Adequate method validation data have been submitted for the LC-MS/MS method (AI-001-P04-01) for the determination of residues of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in plant commodities. The validation data are representative of the expected residue levels for the plant commodities. The method is adequate to quantitate incurred residues of pyrasulfotole, pyrasulfotole-desmethyl, and pyrasulfotole-benzoic acid in plant matrices.

E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

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3. Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. Haas, M. (2004). Metabolism of [phenyl-U-^{14} C] AE 0317309 in Wheat Following Treatment at an Application Rate of 100 g/ha with and without Safener. Unpublished Bayer CropScience Report No. MEF-322/03

11. Beedle, E. C. and Ying, S.L. (2006). The Metabolism of [Phenyl-UL-^{14}C] AE 0317309 in Confined Rotational Crops. Unpublished Bayer CropScience Report No. 201152.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412
PC Code: 000692

Template Version June 2005.

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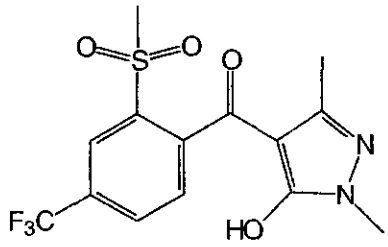
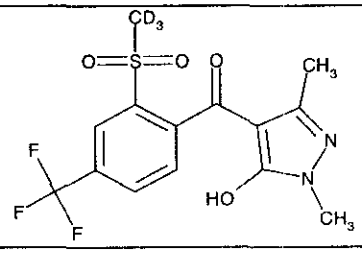
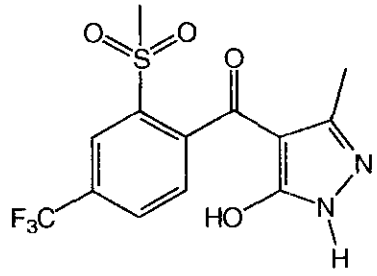
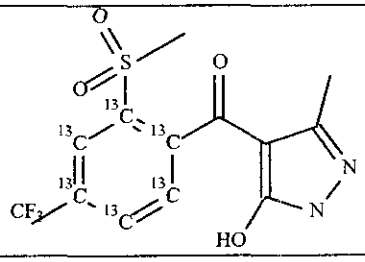
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
[phenyl-$^{13}C_6$]AE 107391 AE 1073910-IS	(5-Hydroxy-3-methyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl-$^{13}C_6$]methanone	

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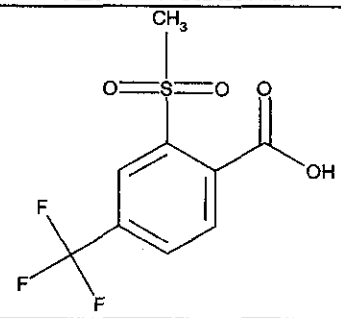
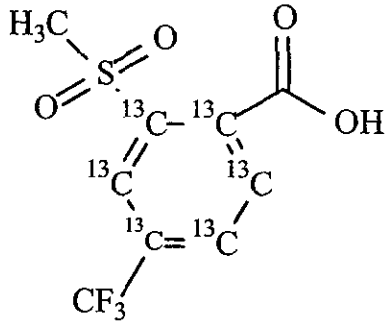
Reference standards continued.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	April 15/2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Environmental Protection Agency (U.S. EPA)	Date: 4/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Environmental Protection Agency (U.S. EPA)	Date: 6-2007

STUDY REPORTS:

MRID No. 46801804 Rupprecht, J. K. (2006) Metabolism of [Phenyl-U-^{14}C]-AE 0317309 in the Lactating Goat : Bayer CropScience Study Identification Number: A9041002, Unpublished Bayer CropScience Report Number: MEAIM009. January 13, 2006. 102 pages.

MRID No. 46801805 Rupprecht, J. K. (2006) Metabolism of [Pyrazole-3-^{14}C]-AE 0317309 in the Lactating Goat: Bayer CropScience Study Identification: A9041001. Unpublished Bayer CropScience Report Number: MEAIM010. January 25, 2006. 98 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience has submitted two studies investigating the metabolism of [phenyl-U-^{14}C]-AE 0317309 and [pyrazole-3-^{14}C]- pyrasulfotole (AE 0317309) in lactating goats.

Two lactating goats were dosed orally once daily for 3 consecutive days at a dose level equal to 51.2 ppm [phenyl-U-^{14}C]-pyrasulfotole equivalents (specific activity of 56.8 µCi/mg) in the diet, based on dry weight of feed, corresponding to 0.93 mg /kg body weight per day. Also, two lactating goats were dosed orally once daily for 3 consecutive days at a dose level equal to 28.1 ppm [pyrazole-3-^{14}C]- pyrasulfotole equivalents (specific activity of 59.4 µCi/mg) in the diet, based on dry weight of feed, corresponding to 1.24 mg /kg body weight per day.

Milk, feces and urine were collected twice a day during the treatment period. Approximately 23 hours after the last dose, the goats were sacrificed and the edible tissues (liver, kidney, muscle and composite fat) were collected for analysis. Identification and quantitation of the metabolites in the extractable residue was accomplished by using reverse phase high performance liquid chromatography (HPLC) and high performance liquid chromatography with electrospray ionization and tandem mass spectrometry (LC-MS/MS).

In the phenyl-label study, the total radioactive residue (TRR, expressed as pyrasulfotole equivalents) was 1.477 ppm in liver, 0.533 ppm in kidney, 0.010 ppm in fat, 0.010 ppm in muscle, 0.016 ppm in Day 1 milk, 0.017 ppm in Day 2 milk, and 0.017 ppm in Day 3 milk. The majority of the residue in the tissues was extractable (92.4-99.6% of the TRR). All tissue extracts were analyzed by HPLC with the exception of the fat extracts, which represented residues less than 0.010 ppm. The majority of the residue was identified/characterized in all analyzed matrices (88.5 -99.6% of the TRR). The majority of the residue was comprised of pyrasulfotole, with lesser amounts identified as pyrasulfotole-desmethyl metabolite (AE 1073910), and hydroxymethyl pyrasulfotole. More than 67% of the administered dose was recovered in urine and feces, with less than 1.15% in tissues, and 0.012% in milk.

In the pyrazole-label study, the TRR (expressed as pyrasulfotole equivalents) was 1.723 ppm in liver, 0.269 ppm in kidney, 0.008 ppm in fat, 0.007 ppm in muscle, 0.039 ppm in Day 1 milk, 0.031 ppm in Day 2 milk, and 0.044 ppm in Day 3 milk. The majority of the residue in the tissues was extractable (69.8-97.2% of the TRR). All tissue extracts were analyzed by HPLC with the exception of the fat and muscle extracts, which represented residues < 0.010 ppm. Pyrasulfotole was identified as the major residue in the liver (93.3% of the TRR, 1.603 ppm) and kidney (92.4% of the TRR, 0.249 ppm). Additionally, two minor metabolites were identified/characterized from the extractable liver residue as pyrasulfotole-desmethyl (1.4% of the TRR, 0.025 ppm), and an unidentified polar metabolite (1.7% of the TRR, 0.030 ppm). In milk, the predominant residue was pyrasulfotole (38.8% of the TRR, 0.017 ppm) with lesser amounts of three unknown polar compounds, none of which exceeded 0.006 ppm. Most of the radioactivity (>92%) was recovered in urine and feces, with less than 0.1% in milk, and 0.925% in tissues.

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The metabolic fate of [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in lactating goats involved either *N*-demethylation of pyrasulfotole to afford pyrasulfotole-desmethyl, or oxidation of pyrasulfotole to afford pyrasulfotole-hydroxymethyl.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the lactating goat metabolism data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

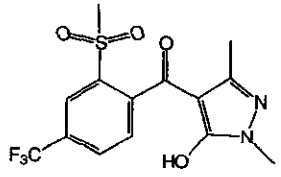
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

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TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

B. EXPERIMENTAL DESIGN

B.1. Livestock

B.1.1 Test System, Animal Handling and Dosing

The biological phase of this metabolism study was conducted at Genesis Midwest Laboratories. Two non-pregnant, lactating goats (*Capra hircus*, breed; Saanen) were dosed with [phenyl-U-^{14}C]-AE 0317309 at a rate of 0.93 mg/kg body weight on each of 3 consecutive days. Also, goats were dosed with [pyrazole-3-^{14}C]-AE 0317309 at a rate of 1.24 mg/kg body weight/day for 3 days. The treatments were administered orally via gelatin capsule using a balling gun each day after the morning milking. The animals were allowed *ad libitum* access to feed and water throughout the study. General test animal information, test animal dietary regime and test animal dosing regime are given in TABLES B.1.1 and B.1.2 and B.1.3.

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TABLE B.1.1. General Test Animal Information.

Species	Breed	Age	Weight at study initiation (kg)	Health Status	Description of housing/holding area
Phenyl-label study					
Capra aegagrus hircus	Saanen	3-5 years	(Goat 1) 60	Acceptable and clinically normal (except bilateral anterior uveitis)	Housed in a building: The average minimum /maximum temperatures 16.7-21.7°C, photoperiod of 14 hours light and 10 hours dark. Held in stainless steel metabolism cages.
			(Goat 2) 52	Acceptable and clinically normal (except for overgrown hooves)	
Pyrazole-label study					
Capra aegagrus hircus	Saanen	3-5 years	(Goat 1) 38	Acceptable and clinically normal	Housed in a building: The average minimum /maximum temperatures 15.6-21.7°C, photoperiod of 14 hours light and 10 hours dark. Held in stainless steel metabolism cages.
			(Goat 2) 41		

TABLE B.1.2. Test Animal Dietary Regime.

Composition of Diet	Feed consumption (kg/day)[a]		Water	Acclimation period(days)		Predosing
	Phenyl	Pyrazole		Phenyl	Pyrazole	
Goat pellet 16% and alfalfa hay cubes	(Goat 1) 1.1179	1.5414	*ad libitum*	4	5	None
	(Goat 2) 0.8901	1.9547				

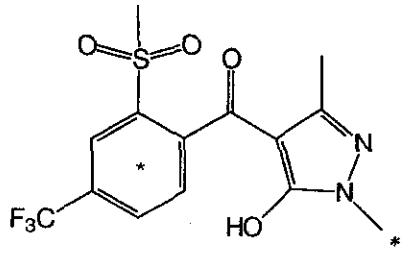
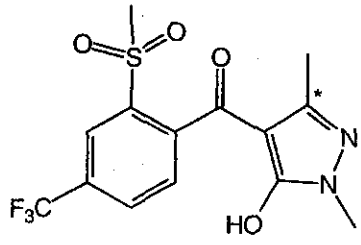
[a] This represents the average daily feed consumption for both goats in this study from Day 0 to Day 3.

TABLE B.1.3. Test Animal Dosing Regime.

Treatment Type	Feeding Level (ppm test material in food)		Vehicle	Timing/Duration
Oral	51.2	28.1	capsule	Between 9:01 and 9:18 AM / 3 days

B.2. Test Materials

TABLE B.2.1. Test Material Characteristics.

Chemical structure	 position of radiolabel	 * position of radiolabel
Radiolabel position	[phenyl-U-^{14}C]-AE 0317309	[pyrazole-3-^{14}C]-AE 0317309
Lot No.	SEL/1006	SEL/1009
Purity	>99.0%	100.0%
Specific activity (Bq)*	3.19 MBq/mg56.8 µCi/mg	5.51 MBq/mg59.4 µCi/mg

*Bq = disintegrations per second

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B.3. Sampling Information

Each animal was milked twice daily, once prior to dosing and again 8 to 12 hours after dosing. Milk from the afternoon and the following morning were composited to form one day's sample. The animals were humanely terminated approximately 23 hours following the third dose. Fat (composite of omental, renal, and subcutaneous), kidney (both), liver, and muscle (composite of loin, round, and flank) were collected. The same tissues from the two animals were composited. Sample collection information is given in TABLE B.3.1.

TABLE B.3.1. Sample Collection Information.

Milk collected [a]	Urine, feces and cage wash collected[b]	Interval from last dose to sacrifice	Tissues harvested and analyzed
Phenyl-label study			
Treatment production: 809.9 g dailyNormal production (i.e. acclimation period): 988.6 g daily	Urine: 2589.1 g dailyFeces: 1975.4 g daily	23 hours	Liver, kidney, muscle, fat
Pyrazole-label study			
Treatment production: 2526.8 g dailyNormal production (i.e. acclimation period): 1893.2 g daily	Urine: 2532.7 g dailyFeces: 3651.0 g daily	23 hours	Liver, kidney, muscle, fat

[a] This represents the average daily milk production for both goats in this study.
[b] This represents the average daily urine and feces production for both goats in this study from Day 0 to Day 3.

B.4. Identification/ Characterization of Residues

B.4.1. Sample Handling and Preparation

B.4.1.1. Sample Processing and Shipping

Tissues were frozen and then homogenized at three days following termination while at Genesis Midwest Laboratories and were shipped frozen to the Bayer Research Park. All samples for analysis arrived still thoroughly frozen on dry ice and were immediately placed in a freezer and stored frozen prior to analysis. Upon arrival, aliquots (2.0 mL) of the milk samples were radioassayed, and aliquots (0.10 to 0.15 g) of the tissues were oxidized to determine the TRR levels (TABLE C.2.1). All remaining milk and tissues were stored frozen for later analysis.

B.4.1.2. Extraction and Analysis of Samples

Specific details related to the extraction of radioactive residues in liver, kidney, muscle, fat and milk are given below and in FIGURES B.4.1.2.1. to B.4.1.2.5. All solvents (HPLC grade) and reagent chemicals were obtained from commercial suppliers and were used without additional purification. Water was deionized and purified using a MILLI-Q Water System.

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B.4.1.2.1. Liver

Phenyl:
Extraction of the liver is outlined in FIGURE B.4.1.2.1. An aliquot of liver was weighed into a 200-mL centrifuge bottle. The sample was blended with 75 mL of acetonitrile/water (4:1) for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2900 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile/water (4:1). The combined acetonitrile/water (4:1) extract was radioassayed.

The remaining solids were blended with 75 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2900 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile. The combined acetonitrile extract was radioassayed. Aliquots of the acetonitrile/water extract, and the acetonitrile extract were combined and concentrated to dryness using the Büchi rotary evaporator. The residual solids were reconstituted in acetonitrile/aqueous 0.1% trifluoroacetic acid (TFA) (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC. Aliquots of the pre-weighed extracted liver were taken for combustion analysis.

Pyrazole:
An aliquot of liver was weighed into a 200 mL centrifuge bottle. The sample was blended with 75 mL of methanol for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2500 rpm for 10 min. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of methanol. The combined methanol extract was radioassayed.

An aliquot of the methanol extract was concentrated to dryness using the Büchi rotary evaporator. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed and analyzed by HPLC.

The remaining methanol extracted solids were suspended in 150 mL of methanol/water (4:1), and refluxed at 70 to 80°C for 8 hours. The suspension was cooled to room temperature and filtered through a sinter funnel into a graduated cylinder. The resulting filter cake was rinsed three times with methanol/water (4:1). The filtrate and rinses were combined and radioassayed.

An aliquot of the methanol/water (4:1) reflux extract was concentrated to dryness using the Büchi rotary evaporator. The residual solids were dissolved in 100 mL of water and approximately equal portions of the sample were loaded onto two 10 g, C-18 solid phase extraction (SPE) cartridges previously conditioned with 75 mL of methanol followed by 75 mL of water. The initial effluents from both cartridges were collected, after which the SPE cartridges were eluted with approximately 150 mL volume of water, followed by approximately 150 mL volumes of methanol/water (4:1) and methanol. Each eluate was collected separately and radioassayed. The methanol/water (4:1) and methanol eluates were combined and radioassayed.

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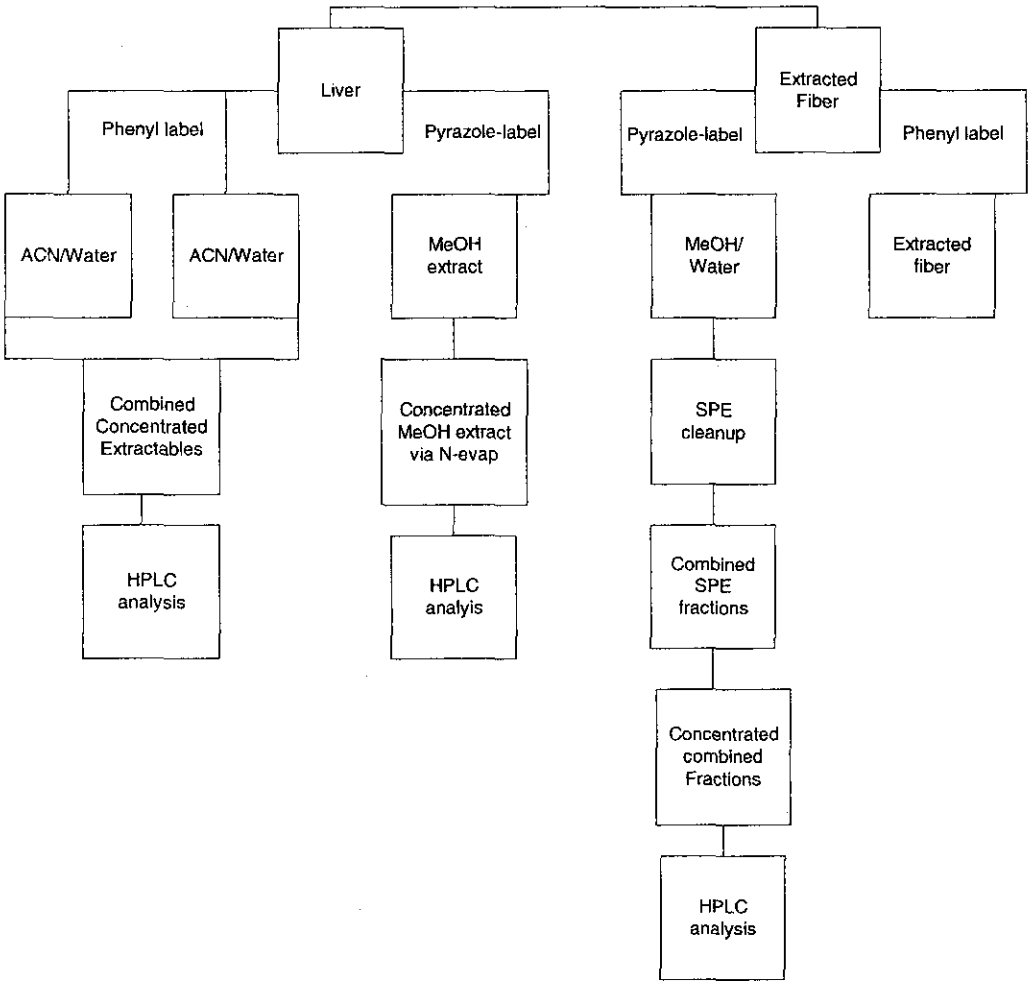
The combined eluates were concentrated to dryness under a gentle stream of nitrogen. The residual solids were reconstituted in 4 mL of acetonitrile/aqueous 0.1% trifluoroacetic acid (TFA) (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC. Aliquots of the pre-weighed reflux extracted liver were taken for combustion analysis.

FIGURE B.4.1.2.1. Summary of Extraction of Liver



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B.4.1.2.2. Kidney

Phenyl and Pyrazole:
Extraction of the kidney samples is outlined in FIGURES B.4.1.2.2. An aliquot of kidney was weighed into a 200 mL centrifuge bottle. The sample was blended with 75 mL of acetonitrile for 3 minutes using an Ultra Turrex. The sample was centrifuged at 2900 rpm for 10 minutes. The supernatant was decanted from the solids into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile. The combined acetonitrile extract was radioassayed.

The acetonitrile extract was concentrated to dryness using the Büchi rotary evaporator. The residual solids were dissolved in 100 mL of water and the sample was loaded onto two 10 g, C-18 SPE cartridges previously conditioned with 75 mL of acetonitrile followed by 75 mL of water. The initial effluents from the cartridges were collected, and the cartridges were eluted with water followed by acetonitrile/water (4:1), acetonitrile, methanol, 0.1% TFA in acetonitrile, aqueous 0.1% TFA / 0.1% TFA in acetonitrile (1:1) and methanol. Each eluate was collected separately and radioassayed. All of the eluates with the exception of the column load and water fraction were combined and radioassayed. An aliquot of the combined eluates was concentrated to dryness under a gentle stream of nitrogen. The residual solids were reconstituted in 3 mL of acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed and an aliquot was analyzed by HPLC.

The remaining acetonitrile extracted solids were suspended in methanol/water (4:1) and refluxed at 70 to 80°C for 8 hours. The suspension was cooled to room temperature and filtered through a sinter glass funnel into a graduated cylinder. The resulting filter cake was rinsed three times with methanol/water. The filtrate and rinses were combined and radioassayed.

An aliquot of the methanol /water (4:1) reflux extract was concentrated to dryness using the Büchi rotary evaporator. The residual solids were dissolved in 100 mL of water and the sample was loaded onto two 10 g, C-18 SPE cartridges previously conditioned with 75 mL of acetonitrile followed by 75 mL of water. The initial effluents from the cartridges were collected, and the cartridges were eluted with water, methanol/water (4:1) and methanol. Each eluate was collected separately and radioassayed. The water, methanol/water (4:1) and methanol eluates were combined and radioassayed. The combined eluates were concentrated to dryness under a gentle stream of nitrogen. The residual solids were reconstituted in 4 mL of acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC. Aliquots of the pre-weighed reflux extracted kidney were taken for combustion analysis.

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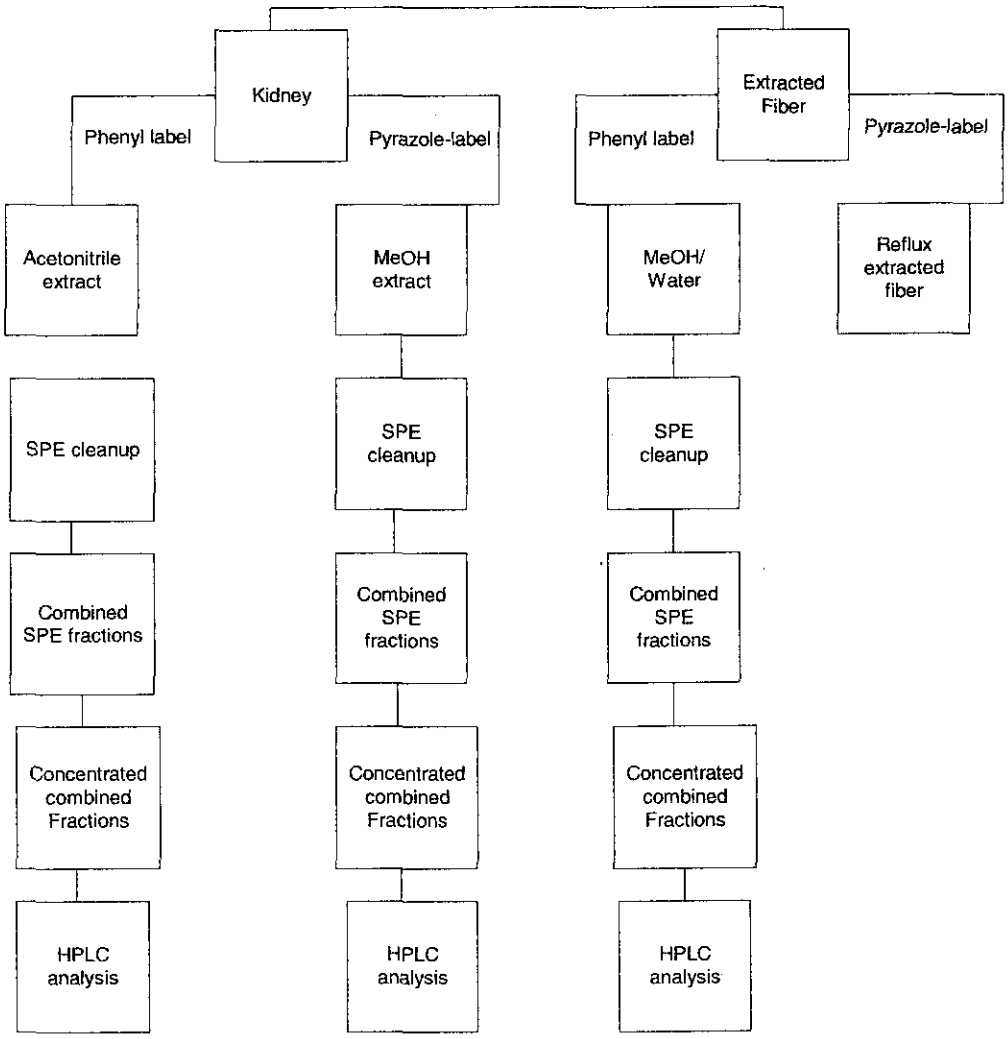
FIGURE B.4.1.2.2. Summary of Extraction of Kidney



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B.4.1.2.3. Muscle

Phenyl and Pyrazole:
Extraction of the muscle samples is outlined in FIGURES B.4.1.2.3. Four aliquots of muscle were weighed into separate 200 mL centrifuge bottles. Each sample was blended with 100 mL of acetonitrile for 3 minutes using the Ultra Turrex. The samples were centrifuged at 2900 rpm for 10 minutes. The supernatants were decanted from the solids into a graduated cylinder. For each centrifuge bottle, the extraction and centrifugation procedure was repeated twice with a fresh 75 mL portion of acetonitrile. The combined acetonitrile extract was radioassayed.

In the case of the phenyl-label, the acetonitrile extract was concentrated to dryness using the Büchi rotary evaporator. The residual solids were dissolved in 100 mL of water, and the sample was loaded onto two 10 g, C-18 SPE cartridges previously conditioned with 75 mL of acetonitrile followed by 75 mL of water. The initial effluents from both cartridges were collected and both cartridges were further eluted with water followed by acetonitrile/water (4:1), acetonitrile and methanol. Each eluate was collected separately and radioassayed. The acetonitrile/water (4:1), acetonitrile and methanol eluates were combined and radioassayed. The combined eluates were concentrated to dryness under a gentle stream of nitrogen. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC. Aliquots of the pre-weighed extracted muscle were taken for combustion analysis.

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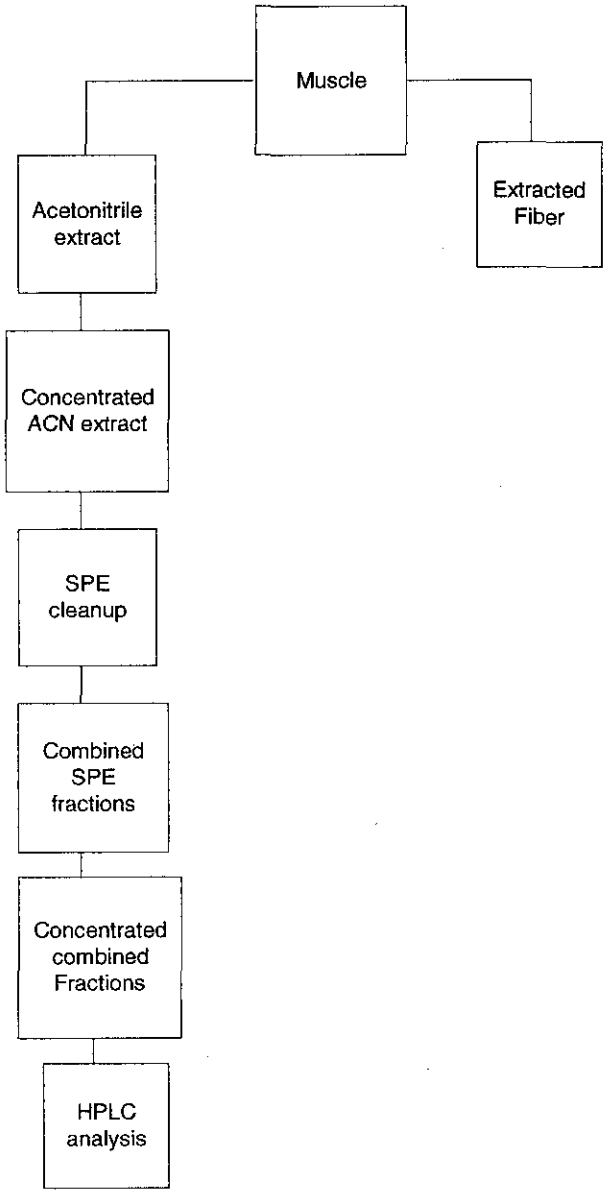
FIGURE B.4.1.2.3. Summary of Extraction of Muscle



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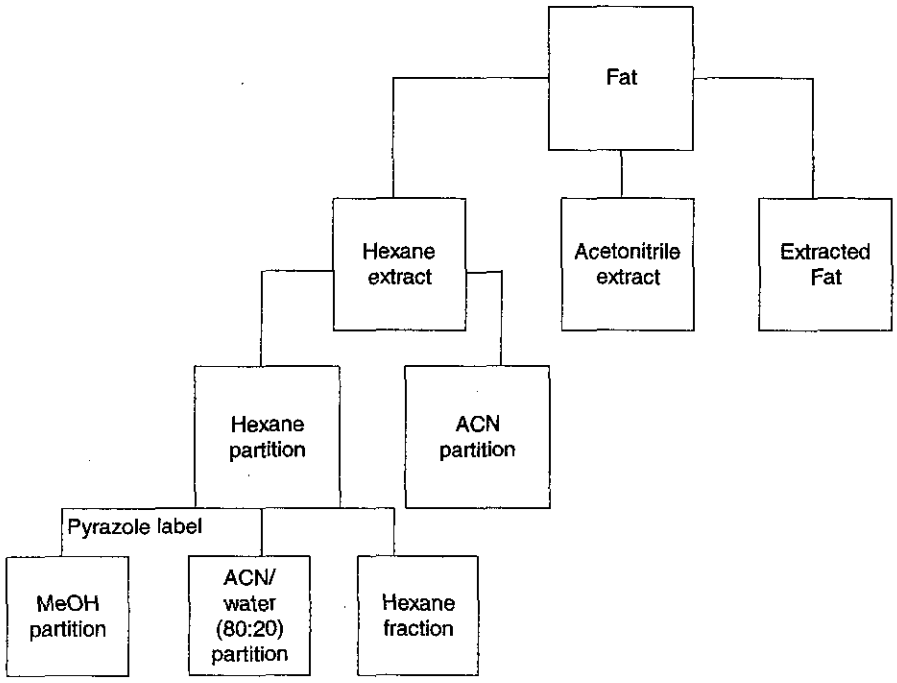
B.4.1.2.4. Fat

Phenyl and Pyrazole:
The extraction of fat is outlined in FIGURE B.4.1.2.4. Four aliquots of fat were weighed into separate 200 mL centrifuge bottles. Each sample was blended with 100 mL of hexane for 3 minutes using the Ultra Turrex. The samples were centrifuged at 2500 rpm for 10 minutes. The supernatants were decanted from the solids into a separatory funnel. For each centrifuge bottle, the extraction and centrifugation procedure was repeated twice with a fresh 75 mL portion of hexane. The hexane was then partitioned three times 150 mL with acetonitrile (pre-saturated with hexane). The resulting hexane and acetonitrile partition fractions were radioassayed. Aliquots of the pre-weighed extracted muscle were taken for combustion analysis.

In the case of the pyrazole-label, the hexane fraction was further partitioned three times with 150 mL of methanol, followed by acetonitrile/water (4:1). The resulting hexane, methanol, and acetonitrile/water partition fractions were radioassayed. The remaining hexane extracted solids were blended with 75 mL of acetonitrile for 3 min using the Ultra Turrex. The samples were centrifuged at 2500 rpm for 10 min. The supernatants were decanted from the solids into a graduated cylinder. For each centrifuge bottle, the extraction and centrifugation were repeated twice with a fresh 75 mL portion of acetonitrile. The acetonitrile extract was radioassayed. Aliquots of the pre-weighed extracted fat were taken for combustion analysis

FIGURE B.4.1.2.4. Summary of Extraction of Fat



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B.4.1.2.5. Milk

Phenyl:
The extraction of milk is summarized in FIGURE B.4.1.2.5. A sample of milk (Day 3 sample, the highest residue level, 250 mL) was partitioned two times using 250 mL of hexane. The partitioned extracts were separated and radioassayed. The aqueous partition fraction was freeze dried. The resulting freeze dried sample was blended with 125 mL of methanol for 3 minutes. The samples were centrifuged at 2500 rpm for 10 minutes. The extraction and centrifugation were repeated two times with fresh 100 mL portions of methanol. The combined methanol extract was radioassayed.

The hexane partition fraction was partitioned a further two times with 250 mL portions of methanol/water (9:1). The combined methanol/water (9:1) partition extract and the remaining hexane partition extract were radioassayed.

The methanol extract and the methanol/water (9:1) partition extract were combined and radioassayed. An aliquot of the combined aqueous methanol soluble fraction was concentrated to dryness using the Büchi rotary evaporator. The residual solids were reconstituted in 6 mL of acetonitrile/aqueous 0.1% TFA (1:9). The sample was radioassayed, and an aliquot was analyzed by HPLC.

Pyrazole:
A sample of milk (Day 3 sample, the highest residue level, 200 mL) was partitioned three times with 150 mL of hexane. The resulting hexane and aqueous partition fractions were separated and radioassayed. The hexane fraction was further partitioned two times with 250 mL of methanol/water (9:1), followed by methanol (two times with 250 mL). The hexane, methanol/water, and methanol fractions were separated and radioassayed. The aqueous partition fraction was freeze-dried. The resulting freeze dried sample was weighted and quantitatively transferred in approximately equal portions into two separated 200 mL centrifuge bottles. Each bottle was blended with 100 mL of methanol for 3 min. The samples were centrifuged at 2500 rpm for 10 min. The supernatants were decanted into a graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of methanol. The combined methanol extract was radioassayed.

The centrifuge bottles which contained the methanol extracted solids were blended with 100 mL of acetonitrile/water (4:1) for 3 min using the Ultra Turrex. The samples were centrifuged at 2500 rpm for 10 min. The supernatants were decanted into a 500 mL, graduated cylinder. The extraction and centrifugation were repeated two times with fresh 75 mL portions of acetonitrile/water (4:1). The combined acetonitrile/water extract was radioassayed.

The acetonitrile/water extracted solids were combined with the methanol partition fraction and dried under a gentle stream of nitrogen. The solids were blended with 100 mL of acetonitrile/water (4:1) for 3 min using the Ultra Turrex. The samples were centrifuged at 2500 rpm for 10 min. The supernatants were decanted into a graduated cylinder. The extraction and

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centrifugation were repeated two times with fresh 75 mL portions of acetonitrile/water (4:1). The combined acetonitrile/water extract was radioassayed.

The remaining extracted solids were suspended in 150 mL of methanol/water (4:1), and refluxed at 70 to 80°C for 8 hours, using PMC Digital Hot Plate/Stirrer. The suspension was cooled to room temperature and filtered through a sinter funnel into a graduated cylinder. The resulting filter cake was rinsed three times with methanol/water (4:1). The filtrate and rinses were combined and radioassayed.

The combined methanol and acetonitrile/water extract, and methanol reflux extract were combined and concentrated to dryness under a gentle stream of nitrogen. The residual solids were dissolved in 100 mL of water, and approximately equal portions of the sample were loaded onto three 10 g, C-18 SPE cartridges previously conditioned with 75 mL of methanol followed by 75 mL of water. The initial effluents from the cartridges were collected, after which the SPE cartridges were eluted with approximately 75 mL volume of water followed by approximately 75 mL volumes of methanol/water (4:1), methanol, again with methanol/water (4:1), and multiple elutions with methanol (3x). Each eluate was collected separately and radioassayed.

The methanol/water (4:1) and methanol eluates were combined and radioassayed. The combined eluates were concentrated under a gentle stream of nitrogen. The residual solids were reconstituted in 10 mL of acetonitrile/aqueous 0.1% TFA (1:9) and centrifuged at 2000 rpm for 20 min. The top layer (10 mL) was removed and radioassayed. An aliquot was analyzed by HPLC.

The load and water elutes were combined and radioassayed. The combined extracts were concentrated to dryness under a gentle stream of nitrogen. The residual solids were reconstituted in acetonitrile/aqueous 0.1% TFA (1:9) and centrifuged at 2000 rpm for 20 min. The liquid layer was removed and radioassayed. An aliquot was analyzed by HPLC. Aliquots of the pre-weighed extracted milk were taken for combustion analysis.

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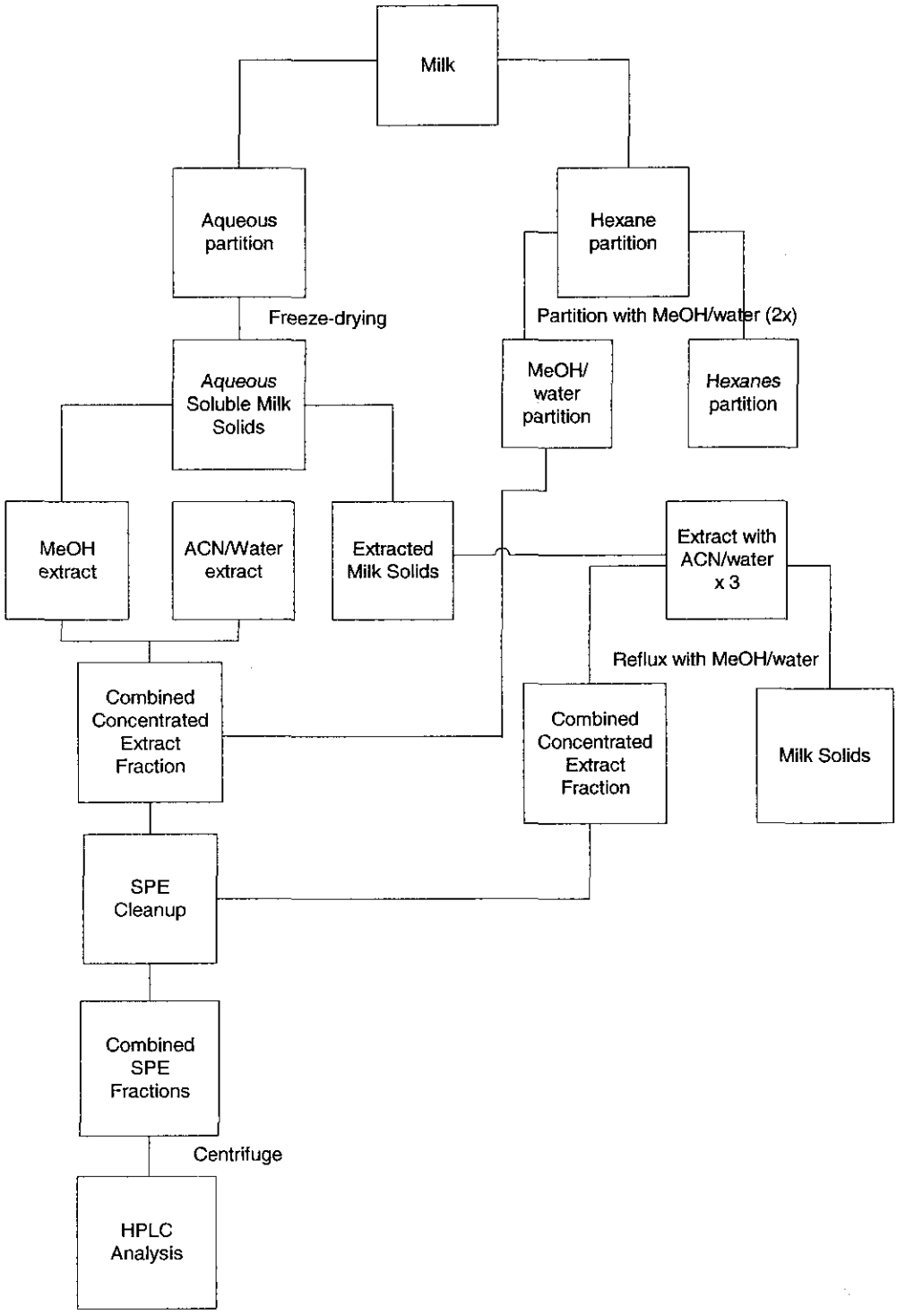
FIGURE B.4.1.2.5. Summary of Extraction of Milk



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B.4.1.2.6. Urine

Phenyl:
Urine samples from Day 1, 2 and 3 were radioassayed.

Pyrazole:
Urine samples from Day 1, 2 and 3 were radioassayed. An aliquot of Day 3 urine (0.100 mL) was dried under a gentle stream of nitrogen. The residual solids were reconstituted in 2 mL of acetonitrile/aqueous 0.1% TFA (1:9). An aliquot was analyzed by HPLC.

B.4.2. Analytical Methodology

B.4.2.1 Measurement of Radioactivity

Liquid samples (0.010 mL to 2.00 mL) were mixed with 6 or 20 mL of Ultima Gold™ scintillation fluid and radioassayed in a Beckman Model LS6000LL, or LS6500 liquid scintillation counter (LSC). Data were processed with Beckman data reduction software.

Aliquots (0.10 g to 0.15 g) of solid samples were oxidized, and radioassayed.

B.4.2.2 Chromatography

B.4.2.2.1 Radio-High Performance Liquid Chromatography (HPLC)

HPLC analysis was performed with a Beckman System Gold Chromatographic system consisting of a Beckman Model 128 solvent module and a Beckman Model 166 variable wavelength detector. The chromatographic system was connected to a radioactivity detector. Data were collected and analyzed by Beckman Gold Nouveau Chromatography Workstation. Samples were dissolved in acetonitrile/0.1% aqueous TFA (1:9), except as noted, prior to HPLC analysis.

TABLE B.4.2 Limits of Detection and Quantification.

Study	Background	Counting Efficiency		Specific Activity	Sample Volume	Aliquot Size	LSC LOQ	Combustion LOQ	HPLC LOD
		Combustion	LSC	dpm/µg	mL	g	ng	ppm	ng
Phenyl-label	25 dpm	81%	84%	126,096	1	0.1	0.47 ng	0.00049	4.5
Pyrazole-label	25 dpm	81%	84%	131,868	1	0.1	0.45 ng	0.00047	4.3

B.4.2.2.2 Mass Spectrometry

Mass spectral analyses were performed with a TSQ 7000 mass spectrometer. The spectrometer was connected to an HPLC system consisting of a P4000 quaternery gradient solvent pump, an autosampler (Thermoseparations, Model AS3000), and a Zorbax Rx C8 (5µm, 250 mm x 4.6mm) reverse phase column. For negative ion electrospray LC-MS analyses, solvent A (0.1%

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formic acid) and solvent B (MeOH) were used in combination as the mobile phase at a flow rate of 0.8 mL/min. The flow from the column was split to deliver 0.2 mL/min to the electrospray interface and 0.6 mL/min to a radiodetector. The solvent gradient program was a linear ramp from 5% solvent B to 100% solvent B over 11 min.

Daughter ion spectra were produced by liquid chromatography/mass spectrometry/mass spectrometry (LC-MS/MS). The first quadrapole of the TSQ 7000 was used to isolate a precursor ion, which, in the negative ion mode, was a deprotonated $(M-1)^+$ ion. The second stage of the instrument was used to induce fragmentation of the precursor ion by collision with argon gas at approximately 2.3 mTorr and collision energy of about 20 eV. The second quadrapole of the instrument was used to measure the mass spectra of the resultant molecular fragments.

C. RESULTS AND DISCUSSION

TRR in milk and tissues are reported in TABLE C.2.1. The distribution of radioactivity in goat commodities is reported in TABLE C.2.2. Characterization and identification of radioactive residues is summarized in TABLE C.2.3.

Distribution of total radioactive residues:

A total of 68.4% and 93.3% of the administered dose was recovered for [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole studies, respectively. The lower accountability in the phenyl-label study is attributed to the differences in the recovery of urine and feces due to splashing in the containment cage. In these two studies, radioactivity in the cage washes was not accounted for. The majority of the recovered radioactivity was in the excreta at 85.5% (phenyl-label) and 92.1% (pyrazole-label). Radioactivity in tissues was highest in liver and lowest in muscle/fat for both radiolabels. The TRR reported for the [phenyl-U-^{14}C] study in liver, kidney, muscle and fat was 1.477 ppm, 0.533 ppm, 0.010 ppm and 0.010 ppm, respectively. Residue levels in the milk ranged from 0.016 to 0.017 ppm, for a total of 0.05 ppm. The TRR reported for the [pyrazole-3-^{14}C] study in liver, kidney, muscle and fat was 1.723 ppm, 0.269 ppm, 0.007 ppm, and 0.008 ppm, respectively. Residue levels in the milk ranged from 0.031 ppm to 0.044 ppm for a total of 0.114 ppm.

Characterization and identification of total radioactive residues:

The major component of the combined acetonitrile/water, acetonitrile, and acetonitrile/water reflux extracts was isolated by preparative HPLC and subjected to mass spectrometry. Negative ion LC-MS showed a parent ion at m/z 361 $(M-1)^+$. The negative ion LC-MS/MS daughter ion spectrum of the m/z 361 and HPLC retention time were both identical to an authentic pyrasulfotole standard (MW=362). The pyrasulfotole-desmethyl (AE 1073910) metabolite was identified based on its HPLC retention time relative to an authentic standard of AE 1073910. Also, the negative ion LC-MS showed an ion at m/z 347 $(M-1)^+$. The negative ion LC-MS/MS daughter ion spectrum of m/z 347 and HPLC retention time were both identical to an authentic AE 1073910 standard (MW=348). The pyrasulfotole-hydroxymethyl metabolite was identified

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based on its HPLC retention time relative to pyrasulfotole-hydroxymethyl.

Phenyl-label study: Extraction of liver with acetonitrile/water (4:1) and acetonitrile released 95.5% of the TRR (1.411 ppm). The HPLC profile showed a single component of 95.5 % of the TRR. The remaining solids contained only 4.5% of the TRR (0.066 ppm) and were not analyzed further. The single component of the combined acetonitrile/water (4:1) and acetonitrile liver extract (95.5% of the TRR, 1.411 ppm) was positively identified as pyrasulfotole (MW= 362). Total identification of the radioactive residues in liver was 95.5% of the TRR (1.411 ppm). All extractable radioactive residues were identified. The overall accountability of the total radioactive residue was 100%.

Extraction of kidney with acetonitrile released 71.0% of the TRR (0.379 ppm) identified as pyrasulfotole. Methanol reflux released an additional 28.6% of the TRR (0.153 ppm) also identified as pyrasulfotole. The remaining solids contained 0.4% of the TRR (0.002 ppm). Total identification of the radioactive residues in kidney was 99.6% of the TRR (0.532 ppm). All extractable radioactive residues were identified. The overall accountability of the total radioactive residue was 100.2%.

Extraction of muscle with acetonitrile released 93.1% of the TRR (0.009 ppm). The HPLC profile showed two components. The remaining solids contained only 6.9% of the TRR (0.001 ppm). Due to the low residues levels (< 0.010 ppm) the two components of the acetonitrile extract were identified or characterized based on HPLC retention times. The major component of the acetonitrile extract (80.2% of the TRR, 0.008 ppm) was identified as pyrasulfotole. The other minor component of the acetonitrile extract representing an additional 8.3% of the TRR (0.001 ppm) was identified as pyrasulfotole-hydroxymethyl. The overall accountability of the total radioactive residue was 91%.

Extraction of fat with hexane and acetonitrile released 92.4% of the TRR (0.009 ppm). The total extractable residue was < 0.01 ppm with no single extract representing > 0.007 ppm; therefore, the samples were not analyzed further. The remaining solids contained only 7.6% of the TRR (0.001 ppm). The overall accountability of the total radioactive residue was 100%.

Partitioning of the Day 3 milk with hexane followed by partitioning of the hexane partition with methanol /water (9:1) resulted in a combined aqueous methanol extract which constituted 98.8% of the TRR (0.016 ppm). The remaining hexane extractables contained only 1.2% of the TRR (<0.001 ppm). The major component (82.7% of the TRR, 0.014 ppm) of the combined aqueous methanol extract was positively identified as pyrasulfotole, with an additional 16.1% of the TRR (0.03 ppm) as pyrasulfotole-desmethyl and pyrasulfotole-hydroxymethyl. All radioactive residues greater than 12% of the TRR (0.02 ppm) were identified. The overall accountability of the total radioactive residue was 100%.

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Pyrazole-label study: Extraction of liver with methanol released 87.5% of the TRR (1.508 ppm). Methanol reflux released an additional 9.7% of the TRR (0.166 ppm). The methanol reflux extract was subjected to a C-18 SEP column cleanup and the resulting extract of combined SPE fractions (representing 9.0% of the TRR, 0.150 ppm) was analyzed by HPLC. The remaining solids contained only 2.8% of the TRR (0.049 ppm) and were not analyzed further.

The major component of the methanol liver extract (84.3% of the TRR, 1.453 ppm) was identified as pyrasulfotole, with one minor component representing an additional 1.4% of the TRR (0.025 ppm) identified as pyrasulfotole-desmethyl. A second minor component of the methanol extract, representing an additional 1.7% of the TRR (0.030 ppm) was characterized as an unidentified polar metabolite L#1. The single component of the combined SPE fractions extract from the methanol reflux extract (9.0% of TRR, 0.150 ppm) was identified as pyrasulfotole. The total radioactive residue in the liver was identified (93.3% of the TRR, 1.603 ppm) as pyrasulfotole. An additional 1.0% of the TRR (0.016 ppm) was characterized as two minor components in the SPE load and SPE water. The overall accountability of the total radioactive residue was 100%.

Extraction of kidney with methanol released 95.9% of the TRR (0.258 ppm). The methanol extract was subjected to a C-18 SEP column cleanup and the resulting extract of combined SPE fractions (representing 92.4% of the TRR, 0.249 ppm) was analyzed by HPLC. The HPLC profile showed a single component identified as pyrasulfotole. An additional 3.1% of the TRR (0.009 ppm) remained in the SPE load and SPE water. The remaining solids contained 4.1% of the TRR (0.011 ppm) and were not analyzed further. The overall accountability of the total radioactive residue was 100%.

Extraction of muscle with methanol released 69.8% of the TRR (0.005 ppm). The remaining solids contained 30.2% of the TRR (0.002 ppm). The total extractable residue was < 0.01 ppm; therefore, the sample was not analyzed further. The overall accountability of the total radioactive residue was 100%.

Extraction of fat with hexane and acetonitrile released 87.9% of the TRR (0.007 ppm). The total extractable residue was < 0.01 ppm with no single extract representing >0.005 ppm; therefore, the samples were not analyzed further. The remaining solids contained 12.1% of the TRR (0.001 ppm). The overall accountability of the total radioactive residue was 100%.

An extract of combined extractable residues of the Day 3 milk representing 68.2% of the TRR (0.030 ppm) was subjected to a C-18 SEP column cleanup that resulted in two extracts of combined SPE fractions. The resulting extract of the combined methanol and methanol/water (4:1) SPE fractions (representing 38.8% of the TRR, 0.017 ppm) was analyzed by HPLC and was identified as pyrasulfotole. The resulting extract of the combined load and water SPE fractions (representing 29.4% of the TRR, 0.013 ppm) showed three polar components M#1 (7.5% of the TRR, 0.003 ppm), M#2 (12.3% of the TRR, 0.006 ppm) and M#3 (9.6 % of the TRR, 0.004 ppm. The remaining methanol and hexane extractables contained 2.3% (0.001 ppm) and 8.7% of the

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TRR (0.004 ppm), respectively and were not analyzed further. The remaining solids contained 20.7% of the TRR (0.009 ppm). The overall accountability of the total radioactive residue was 100%.

C.1. Storage Stability

Animal tissues were frozen immediately after dissection. Milk, feces and urine samples were frozen after collection. Samples were stored frozen prior to analysis. The tissues were shipped to Bayer CropScience on dry ice. Upon arrival at Bayer CropScience the samples remained frozen solid and were stored frozen prior to analysis.

All tissues were initially extracted and the metabolic profile determined within 4-6 months (TABLE C.1). Metabolites in the extractable residue of kidney, liver, muscle and milk were profiled within 5 months of necropsy. The high accountability of the TRR as identified metabolites and the similarity of the profile between tissues support stability over the short storage period. A liver sample was extracted and analyzed after 243 days of storage and the extractability was virtually identical to a samples extracted after 14 days. Analysis of this samples indicated that 94.6 % of the residue was parent compound thus confirming the stability during storage.

TABLE C.1. Summary of Storage Conditions.

Matrix	Storage Temp.(°C)	Actual Storage Duration (days)		Interval of Demonstrated Storage Stability (days)[a]
		Phenyl	Pyrazole	
Urine	<-20	NA	NA	Not required[b]
Feces	<-20	NA	NA	Not required
Muscle	<-20	145	140	Not required
Fat	<-20	214[b]	137	Not required
Kidney	<-20	11	24	Not required
Liver	<-20	243	33	243
Milk	<-20	21	60	Not required

[a] Storage stability data should not normally be required for samples analyzed within 4 to 6 months of collection.[10]
[b] Due to low residue the extraction of the fat was not required by the guidance.

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TABLE C.2.1. Total Radioactive Residues (TRR) in Milk, Tissue and Excreta.

Matrix	Collection Timing	[phenyl-U-^{14}C]-AE 0317309		[pyrazole-3-^{14}C]-AE 0317309	
		ppm	%AD	ppm	%AD
Urine	Day 1, pm + am Day 2, pm + am Day 3, pm + am	12.101 23.720 10.414	8.323 21.790 10.370	23.758 18.120 22.422	16.450 19.287 22.001
Feces	Day 1, pm + am Day 2, pm + am Day 3, pm + am	7.372 14.450 17.457	5.262 8.288 13.248	8.749 8.317 10.710	12.595 9.946 12.025
Total		85.514	67.3	92.076	92.3
Muscle	At sacrifice	0.011	0.004	0.007	0.003
Fat	At sacrifice	0.010	0.004	0.008	0.003
Kidney	At sacrifice	0.533	0.064	0.269	0.027
Liver	At sacrifice	1.477	1.074	1.723	0.892
Milk	Day 1, pm + am Day 2, pm + am Day 3, pm + am	0.016 0.017 0.017	0.004 0.004 0.004	0.039 0.031 0.044	0.033 0.026 0.041
Total		0.05	0.012	0.114	0.1
Upper GI tract	Not harvested	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lower GI tract	Not harvested	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Other	Bile, At sacrifice	Not analyzed	Not analyzed	Not analyzed	Not analyzed
% of Administered Dose		68.4 %		93.3 %	

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TABLE C.2.2. Distribution of the Parent and the Metabolites in Livestock Matrices when Dosed with [Phenyl-U-^{14}C] and [Pyrazole-3-^{14}C]-Pyrasulfotole.

	Muscle		Fat		Kidney		Liver		Milk	
Metabolite Fraction	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
Phenyl-label study										
Organosoluble	93.1	0.009	92.4	0.009	99.6	0.532	95.5	1.411	98.8	0.016
AE 0317309	80.2	0.008	-	-	99.6	0.532	95.5	1.411	82.7	0.014
Desmethyl AE0317309	-	-	-	-	-	-	-	-	11.7	0.002
Hydroxymethyl AE 0317309	8.3	0.001	-	-	-	-	-	-	4.4	0.001
Pyrazole-label study										
Organosoluble	69.8	0.005	87.9	0.007	95.9	0.258	97.2	1.674	79.2	0.036
AE 0317309	-	-	-	-	92.4	0.249	93.3	1.603	38.8	0.017
Desmethyl AE0317309	-	-	-	-	-	-	1.4	0.025	-	-
L #1	-	-	-	-	-	-	1.7	0.030	-	-
M#1	-	-	-	-	-	-	-	-	7.5	0.003
M#2	-	-	-	-	-	-	-	-	12.3	0.006
M#3	-	-	-	-	-	-	-	-	9.6	0.004
SPE load	-	-	-	-	0.3	0.001	0.3	0.005	-	-
SPE water	-	-	-	-	2.8	0.008	0.7	0.011	-	-
Hexanes Partition	-	-	-	-	-	-	-	-	2.3	0.001
MeOH/Water Partition	-	-	-	-	-	-	-	-	8.7	0.004

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Table C.2.3. Summary of Characterization and Identification of Radioactive Residues in Livestock Matrices Following Application of Radiolabeled AE 0317309 at a rate of 51.2 ppm [phenyl-U-^{14}C]-AE 0317309 equivalents in the diet and 28.1 ppm [pyrazole-3-^{14}C]-AE 0317309 equivalents in the diet.

Phenyl-label study										
Compound	Muscle TRR = 0.011 ppm		Fat TRR = 0.010 ppm		Kidney TRR = 0.533 ppm		Liver TRR = 1.477 ppm		Milk TRR = 0.017 ppm	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm	%TRR	ppm
AE 0317309	80.2	0.008	-	-	99.6	0.532	95.5	1.411	82.7	0.014
AE 1073910[a]			-	-	-	-	-	-	11.7	0.002
Hydroxymethyl AE 0317309	8.3	0.001	-	-	-	-	-	-	4.4	0.001
Total identified	88.5	0.009	-	-	99.6	0.532	95.5	1.411	98.8	0.016
Total characterized	-	-	92.4	0.009	-	-	-	-		
Total extractable	93.1	0.009	92.4	0.009	99.6	0.532	95.5	1.411	100.0	0.017
Unextractable (PES)[a]	6.9	0.001	7.6	0.001	0.4	0.002	4.5	0.066	0.0	0.000
Accountability[b]	91		100		100.2		100		100	
Pyrazole-label study										
Compound	Muscle TRR = 0.007 ppm		Fat TRR = 0.008 ppm		Kidney TRR = 0.269 ppm		Liver TRR = 1.723 ppm		Milk TRR = 0.044 ppm	
	% TRR	ppm	% TRR	ppm	% TRR	ppm	% TRR	ppm	%TRR	ppm
AE 0317309	-	-	-	-	92.4	0.249	93.3	1.603	38.8	0.017
AE 1073910	-	-	-	-	-	-	1.4	0.025	-	-
Total identified	-	-	-	-	92.4	0.249	94.7	1.628	38.8	0.017
Total characterized	-	-	-	-	3.1	0.009	2.7	0.046	40.4	0.018
Total extractable	69.8	0.005	87.9	0.007	95.5	0.258	97.2	1.674	68.2	0.035
Unextractable (PES)[a]	30.2	0.002	12.1	0.001	4.1	0.011	2.8	0.049	20.7	0.009
Accountability[b]	100		100		100		100		100	

[a] Residues remaining after exhaustive extractions.
[b]Accountability = (Total extractable (ppm) + Total unextractable (ppm))÷(TRR (ppm) from combustion analysis)* 100

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C.3. Proposed Metabolic Profile

The proposed metabolic pathway for the [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole in lactating goats is shown in FIGURE C.3.1. Pyrasulfotole is metabolized by either *N*-demethylation of pyrasulfotole to afford the pyrasulfotole-desmethyl (AE 1073910) or oxidation of pyrasulfotole to afford pyrasulfotole-hydroxymethyl.

FIGURE C.3.1. Proposed Metabolic Profile of Pyrasulfotole in the Lactating Goat

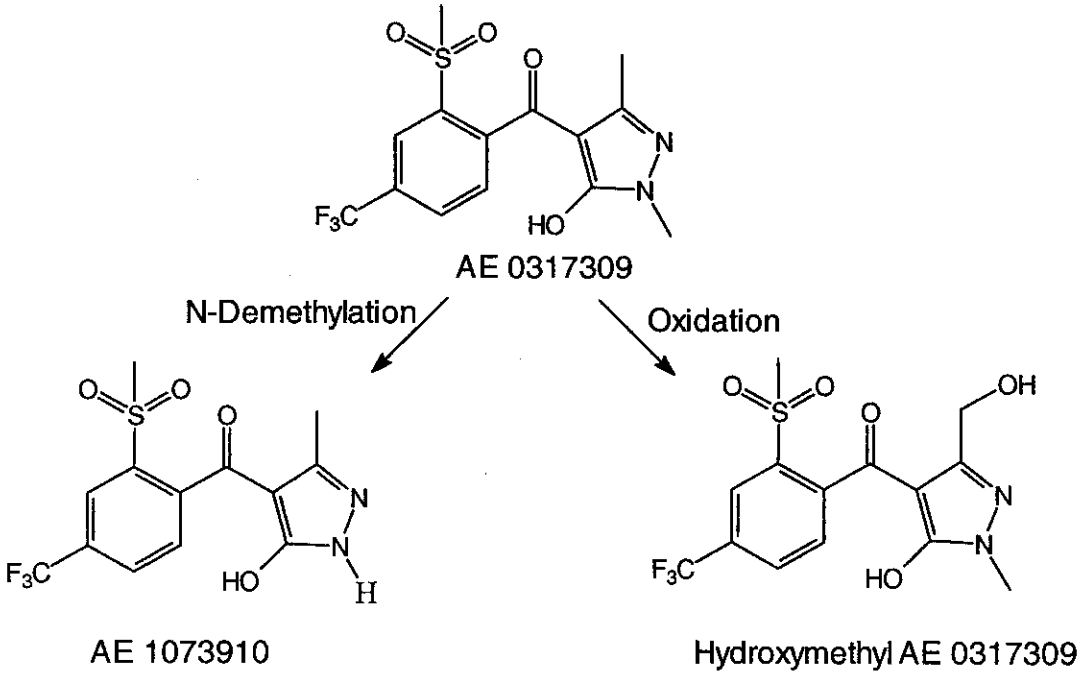

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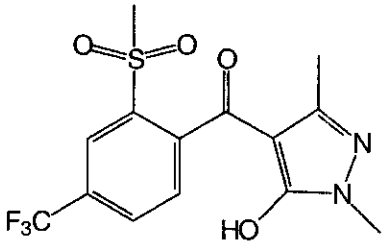
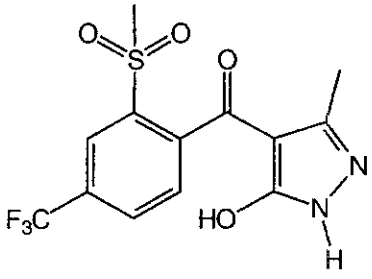
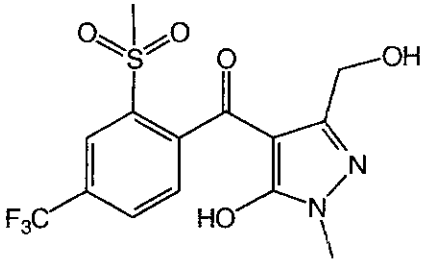
TABLE C.3.1. Identification of Compounds from Metabolism Study.

Common name/code Figure C.3.1 ID No.	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-hydroxymethyl	5-hydroxy-3-hydroxymethyl-1-methyl-1*H*-pyrazol-4-yl)-(2-methanesulfonyl-4-trifluoromethyl-phenyl)methanone	

D. CONCLUSION

The metabolic fate of pyrasulfotole in tissues and milk has been studied in lactating goats dosed orally for 3 consecutive days with [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole. Pyrasulfotole was the predominant residue in tissues and milk. The metabolic profile involved N-demethylation of the parent pyrasulfotole to afford the pyrasulfotole-desmethyl metabolite (AE 1073910), or oxidation resulting in the pyrasulfotole-hydromethyl metabolite.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

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3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. Zager, E. and Edwards, D. (1992). EPA Memorandum: Additional guidance for conducting plant and livestock metabolism studies. Pesticide registration rejection rate analysis for residue chemistry.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (15 November 2006); George Kramer (15 November 2006).
Petition Number: 6F7059
DP#: 333412

Template Version June 2005.

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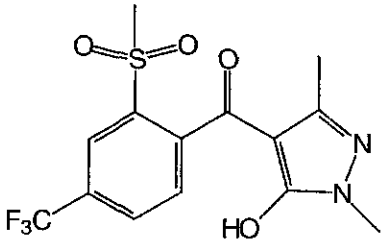
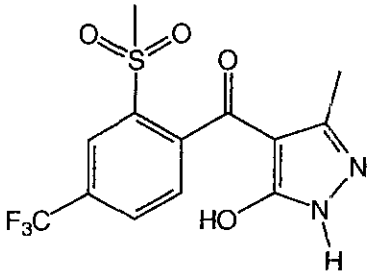
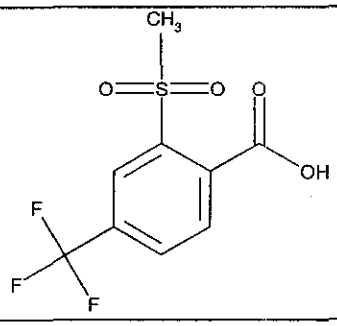
APPENDIX 1

Reference Standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	

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Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Apr 13 2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R. Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801748 D. Koehn and M. Haas (2004), Metabolism of [pyrazole-3-^{14}C] AE 0317309 in Wheat (*Triticum aestivum*) Following Treatment at a Nominal Application Rate of 100 g a.s./ha, Lab Project Number: CM 02/007, Bayer CropScience Report Number: MEF-194/03. Unpublished study prepared by Bayer CropScience. 115 pages.

MRID No. 46801749 D. Koehn and M. Haas (2004), Metabolism of [phenyl-U-^{14}C] AE 0317309 in Wheat (*Triticum aestivum*) Following Treatment at a Nominal Application Rate of 100 g a.s./ha, Lab Project Number: CM 02/006, Bayer CropScience Report Number: MEF-193/03. Unpublished study prepared by Bayer CropScience. 108 pages.

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EXECUTIVE SUMMARY:

The metabolism of pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone) was investigated in spring wheat following spray application. [Phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole were formulated as an oil suspension (OD 5) and applied by spraying at a nominal rate of 100 g a.i./ha (onefold rate experiment). A twofold rate experiment was performed in parallel to isolate metabolites for use as reference compounds. Wheat was treated at BBCH growth stage 21-22 (early tillering). Some plants were sampled approximately 3 hours after application. Following growth under outdoor conditions, further samples were taken at stage 43 (forage, 27-28 days after treatment, DAT), stage 73 (hay, 49-50 DAT), and stage 89 (harvest, 89-90 DAT). Untreated control samples were taken at each growth stage.

All samples from the onefold application were homogenized and the total radioactive residue (TRR) determined immediately after each sampling by liquid scintillation counting (LSC) and combustion. Aliquots were extracted with acetonitrile and water, and analysed by high performance liquid chromatography (radio-HPLC) and thin layer chromatography (radio-TLC). Non-extractable residues of forage and straw were additionally released by Soxhlet extraction. The solids of forage, grain, and straw were further characterised by enzymatic, acidic or alkaline hydrolysis.

At maturity, the overall distribution of radioactivity from the whole plant was 74.4-95.1% of the TRR in straw, and 4.9-25.6% of the TRR in grain. TRR levels were 0.44 ppm in forage, 0.18 ppm in hay, 0.55 ppm in straw, and 0.30 ppm in grain for the [phenyl-U-^{14}C]-label study. TRR levels amounted to 0.47 ppm in forage, 0.06 ppm in hay, 0.38 ppm in straw, and 0.03 ppm in grain for the [pyrazole-3-^{14}C]-label study.

The majority of extractable residue in the phenyl-label study was identified (60.2-89.5% of the TRR; 0.13-0.39 ppm) in all of the wheat matrices, with 1.6 to 11.5% of the TRR (0.007-0.02 ppm) remaining non-extractable. Polar components were characterized at levels of 4.5-35.8% of the TRR (0.02-0.15 ppm). The predominant residue was pyrasulfotole-benzoic acid in all wheat matrices with levels increasing as the plant matured (24.1-89.5% of the TRR; 0.11-0.35 ppm). Pyrasulfotole-desmethyl-*O*-glucoside was also a major component in wheat forage and hay, and a minor component in straw. Repeated analysis of the 90 DAT straw sample, as well as re-extraction, did not show any significant variation in the extraction efficiency over four months.

In the pyrazole-label study, 0.7-43.4% of the TRR (<0.001-0.2 ppm) was identified in wheat matrices, with 1.8-34.8% of the TRR remaining non-extractable. Many polar components were characterized (38.1-77.1% of the TRR; 0.021-0.273 ppm) in wheat matrices. Pyrasulfotole-desmethyl-*O*-glucoside was the only metabolite identified in forage, hay, straw (21.7-43.0% of the TRR; 0.015-0.20 ppm), and grain (0.7% of the TRR; <0.001 ppm). A polar fraction, p1, was a major part of the residue in hay (20.9% of the TRR; 0.01 ppm), straw (10.9% of the TRR; 0.04 ppm), and (11.2% of the TRR; 0.003 ppm). Several unknown metabolite fractions of varying polarity were detected in wheat matrices, none of them exceeding 7.7% of the TRR (0.04 ppm).

The metabolic profile of pyrasulfotole in spring wheat involved the demethylation and subsequent glucosylation of the parent compound, yielding pyrasulfotole-desmethyl-*O*-glucoside. There was also cleavage of the complete pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite as detected by the phenyl label study and a polar fraction (p1) formed from the pyrazole label. Fraction p1 was characterized as being natural or incorporated into the matrix.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the plant metabolism data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document (DP# 333412), in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No GLP deviations were reported which would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

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TABLE A.1. Test Compound Nomenclature.

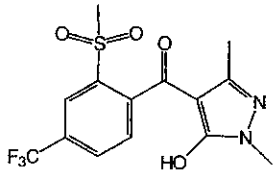
Compound	Chemical Structure
	
Common name	pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; AE 0317309 02 SE06; AE 0317309 03 EC 23 A8

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound.

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0pH 7.0pH 9.0	8
UV/visible absorption spectrum	λ_{max} = 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. EXPERIMENTAL DESIGN

B.1. Test Site and Crop Information

The plants were artificially irrigated, fertilized, and treated with other pesticides if needed, to allow growth under optimal conditions. Natural sunlight had access from the side of the vegetation hall. Between application of the test item and harvest, the air temperature ranged from 10°C (night) to 39°C (day). No meteorological abnormalities impacted the study.

TABLE B.1.1. Test Site Information.

Type	Testing Environment	Soil characteristics			
		Type	%OM	pH	CEC
Foliar Treatment	Outdoor, vegetation hall, surrounded by wire-mesh fencing, covered with a glass roof	Sandy loam	1.9%	5.8 ($CaCl_2$)	6.15 meq/100 g dry soil

TABLE B.1.2. Crop Information.

Crop/crop group	Variety	Application	Growth stage at application	Growth stage at harvest	Harvested RAC	Harvesting procedure
Spring wheat (*Triticum aestivum*)/ Cereals	Triso	1 appl. each (onefold rate, twofold rate)	Early tillering (BBCH code: 21 – 22)	Early tillering BBCH code 21-22 Mid boot stage BBCH code: 43 Early milk BBCH code: 73 Maturity BBCH code: 89	Some plants Forage Hay Straw Grain	Plants were cut shortly above the soil surface with hand clippers. Plants were cut shortly above the soil surface. Grain was collected by hand, remaining ears and chaffs were combined with the straw.

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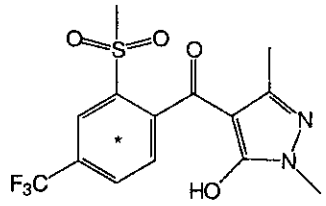
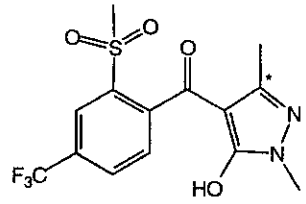
B.2. Test Materials

TABLE B.2.1. Test Material Characteristics.		
Chemical structure		
	 *position of ^{14}C radiolabel	 * position of ^{14}C radiolabel
Radiolabel position	[phenyl-U-^{14}C] AE 0317309	[pyrazole-3-^{14}C]-AE 0317309
Lot No.	SEL/1006	SEL/109
Purity	99.1%	>98%
Specific activity	3.19 MBq/mg 86.23 µCi/mg 191,400 dpm/µg	3.2 MBq/mg 86.89 µCi/mg 192,889 dpm/µg

B.3. Study Use Pattern

TABLE B.3.1. Use Pattern Information.	
Formulated product	Oil suspension concentrate (5% a.i.)
Application method	Computer controlled track sprayer, with a flat fan nozzle
Application rate (onefold) Application rate (twofold)	100 g a.i./ha (7 mg a.i./0.7 m^2) 200 g a.i./ha (14 mg a.i./0.7 m^2)
Number of applications	1
Timing of applications	Postemergent, BBCH Stage 21-22
PHI	90 days (phenyl label); 89 days (pyrazole label)

B.4. Identification/ Characterization of Residues

B.4.1. Sample Handling and Preparation

Sample collection:
For the phenyl-label study, samples of forage (28 DAT), hay (50 DAT), straw (90 DAT), and grain (90 DAT) were collected. For the pyrazole-label study, samples of forage (27 DAT), hay (49 DAT), straw (89 DAT), and grain (89 DAT) were collected. Samples were weighed then homogenized in a kitchen blender in the presence of dry ice. Aliquots of each sample were stored in a freezer. Further aliquots of the samples were combusted in an oxidizer or extracted. Work-up of normal dose samples was initiated immediately after sampling to ensure the extraction and identification/characterization of the original residues.

Extraction of residues:
Aliquots of the homogenized samples were extracted with acetonitrile/water (80/20, v/v, 3-5 times) at ambient temperature using an Ultra-Turrax. Samples were centrifuged between extractions. Pooled extracts from each crop matrix were cleaned up by solid phase extraction

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(SPE, C18) and concentrated by rotary evaporation. Aliquots of the extracts were taken in triplicate for radioactivity measurement by LSC. Losses during work-up were monitored. To determine the non-extractable residues, the extracted and air-dried solids were homogenized. Aliquots were combusted, and the radioactivity determined by LSC. Residues of forage and straw not extractable at ambient temperature were additionally extracted (Soxhlet extraction, 4 hours, acetonitrile/water 80/20, v/v).

Investigation of the non-extractable residues
For further characterization, the non-extractable residues of forage and straw were investigated by a stepwise treatment with matrix digesting enzymes, and acid or base. After Soxhlet extraction, the homogenized remainder was soaked overnight in 0.1 N sodium acetate buffer, pH 4.6. Matrix digesting enzymes (cellulase "Onozuka R-10 + macerozyme R-10) were added. This mixture was incubated at approx. 35°C for 2 days. After centrifugation, the radioactivity of the supernatant was determined by LSC. The remainder, after enzymatic treatment, was divided into two equal portions, which were incubated for approximately 4 hours at ambient temperature with 1 M HCl or 1 M NaOH, respectively. After centrifugation, the radioactivity of the supernatants was determined. The remainders of the previous steps were hydrolyzed with 6 M HCl and 10 M NaOH, respectively, under reflux heating for 4 hours. After neutralization and centrifugation the supernatants were measured by LSC. Supernatants containing ≤3% of the TRR were partitioned 3x with ethyl acetate. The air-dried solids were combusted to determine the amount of unreleased radioactivity (i.e., non-extractable residues after exhaustive extraction steps).

Isolation of metabolites and further characterization
A radiolabelled metabolite was isolated from the overdose experiment of the forage sample. After extraction, purified by SPE, and concentration, several aliquots were subjected to HPLC. The metabolite fraction of each HPLC run was collected. The combined fractions were evaporated and partitioned with ethyl acetate. A further clean-up step of the concentrated organic phase was carried out by successive micro-preparative HPLC. The purified metabolite fraction was concentrated to dryness and used for structural elucidation by NMR, LC-MS, and LC-MS/MS.

Aliquots of metabolite were concentrated to dryness and hydrolyzed in 0.2 M sodium acetate buffer containing 90 units β-glucosidase (18 h at 37°C) or 1 N HCl (2 h at 100°C). Hydrolyzed samples were neutralized, centrifuged, concentrated, and reconstituted with water/ACN 20:80, v/v). Each sample was analyzed by HPLC.

To isolate a sufficient amount of the very polar fraction, onefold and twofold straw samples were combined, soaked overnight into water (containing HCOOH), and extracted. The extraction was repeated with ACN/water (50/50, v/v) and acetonitrile, also containing of formic acid. After filtration and concentration to the aqueous remainder, SPE cartridges were applied.

Partition using a Craig apparatus:
The Craig partition apparatus consisted of 150 separation elements, each filled with water/trifluoroacetic acid (or water/ammonium hydroxide) and butanol. After separation, the

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phases in the elements were homogenized by addition of 2-propanol and the amount of radioactivity was determined by LSC.

B.4.2. Analytical Methodology

Aliquots of extracts and non-extractable residues were analyzed for radioactivity by LSC and combustion/LSC. Extracts were cleaned up and concentrated prior to analysis by HPLC and TLC. HPLC was used for quantitation, characterization, and identification of metabolites. TLC was used as a second analytical system to confirm the HPLC results. Metabolites were identified by co-chromatography with authentic reference standards and mass spectroscopy.

HPLC analyses were conducted using a reverse-phase C18 column and a gradient mobile phase of 0.02 M aqueous ammonium formate (adjusted to pH 2) and ACN. Non-labeled references were detected by UV (215 nm), and radioactivity was quantified using a radioactivity flow monitor and additionally by fraction collection/LSC for confirmation.

Aliquots of extracts were applied to silica gel 60 F_{254} plates (normal phase) and developed using a mobile phase of chloroform : methanol : toluene : acetic acid (50:35:15:1) or toluene : ethanol : ammonia solution (25% NH_3) (6:5:1). Non-labeled reference items were visualized using UV light (254 nm), and radioactivity was detected using a Bio-Imaging Analyzer.

High-performance liquid chromatography/electrospray ionization mass spectroscopy (LC-MS/MS) and LC-MS analyses were used to confirm the identity of the metabolites. For the MS/MS experiments, argon was used as the collision gas. A radioactivity detector was coupled via a flow splitter between the HPLC instrument and mass spectrometer.

The LOQ for radio-HPLC was reported as 0.006 ppm (phenyl-label) and 0.002 ppm (pyrazole-label).

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C. RESULTS AND DISCUSSION

Residue levels are expressed as parent compound equivalents and as percent of the TRR. The distribution of total radioactive residues in wheat matrices is reported in TABLE C.2.1 and depicted in FIGURES C.2.1 and C.2.2. T he distribution of pyrasulfotole and the metabolites in spring wheat when dosed with [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole is reported in TABLES C.2.2 and C.2.2.1. The summary of characterization and identification of radioactive residues is reported in TABLES C.2.3 and C.2.3.1. Identification of metabolites was achieved by mass spectrometry and co-chromatography with reference compounds. Unknown metabolite fractions were classified according to their chromatographic behavior on HPLC using different gradient and reverse-phase columns. The distribution of total radioactive residues in wheat matrices was quantitatively different for both radiolabels indicating that cleavage of the parent molecule had occurred.

Phenyl label: The overall accountability was in the range of 94.4-100.0%. Straw and grain were analyzed separately. A total of 74.4% of the radioactivity in the whole plant was detected in straw at maturity. The remaining 25.6% of radioactivity was in grain. Total radioactive residue levels were 0.44 ppm in forage, 0.18 ppm in hay, 0.55 ppm in straw, and 0.30 ppm in grain.

Forage
Using aqueous acetonitrile, 83.8% (0.37 ppm) of the TRR was extracted, whereas 16.2% (0.07 ppm) of the TRR remained non-extractable (solids) at ambient temperature. Additionally, 5.9% (0.03 ppm) of the TRR was released by Soxhlet extraction. By applying successive treatments with enzymes and acid, only low amounts of radioactivity were released, accounting for 1.4% of the TRR (enzymatic hydrolysis), and 2.7% of the TRR (acidic hydrolysis). Applying an alkaline hydrolysis after the enzymatic treatment released 7.4% (0.03 ppm) of the TRR, leaving only 1.6% of TRR (0.01 ppm) as final non-extractable residue. Two major metabolites were detected in the conventional extracts of forage at ambient temperature. One metabolite comprising 24.1% (0.11 ppm) of the TRR was identified as pyrasulfotole-benzoic acid (AE B197555). A second metabolite amounting for 33.8% (0.15 ppm) of the TRR was identified as the *O*-glucoside of pyrasulfotole-desmethyl. Several unknown metabolite fractions and regions were detected, none of them exceeding 5.9% of the TRR or 0.03 ppm. The metabolic patterns of Soxhlet extraction and extraction at ambient temperature were comparable. By comparison of the retention times (HPLC) and Rf values (TLC) of both extracts, 1.9% (0.01 ppm) of the TRR of the Soxhlet extract was identified as the pyrasulfotole-benzoic acid metabolite. In total, 60.2% of the TRR was identified, and 35.8% was characterized as medium polarity residues.

Hay
By conventional extraction with aqueous acetonitrile, 88.5% (0.16 ppm) of the TRR was extracted at ambient temperature, leaving 11.5% (0.02 ppm) of the TRR with the non-extractable residues. The main metabolite comprising 60.8% (0.11 ppm) of the TRR was identified as pyrasulfotole-benzoic acid (AE B197555). The pyrasulfotole-desmethyl-*O*-glucoside amounted to 10.4% (0.02 ppm) of the TRR. Several unknown metabolite fractions and regions were detected, none of them exceeding 3.2% of TRR (<0.01 ppm). In total, 71.2% of the TRR was identified and 12.4% was characterized.

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Straw
Using aqueous acetonitrile, 83.4% (0.46 ppm) of the TRR was extracted, whereas 16.6% (0.09 ppm) of the TRR remained non-extractable in the solids at ambient temperature. Additionally, 5.3% (0.03 ppm) of the TRR in non-extractable residues was released by Soxhlet extraction. By applying successive treatment with enzymes and acid, only low amounts of radioactivity were released, accounting for 1.7% of the TRR (enzymatic hydrolysis), and 1.3% of the TRR (acidic hydrolysis). An alkaline hydrolysis after the enzymatic treatment released 7.2% (0.04 ppm) of the TRR, leaving only 1.7% of TRR (0.01 ppm) as the non-extractable residue. Pyrasulfotole-benzoic acid amounted to 63.6% (0.35 ppm) of the TRR. Pyrasulfotole-desmethyl-*O*-glucoside (4.5%, 0.03 ppm of the TRR) was also identified. Several polar and medium polar metabolite fractions and regions were detected, none of them exceeding 5.4% of TRR or 0.03 ppm. By comparison of the retention times (HPLC) and Rf values (TLC) of both extracts, 2.4% (0.01 ppm) of the TRR was identified as the major metabolite pyrasulfotole-benzoic acid. In total, 71.1% of the TRR was identified and 25.2% was characterized as polar and medium polarity components.

Grain
By conventional extraction with aqueous acetonitrile, 95.2% (0.29 ppm) of the TRR was extracted, leaving 4.8% (0.02 ppm) of the TRR with the non-extractable residues. Pyrasulfotole-benzoic acid was detected as the main component in the grain sample amounting to 89.5% (0.27 ppm) of the TRR. In total, 89.5% of the TRR was identified and 4.5% was characterized.

The extraction and analysis of the plant samples was generally initiated immediately after sampling, or within 17 days. The extract of straw at 90 DAT was reanalyzed after approximately 4.5 months, demonstrating that the metabolic pattern did not change significantly. An additional extraction of straw (90 DAT) after 4.5 months resulted in the similar composition and levels of residues. These results demonstrate that the metabolites were stable at the conditions of storage (freezer).

Pyrazole label: The accountability was in the range of 93.1-105.3%. Straw and grain were analyzed separately. A total of 95.1% of the radioactivity in the whole plant was detected in the straw, with only 4.9% determined in the grain at maturity. TRR levels amounted to 0.47 ppm in forage, 0.06 ppm in hay, 0.38 ppm in straw, and 0.03 ppm in grain.

Forage
Using aqueous acetonitrile, 82.3% (0.39 ppm) of the TRR was extracted, whereas 17.7% (0.08 ppm) of the TRR remained non-extractable (solids) at ambient temperature. Additionally, 4.8% (0.02 ppm) of the TRR in the non-extractable solids was released by Soxhlet extraction. By applying successive treatment with enzymes and acid, only low amounts of radioactivity were released, accounting for 1.8% (0.01 ppm) of the TRR (enzymatic hydrolysis), and 2.8% (0.013 ppm)of the TRR (acidic hydrolysis). Applying an alkaline hydrolysis after the enzymatic treatment released 9.1% (0.04 ppm) of the TRR, leaving only 1.8% of the TRR (0.01 ppm) as non-extractable residue. The major metabolite amounted to 43.0% (0.20 ppm) of the TRR, and was identified as the *O*-glucoside of pyrasulfotole-desmethyl. Several unknown metabolite

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fractions and regions were detected, none of them exceeding 7.7% of the TRR or 0.04 ppm. From the Soxhlet extract, 0.4% (0.002 ppm) of the TRR was identified as pyrasulfotole-desmethyl-*O*-glucoside. In total, 43.4% of the TRR was identified and 52.1% was characterized.

Hay
By conventional extraction with aqueous acetonitrile, 65.2% (0.04 ppm) of the TRR was extracted at ambient temperature, leaving 34.8% (0.02 ppm) of the TRR as non-extractable residues. The pyrasulfotole-desmethyl-*O*-glucoside amounted to 25.4% (0.02 ppm) of the TRR. A very polar metabolite fraction (p1) comprised 20.9% (0.01 ppm) of the TRR. Several unknown metabolite fractions and regions were detected, none of them exceeding 4.9% of the TRR (<0.01 ppm). In total, 25.4% of the TRR was identified and 38.1% was characterized.

The chromatographic behavior of the polar fraction (p1) was characterized by using different HPLC columns and standard gradients. It was determined that p1 was extremely hydrophilic and polar compound, not a weak acid or base. It was assumed that there are no acidic or alkaline groups in the molecule, with no free OH or NH groups. Finally, the p1 components would consist of C, N, O and H group, only. Therefore, p1 was characterized as being natural or incorporated into the matrix.

Straw
Using aqueous acetonitrile, 52.1% (0.20 ppm) of the TRR was extracted, whereas 47.9% (0.18 ppm) of the TRR remained non-extractable in the solids at ambient temperature. Additionally, 6.7% (0.03 ppm) of the TRR in the non-extractable solids was released by Soxhlet extraction. By applying successive treatment with enzymes and acid, the released radioactivity accounted for 7.7% of the TRR (enzymatic hydrolysis), and 4.5% of the TRR (acidic hydrolysis). Applying an alkaline hydrolysis after the enzymatic treatment released 9.4% (0.04 ppm, enzymatic hydrolysis) and 24.3% (0.09 ppm, alkaline hydrolysis) of the TRR, leaving only 4.1% of the TRR (0.02 ppm) non-released with the final non-extractable residue. In the straw extract at 89 DAT (ambient temperature), the pyrasulfotole-desmethyl-*O*-glucoside amounted to 21.7% (0.08 ppm) of the TRR. The very polar metabolite fraction (p1) comprised 10.9% (0.04 ppm) of the TRR. Several medium polar metabolite fractions and regions were detected, none exceeding 43.0% of TRR or 0.02 ppm. In total, 23.8% of the TRR was identified and 67.7% was characterized.

Grain
By conventional extraction with aqueous acetonitrile, 22.6% (0.006 ppm) of the TRR was extracted, leaving 77.4% (0.022 ppm) of the TRR as non-extractable residues. Additionally, 9.9% (0.003 ppm) of the TRR of the non-extractable solids was released by Soxhlet extraction. By applying successive treatment with enzymes and acid, the released radioactivity accounted for 21.9% (0.006 ppm) of the TRR (enzymatic treatment), and 25.0% (0.007 ppm) of the TRR (acidic treatment), leaving 20.0% of TRR (0.006 ppm) as the final non-extractable residue. Pyrasulfotole-desmethyl-*O*-glucoside accounted for 0.7% (<0.001 ppm) of the TRR. The metabolite fraction (p1) amounted to 11.2% (0.003 ppm) of the TRR. Several polar and medium polar metabolite fractions and regions were detected, none of them exceeding 3.8% of the TRR or 0.001 ppm. In total, 0.7% of the TRR was identified and 67.3% was characterized.

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The extraction and analysis of the plant samples was generally initiated immediately after sampling, or within 17 days. The extract of straw at 89 DAT was reanalyzed after approximately 4.5 months, and the metabolic pattern did not change significantly. An additional extraction of straw (89 DAT) after 4.5 months resulted in similar composition and levels of residues. These results demonstrate that the metabolites were stable under the conditions of storage (freezer).

C.1. Storage Stability

TABLE C.1. Summary of Storage Conditions.

RAC	Storage Temp. (°C)	Actual Study Duration	Interval of Demonstrated Storage Stability
Day 0 wheat matrices	≤-18	Extraction: 7 days HPLC analysis: 1 day	Not required.
Day 27 wheat matrices	≤-18	Extraction: 3 days HPLC analysis: 7 days	Not required.
Day 49 wheat matrices	≤-18	Extraction: 7 days HPLC analysis: 6 days	Not required.
Day 89 wheat matrices	≤-18	Extraction: 17 days HPLC analysis: 6 days	Not required.

TABLE C.1.a. Storage Stability of Samples.

Matrix	Straw Extract – 90 DAT Extraction/Analysis Aug 02/Sep 02 (ppm)	Straw Extract – 90 DAT Extraction/Analysis Aug 02/Jan 03 (ppm)	Straw Extract – 90 DAT Extraction/Analysis Jan 03 (ppm)
[Phenyl-U-^{14}C]-pyrasulfotole			
Pyrasulfotole-benzoic acid	0.352	0.352	0.346
Pyrasulfotole-desmethyl-*O*-glucoside	0.025	0.024	0.033
[Pyrazole-3-^{14}C]-pyrasulfotole			
Matrix	Straw Extract – 89 DAT Extraction/Analysis Aug 02/Sep 02 (ppm)	Straw Extract – 89 DAT Extraction/Analysis Aug 02/Jan 03 (ppm)	Straw Extract – 89 DAT Extraction/Analysis Jan 03 (ppm)
Pyrasulfotole-desmethyl-*O*-glucoside	0.08	0.09	0.08
p1	0.04	0.03	0.03

C.2. Identification, Characterization, and Distribution of Residues

TABLE C.2.1. Total Radioactive Residues in Matrices.

Matrix	Timing and Applic. No.	PHI (days)		[Phenyl-U-^{14}C] -AE 0317309		[Pyrazole-3-^{14}C] -AE 0317309	
		Phenyl	Pyrazole	%TRR	ppm	%TRR	ppm
Whole plant	One application of 100 g a.i./ha at growth stage 21-22 (according to BBCH code)	0	0		10.96		11.49
Forage		28	27		0.44		0.47
Hay		50	49		0.18		0.06
Straw		90	89	74.4	0.55	95.1	0.38
Grain		90	89	25.6	0.30	4.9	0.03

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FIGURE C.2.1. Distribution of Total Radioactive Residues in Wheat Matrices.

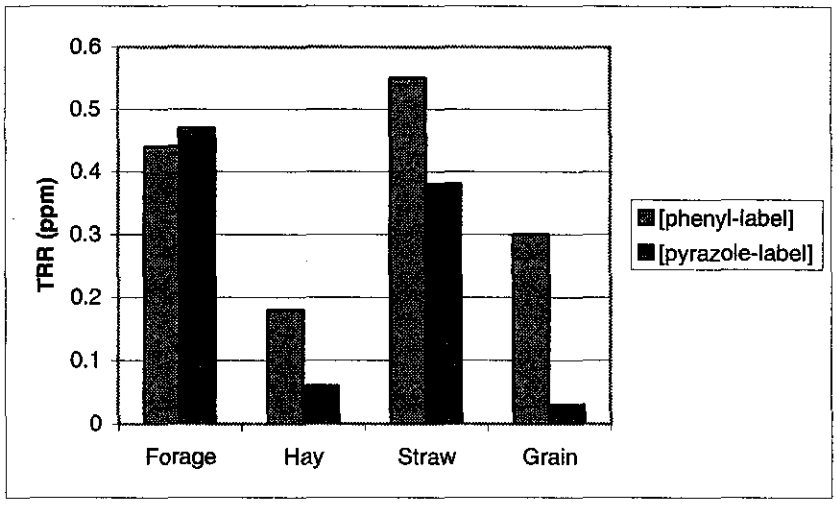

FIGURE C.2.2. Total Radioactive Residue in Wheat Straw and Grain at Maturity

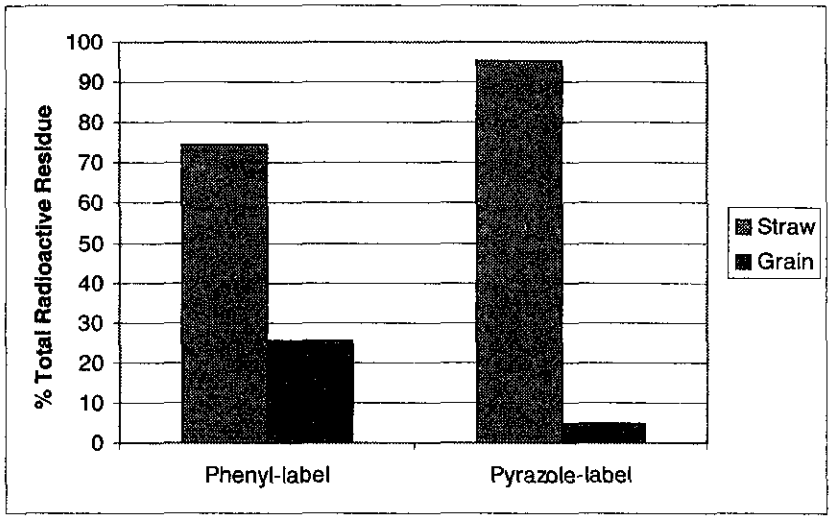

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TABLE C.2.2. Distribution of the Parent and the Metabolites in Plant Matrices when Dosed with [Phenyl-U-^{14}C]-labeled Pyrasulfotole (AE 0317309).

Metabolite Fraction	Forage		Hay		Straw		Grain	
	TRR = 0.44 ppm		TRR = 0.18 ppm		TRR = 0.55 ppm		TRR = 0.30 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
Extracts ACN/H_2O (ambient temperature)	83.8	0.37	88.5	0.16	83.4	0.46	95.2	0.29
AE 0317309-benzoic acid (AE B197555)	24.1	0.11	60.8	0.11	63.6	0.35	89.5	0.27
AE 0317309-desmethyl-*O* glucoside	33.8	0.15	10.4	0.02	4.5	0.03	—	—
Unidentified compound P1	—	—	—	—	1.3	0.01		
Unidentified compound R2	5.9	0.03	3.2	0.006	5.4	0.03	2.3	0.01
Unidentified compound P4	5.1	0.02	2.6	0.005	0.6	<0.01	—	—
Unidentified compound R5	5.0	0.02	3.0	0.005	3.4	0.02	—	—
Unidentified compound P7	2.4	0.01	0.7	0.001	—	—	—	—
Unidentified compound R8	5.5	0.02	2.9	0.005	2.4	0.01	2.2	0.01
Non-extractable residues (PES) after ACN/H_2O extracts	16.2	0.07	11.5	0.02	16.6	0.09	4.8	0.02
Soxhlet extracts	5.9	0.03	—	—	5.3	0.03	—	—
AE 0317309-benzoic acid (AE B197555)	1.9	0.009	—	—	2.4	0.01	—	—
AE 0317309-desmethyl-*O* glucoside	0.4	0.002	—	—	0.6	<0.01	—	—
Unidentified compounds	3.1	0.014	—	—	1.9	0.009	—	—
Loss during work-up	2.3	0.01	4.9	0.01	2.7	0.01	1.2	<0.01
Non-extractable residues (PES) (after Soxhlet extraction)	10.3	0.04	—	—	11.3	0.063	—	—
	1.4	0.006	—	—	1.7	0.01	—	—
Acid hydrolysis	2.7	0.012	—	—	1.3	0.007	—	—
Non-extractable residues (PES) after acid hydrolysis	5.3	0.02	—	—	7.6	0.04	—	—
Alkaline hydrolysis	7.4	0.036	—	—	7.2	0.04	—	—
Non-extractable residues (PES) after alkaline hydrolysis	1.6	0.007	—	—	1.7	0.01	—	—

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TABLE C.2.2.1 Distribution of the Parent and the Metabolites in Plant Matrices when Dosed with [Pyrazole-3-^{14}C]-labeled Pyrasulfotole (AE 0317309).

Metabolite Fraction	Forage		Hay		Straw		Grain	
	TRR = 0.47 ppm		TRR = 0.06 ppm		TRR = 0.38 ppm		TRR = 0.029 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
Extracts ACN/H_2O (ambient temperature)	82.3	0.39	65.2	0.04	52.1	0.20	22.6	0.006
AE 0317309-desmethyl-*O* glucoside	43.0	0.20	25.4	0.015	21.7	0.08	0.7	<0.001
Characterized metabolite P1	3.8	0.02	20.9	0.012	10.9	0.04	11.2	0.003
Unidentified compound P2	—	—	—	—	—	—	0.7	<0.001
Unidentified compound P3	2.3	0.01	1.4	0.001	0.7	<0.01	—	—
Unidentified compound P4	7.6	0.04	4.9	0.003	3.0	0.01	3.8	0.001
Unidentified compound P6	7.7	0.04	4.5	0.003	2.6	0.01	0.7	<0.001
Unidentified compound P7	6.5	0.03	2.9	0.002	3.2	0.01	2.4	0.001
Unidentified compound P8	1.6	0.01	2.4	0.001	2.9	0.01	0.9	<0.001
Unidentified compound P9	4.7	0.02	1.1	0.001	—	—	—	—
Unidentified compound R10	4.4	0.02	—	—	4.3	0.02	0.6	<0.001
Non-extractable residue (PES) after extraction	17.7	0.08	34.8	0.02	47.9	0.18	77.4	0.022
Soxhlet extracts	4.8	0.02	—	—	6.7	0.03	9.9	0.003
AE 0317309-desmethyl-*O* glucoside	0.4	0.002	—	—	—	—	—	—
Unidentified compounds	3.6	0.018	—	—	6.3	0.024	9.9	0.003
Loss during work-up	1.5	0.01	1.9	<0.01	3.0	0.01	1.4	<0.001
Non-extractable residues (PES) (after Soxhlet extraction)	12.9	0.06	—	—	41.2	0.16	67.5	0.020
Enzymatic hydrolysis	1.8	0.009	—	—	7.7	0.03	21.9	0.006
Alkaline hydrolysis after Enzymatic hydrolysis	—	—	—	—	9.4	0.04	—	—
Acid hydrolysis	2.8	0.013	—	—	4.5	0.02	25.0	0.007
Non-extractable residue (PES) after acidic hydrolysis	7.2	0.03	—	—	25.0	0.10	20.0	0.006
Alkaline hydrolysis	9.1	0.043	—	—	24.3	0.09	—	—
Non-extractable residues (PES) after alkaline hydrolysis	1.8	0.01	—	—	4.1	0.02	—	—

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TABLE C.2.3. Summary of Characterization and Identification of Radioactive Residues in Plant Matrices Following Application of [Phenyl-U-^{14}C]-Pyrasulfotole (AE 0317309) at a Rate of 100 g a.i./ha.

Compound	Forage		Hay		Straw		Grain	
	TRR = 0.44 ppm		TRR = 0.18 ppm		TRR = 0.55 ppm		TRR = 0.30 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309-benzoic acid (AE B197555)	26.0	0.119	60.8	0.11	66.0	0.36	89.5	0.27
AE 0317309-desmethyl-*O* glucoside	34.2	0.152	10.4	0.02	5.1	0.03	—	—
Total identified	60.2	0.271	71.2	0.13	71.1	0.39	89.5	0.27
Total characterized	35.8	0.152	12.4	0.022	25.2	0.137	4.5	0.02
Total extractable	96.0	0.423	83.6	0.152	95	0.527	94.0	0.29
Loss during work-up	2.3	0.01	4.9	0.01	2.7	0.015	1.2	< 0.01
Total non-extractable	1.6	0.007	11.5	0.02	1.7	0.01	4.8	0.02
% Accountability	100		101.1		100.4		103.3	

TABLE C.2.3.1. Summary of Characterization and Identification of Radioactive Residues in Plant Matrices Following Application of [Pyrazole-3-^{14}C]- Pyrasulfotole (AE 0317309) at a Rate of 100 g a.i./ha.

Compound	Forage		Hay		Straw		Grain	
	TRR = 0.47 ppm		TRR = 0.06 ppm		TRR = 0.38 ppm		TRR = 0.029 ppm	
	%TRR	ppm	%TRR	ppm	%TRR	ppm	%TRR	ppm
AE 0317309-desmethyl-*O* glucoside	43.4	0.202	25.4	0.015	21.7	0.08	0.7	< 0.001
Total identified	43.4	0.202	25.4	0.015	21.7	0.08	0.7	<0.001
Total characterized	52.1	0.273	38.1	0.023	70.4	0.264	77.1	0.021
Total extractable	95.5	0.475	63.5	0.038	92.1	0.344	77.8	0.021
Loss during work-up	1.5	0.01	1.9	< 0.01	3.0	0.01	1.4	< 0.001
Total non-extractable	1.8	0.01	34.8	0.02	4.1	0.02	20.0	0.006
% Accountability	105.3		96.7		98.4		93.1	

Accountability = (Total extractable + Total unextractable)/(TRRs from combustion analysis) * 100.

C.3. Proposed Metabolic Profile

The following main reactions were involved in the metabolic breakdown of pyrasulfotole in spring wheat after spray application:

- cleavage of the pyrazole moiety resulting in the pyrasulfotole-benzoic acid metabolite (AE B197555) of the parent molecule, and pyrazole specific intermediates (AE 0553959, and 1-methyl-1*H*-pyrazole-5-ol), including highly polar metabolites.
- demethylation yielding pyrasulfotole-desmethyl (AE 1073910), and subsequent glucosylation resulting in pyrasulfotole-desmethyl-*O*-glucoside.

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FIGURE C.3.1 Proposed Metabolic Profile of Pyrasulfotole in Spring Wheat for the [Phenyl-U-^{14}C]- and [Pyrazole-3-^{14}C]-Pyrasulfotole Studies.

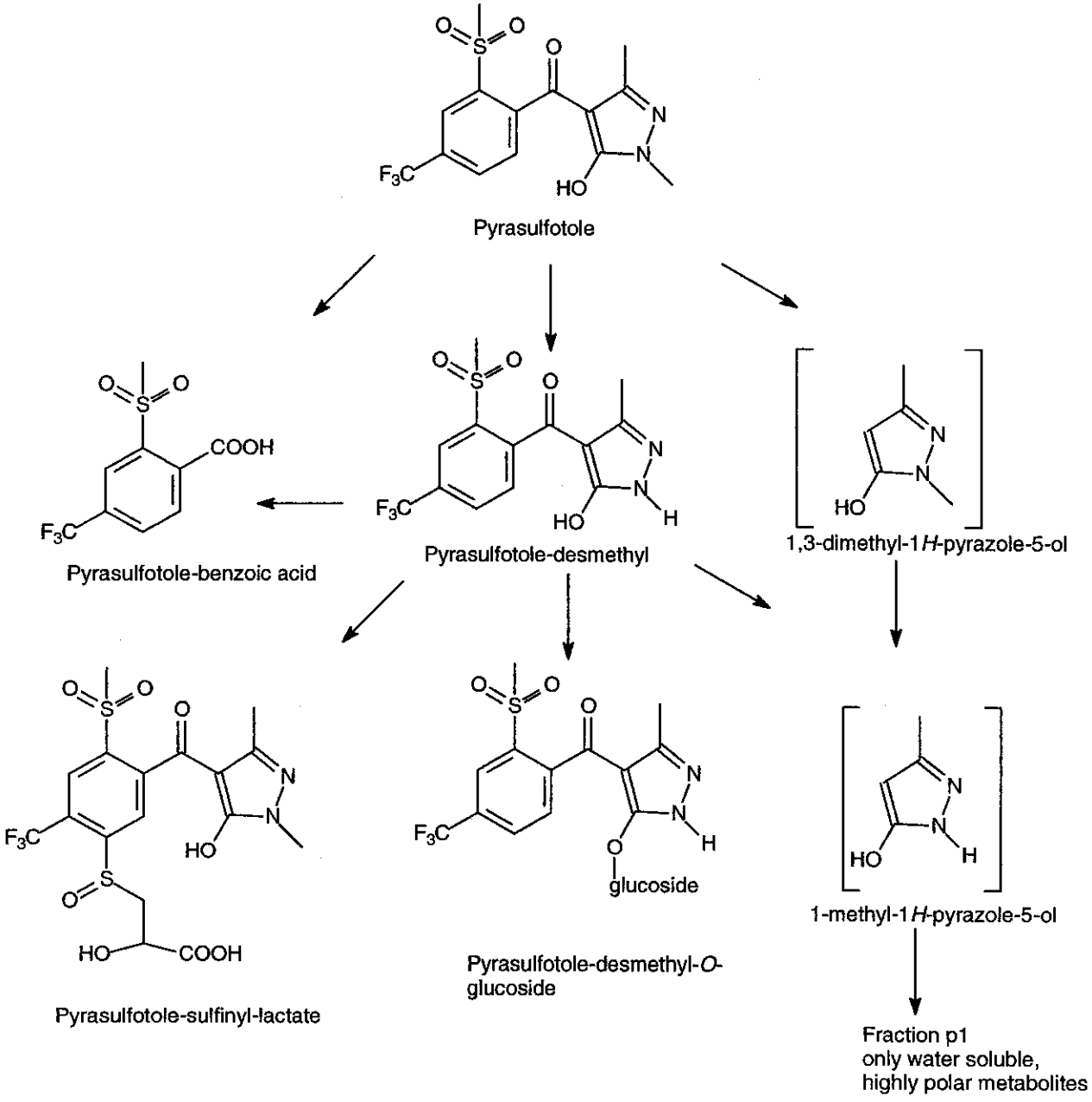

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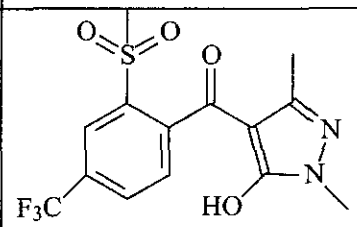
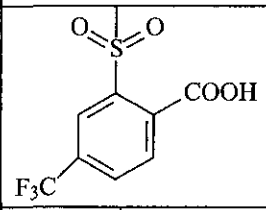
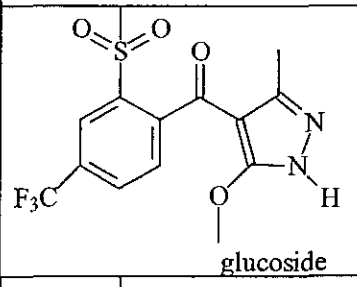
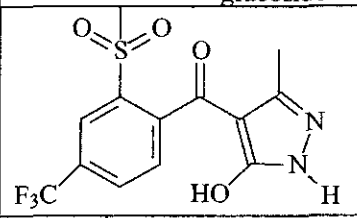
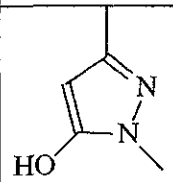
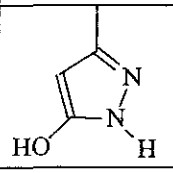
TABLE C.3.1. Identification of Compounds from Metabolism Study.

Common name/code Figure C.3.1 ID No.	Chemical name	Chemical structure
pyrasulfotole AE 0317309	5-hydroxy-1,3-dimethylpyrazol-4-yl) (2-mesyl-4-trifluoromethylphenyl) methanone	
pyrasulfotole-benzoic acid AE B197555	2-mesyl-trifluoromethylbenzoic acid	
pyrasulfotole-desmethyl-*O*-glucoside	Not provided	
desmethyl-pyrasulfotole AE 1073910	(5-Hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
AE 0553959	1,3-dimethyl-1*H*-pyrazol-5-ol	
1-methyl-1*H*-pyrazol-5-ol	1-methyl-1*H*-pyrazol-5-ol	

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D. CONCLUSION

Following a post-emergent application of 100 g each [phenyl-U-^{14}C] and [pyrazole-3-^{14}C]-pyrasulfotole per hectare, total radioactive residues in wheat grain were low (<0.001-0.27 ppm). In wheat grain, no parent compound was detected. The only metabolites detected in grain were pyrasulfotole-benzoic acid (<0.001-0.27 ppm; phenyl-label study) and pyrasulfotole-desmethyl-*O*-glucoside (<0.001 ppm; pyrazole-label study). Pyrasulfotole-desmethyl-*O*-glucoside was the only metabolite identified in forage, hay and straw (21.7-43.4% of the TRR; 0.08-0.2 ppm) for the pyrazole-label study. In the phenyl-label study, the predominant residue was pyrasulfotole-benzoic acid in all wheat matrices (26.0-66.0 of the TRR; 0.11-0.36 ppm). Pyrasulfotole-desmethyl-*O*-glucoside was also a major component in forage and hay (10.4-34.2% of the TRR; 0.02-0.152 ppm), and a minor component in straw (5.1% of the TRR; 0.03 ppm). The primary pathway involves demethylation of pyrasulfotole to pyrasulfotole-desmethyl and subsequent glucosylation resulting in pyrasulfotole-desmethyl-*O*-glucoside. The second major degradation pathway (cleavage of the molecule) leads to pyrasulfotole-benzoic acid and the pyrazole moiety. No metabolite could be identified from the pyrazole moiety, but the pyrazole moiety yielded multiple polar constituents.

E. REFERENCES

1. MRID 46801701 Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. MRID 46801701 Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. MRID 46801701 Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. MRID 46801701 Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

5. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. MRID 46801701 Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. MRID 46801701 Mühlberger, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

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8. MRID 46801701 Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. MRID 46801701 Wiche A., and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (8 November 2006); George Kramer (8 November 2006)
Petition Number: 6F7059
DP#: 333412

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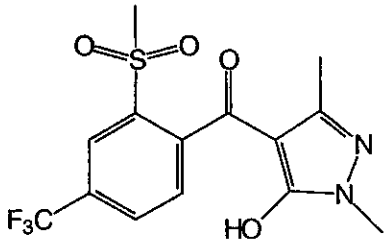
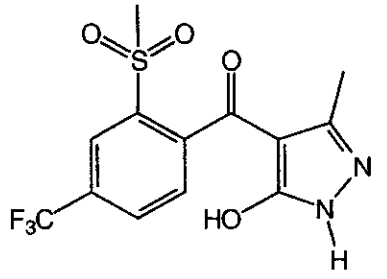
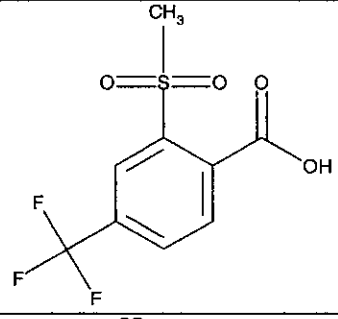
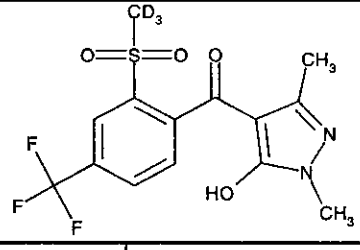
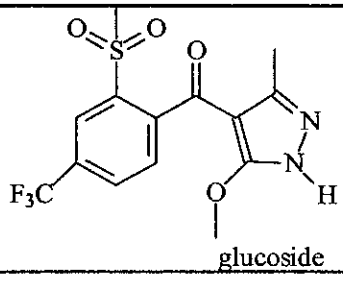
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
pyrasulfotole-desmethyl AE 1073910	(5-hydroxy-1*H*-pyrazol-4-yl)[2-mesyl-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	
pyrasulfotole-desmethyl-O-glucoside 2WI27P5	Not provided	

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Primary Evaluator	Louise G Croteau Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally April 14/2007 Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	R. Bhula Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801809 Lam, C.K., and Qadri, S.S. 9 January 2006. Validation of Bayer CropScience Method AI-004-A05-01. Analytical Method for the Determination of Residues of AE 0317309 in Animal Tissues and Milk Using LC/MS/MS. Bayer CropScience Study Number: RAAIX006. 100 pages.

MRID No. 46801810 Billian, P. and Wirkner, H. 4 November 2005. Independent Method Validation of the Analytical Method AI-004-A05-01 for the Determination of Residues of AE 0317309 in Animal Tissues and Milk Using LC/MS/MS. Bayer CropScience Report Number: MR-122/05. 56 pages.

MRID No. 46801811 Lam, C. K., and Qadri, S.S. 8 March 2006. Extraction Efficiency of Bayer CropScience Method AI-004-A05-01. Analytical Method for the Determination of Residues of AE 0317309 in Animal Tissues and Milk Using LC/MS/MS. Bayer CropScience Study Number: RAAIX010. 47 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience developed a high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS), method AI-004-A05-01, as the data gathering and enforcement method for residues of pyrasulfotole in/on livestock tissues including milk. Briefly, livestock tissues are extracted using acetonitrile (ACN)/water (H_2O) (2/1, v/v). Milk samples are diluted with water and filtered. In the case of whipping cream, the samples are extracted with ACN. The tissue sample extracts are heated to 60°C for at least 30 minutes; afterwards the samples are cooled down and centrifuged (only liver). The stable isotopic internal standard is added to sample extracts and mixed. An aliquot is purified by C18 solid phase extraction (SPE). Milk and whipping cream samples are syringe filtered or partitioned with n-hexane. The solvent is removed from the samples and the residues are reconstituted for analysis using HPLC-MS/MS.

The limit of quantitation (LOQ) is 0.010 ppm for bovine muscle, liver, kidney, and fat; and 0.005 ppm for bovine milk. The proposed enforcement method was adequately validated in bovine tissues and milk matrices. A successful independent laboratory validation (ILV) was completed with samples of kidney, liver, whipping cream and whole milk. Extraction efficiency data demonstrated that the enforcement method can account for incurred residues of pyrasulfotole in kidney, liver and whole milk.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the analytical method test data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

A. BACKGROUND INFORMATION

Pyrasulfotole, ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone), is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature

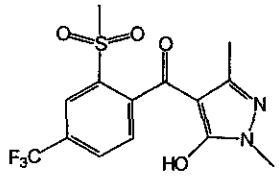
Compound	Chemical Structure
	
Common name	Pyrasulfotole
Company Experimental name	AE 0317309
IUPAC name	(5-hydroxy-1,3-dimethylpyrazol-4-yl)(α,α,α-trifluoro-2-mesyl-*p*-tolyl)methanone
CAS name	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone
CAS #	365400-11-9
End-use product/(EP)	Herbicide; suspo-emulsion AE 0317309 02 SE06 A1

TABLE A.2. Physicochemical Properties of the Technical Grade Test Compound

Parameter	Value		Reference
Melting point	Pure: 201°C No boiling point, decomposition starts at 245°C		1
pH at 22.9°C	3.03		2
Density (g/cm^3)	1.53		3
Water solubility (g/L at 20°C)	2.3 4.2 69.1 49.0	pH 3.0 (distilled water) pH 3.9 (buffer pH 4.0) pH 5.4 (buffer pH 7.0)* pH 5.2 (buffer pH 9.0)* * exceeded buffer capacity	4
Solvent solubility (g/L at 20°C)	Ethanol n-Hexane Toluene Dichloromethane Acetone Ethyl acetate Dimethyl sulfoxide	21.6 0.038 6.86 120-150 89.2 37.2 ≥ 600	5
Vapour pressure at 20°C	2.7 X 10^{-7} Pa		6
Dissociation constant (pK_a)	4.2		7
n-Octanol-water partition coefficient Log(K_{OW}) at 23°C	0.276 -1.362 -1.580	pH 4.0 pH 7.0 pH 9.0	8
UV/visible absorption spectrum	λ_{max}= 264, 241, 216 nm in water, 0.1M HCl, 0.1M NaOH respectively.		9

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B. MATERIALS AND METHODS

B.1. Data-Gathering Method

B.1.1. Principle of the Method:

The livestock tissues are extracted using ACN/H_2O (2/1, v/v). The sample extracts are heated to 60°C for at least 30 minutes, afterwards the samples are cooled down and centrifuged (only liver). The stable isotopic internal standard is added to the sample extract and mixed. An aliquot is purified by C18 SPE. The solvent is removed from the samples and the residues are reconstituted for analysis using HPLC-MS/MS.

Milk samples are diluted with water and the stable isotopic internal standard is added. The diluted samples are syringe filtered and analyzed by HPLC-MS/MS. For whipping cream, the samples are extracted with ACN and centrifuged. The supernatant is decanted into a separatory funnel and the stable isotopic internal standard is added. The extract is partitioned with n-hexane. The ACN layer is drained into glass vial; and the n-hexane phase is discarded. An aliquot of the ACN phase is concentrated to dryness and reconstituted for analysis using HPLC-MS/MS.

Residues of pyrasulfotole were monitored and quantitated in selected reaction monitoring (SRM) mode by a tandem MS operated in positive electrospray ionization $(M + H)^+$ from m/z of 363.1 to 251.1. The confirmation ion was monitored in negative electrospray ionization $(M - H)^-$ from 361.1 to 79.1. Quantitation of the native analyte was based on duplicate, six level calibration curves with concentrations of 2.5, 5.0, 10, 50, 250 and 500 ppb. The peak area ratio of native to internal standard of the compound was plotted against its nominal standard concentrations.

TABLE B.1.1. Summary Parameters for the Analytical Method Used for the Quantitation of Pyrasulfotole (AE 0317309) Residues in Beef Tissues and Milk Matrices.

Method ID	AI-004-A05-01
Analyte(s)	AE 0317309 including deuterated internal standard
Extraction solvent/technique	ACN:Deionized Water (2:1)/ Heat to 60°C for tissues. Dilution with water for milk
Cleanup strategies	Extract, centrifuge, C-18 extraction and concentrate for residues of AE 0317309 in tissues. No cleanup required for milk.
Instrument/Detector	HPLC separation using a C-18 column (50mm x 2mm x 5µm). Tandem Mass Spectrometer with positive electrospray ionization Confirmation ion was monitored by negative electrospray ionization
Standardization method	Multi-point linear regression curve versus stable isotopic internal standard.
Stability of std solutions	Up to 274 days (~9 months).
Retention times	≈ 3.8 minutes for AE 0317309

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B.2. Enforcement Method

The enforcement method is the same as the data-gathering method described in Section B.1.

C. RESULTS AND DISCUSSION

C.1. Data-Gathering Method

TABLE C.1.1. Recovery Results from Method Validation of Beef Tissues and Milk Matrices using the Data-Gathering Analytical Method. Positive Ionization.

Matrix	Spiking level (ppm)	Recoveries (%)	Mean	Std. Dev	RSD
Fat	0.01	93, 93, 90, 88, 91, 94, 92	92	2	2.4
	0.1	118, 120, 115, 121, 122	119	3	2.5
Kidney	0.01	87, 84, 84, 84, 86, 86, 85	85	1	1.5
	0.1	112, 111, 113, 116, 111	113	2	2.0
Liver	0.01	88, 86, 87, 85, 82, 84, 86	85	2	2.0
	0.1	112, 112, 112, 113, 107	111	2	2.1
Muscle	0.01	90, 92, 91, 93, 88, 92, 94	92	2	2.1
	0.1	118, 117, 116, 111, 115	116	3	2.4
Skim milk	0.01	85, 84, 83, 84, 84, 87, 83	84	1	1.7
	0.1	114, 115, 114, 115, 115	115	1	0.5
Whole milk	0.01	90, 87, 88, 88, 86, 86, 86	87	2	1.8
	0.1	111, 112, 111, 113, 114	112	1	1.1
Whipping cream	0.01	72, 70, 71, 71, 75, 72, 74	72	2	2.3
	0.1	98, 91, 95, 94, 96	95	3	2.8

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TABLE C.1.2. Characteristics for the Data-Gathering Analytical Method Used for the Quantitation of Pyrasulfotole Residues in Livestock.	
Analyte	Pyrasulfotole (AE 0317309)
Equipment ID	Phenomenex Gemini C-18, 50 x 2.0 mm, 5 µm Finnigan Quantum Discovery HPLC-MS/MS
Limit of quantitation (LOQ)	Fat, liver, kidney, muscle: 0.010 ppm; skim milk, whole milk, whipping cream: 0.005 ppm
Limit of detection (LOD)	whole milk: 0.00025 ppm; skim milk: 0.00023 ppm; whipping cream: 0.00026 ppm; beef muscle: 0.00061 ppm; beef liver: 0.00054 ppm; beef kidney: 0.00039 ppm, and beef fat: 0.00068 ppm.
Accuracy/Precision	Percent recoveries indicate acceptable accuracy/precision for livestock commodities in the range of the LOQ. The average recoveries, standard deviation and relative standard deviation (RSD) at the LOQ of 0.01 ppm (AE 0317309) from fat, kidney, liver and muscle were 92 ± 2% (RSD=2.4%), 85 ± 1% (RSD=1.5%), 85 ± 2% (RSD=2.0%) and 92 ± 2% (RSD=2.1%) respectively. The average recoveries, standard deviation and relative standard deviation (RSD) at the LOQ of 0.005 ppm (AE 0317309) from whole milk, skim milk and whipping cream were 87 ± 2% (RSD=1.8%), 84 ± 1% (RSD=1.7%), and 72 ± 2% (RSD=2.3%), respectively.
Reliability of the Method/ [ILV]	An independent laboratory method validation (ILV) (Bayer Study Report: MR-122/05) was conducted to verify the reliability of method no. AI-004-A05-01 for the determination of pyrasulfotole residues in livestock matrices. The values obtained are indicative that the method is reliable.
Linearity	The detector response was linear in solvent for pyrasulfotole from the range of 0.0025 to 0.50 ppm with coefficients of determination (r^2) greater than 0.99.
Specificity	The control chromatograms generally had no peaks above the chromatographic background and the spiked sample chromatograms contained only the analyte peak of interest within the retention window. Peaks were generally well defined and symmetrical. The precursor ion (m/z 363) from pyrasulfotole is formed from positive ionization of parent (MW = 362) in the first quadrupole analyzer. Thus MS/MS is extremely specific and selective, and detects only the ion with transition of m/z from 363 to 251. For confirmation, a secondary ion was monitored in negative electrospray ionization $(M - H)^-$ from 361.1 to 79.1. The results are in agreement with the ion generated from primary positive ionization.

C.2. Enforcement Method

The enforcement method is the same as the data-gathering method described in Section C.1. Ruminant metabolism studies[10,11] conducted using [phenyl-UL-^{14}C]-pyrasulfotole and [pyrazole-3-^{14}C]-pyrasulfotole indicated that pyrasulfotole was the predominant residue in beef tissues and dairy products. The results presented in TABLE C.2.1. demonstrate the method extraction efficiency. The residue analytical method, AI-004-A05-01, has been shown to effectively extract incurred radioactive residues of pyrasulfotole from goat kidney (71.4%), liver (95.8%) and whole milk (106.4%).

TABLE C.2.1. Distribution of Residues Found in Goat Kidney, Liver and Whole Milk by the Residue Method as Compared with Those Found in Metabolism Studies.

Matrices	Amount of Pyrasulfotole				Extraction Efficiency (%)
	Analytical Residue Method		Metabolism Studies		
	% TRR	ppm	% TRR	ppm	
Kidney					
Samples	69.2, 80.0, 64.1	0.391, 0.452, 0.362			
Average	71.1	0.402	99.6	0.531	71.4
Liver					
Samples	91.1, 95.2, 88.1	1.277, 1.335, 1.235			
Average	91.5	1.282	95.5	1.411	95.8
Whole milk					
Samples	43.5, 52.2, 39.7, 26.4, 54.2, 31.8	0.0187, 0.0225, 0.0163, 0.0108, 0.0228, 0.0133			
Average	41.3	0.0174	38.8	0.017	106.4

C.3. Independent Laboratory Validation

An ILV study was performed to evaluate the ruggedness, usability, and potential weaknesses of the method of analysis for the pyrasulfotole residue in livestock tissues and whole milk. The matrices selected for the ILV were beef liver, beef kidney, whole milk and whipping cream.

The accuracy of the method is considered to be acceptable, as the mean recoveries for all matrices and all spiking levels are in the range of 70 – 110%. The results of the ILV are presented in TABLE C.3.1.

The analytical method for the determination of residues of pyrasulfotole in livestock tissues and whole milk was successfully validated by an independent laboratory.

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TABLE C.3.1. Recovery Results Obtained by an Independent Laboratory Validation of the Enforcement Method for the Determination of Pyrasulfotole (AE 0317309) in Livestock Matrices.

Sample Material	Spiking Level [ppm]	Single Values [%]					Mean Value [%]	RSD [%]
Liver	0.01	85	87	86	82	80	84	3.5
	0.02	107	103	107	112	106	107	3.0
	0.10	99	99	119	95	106	104	9.1
Kidney	0.01	74	76	73	79	77	76	3.1
	0.02	91	89	94	95	98	93	3.8
	0.10	98	102	104	99	102	101	2.4
Whole milk	0.005	103	108	104	108	104	105	2.3
	0.01	107	107	104	107	106	106	1.2
	0.05	110	108	109	109	110	109	0.8
Whipping Cream	0.005	108	109	105	106	108	107	1.5
	0.01	106	110	109	109	108	108	1.4
	0.05	107	109	109	108	109	108	0.8

D. CONCLUSION

Adequate method validation data have been submitted for the HPLC-MS/MS method (AI-004-A05-01) for the determination of residues of pyrasulfotole in beef tissues and whole milk matrices. The validation data are representative of the expected residue levels for the livestock commodities. The method is adequate to quantitate incurred residues of pyrasulfotole in livestock matrices. The LOQ for pyrasulfotole is 0.010 ppm for bovine fat, kidney, liver, muscle and at 0.005 ppm in milk, including cream.

E. REFERENCES

1. Franke, J. (2004). Melting point, boiling point, thermal stability of AE 0317309: substance, pure code: AE 0317309 00 1B99 0001. Document No. C042370. Bayer CropScience Report No. 20040374.01

2. Mühlberger, B. and Strunk, B. (2003). Determination of the pH-Value of AE 0317309. Document Number C033462. Bayer CropScience Report Number PA03/011.

3. Mühlberger, B. and Lemke, G. (2003). AE 0317309 - Relative density. Bayer CropScience Report Number PA03/040.

4. Mühlberger, B. (2003). Water solubility of AE 0317309 at pH 4, pH 7, pH 9 and bidistilled water. Document Number C028268. Bayer CropScience Report Number PA03/008.

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5. Mühlberger, B. (2003). AE 0317309: Solubility in Organic Solvents. Document Number C034280. Bayer CropScience Report Number PA03/009.

6. Franke, J. (2004). AE 0317309: Vapour Pressure. Document Number C042368. Bayer CropScience Report Number 20040374.02.

7. Mühlberge, B. and Eyrich, U. (2005, amended 2006). AE 0317309: Determination of the Dissociation Constant. Bayer CropScience Report Number PA03/045.

8. Mühlberger, B. (2003). AE 0317309: Partition coefficient 1-octanol/water. Document Number C030789. Bayer CropScience Report Number PA03/010.

9. Wiche, A. and Mühlberger, B. (2003). AE 0317309: Spectral data (UV/VIS, IR, ^{1}H-NMR, ^{13}C-NMR, MS) and molar extinction coefficient. Document Number C036440. Bayer CropScience Report Number PA03/023.

10. Rupprecht, J. K. and Ying, S. L. (2006). Metabolism of [phenyl-UL-^{14}C]-AE 0317309 in the Lactating Goat. Unpublished Bayer CropScience Report No. MEAIM009.

11. Rupprecht, J. K. and Ying, S. L. (2006). Metabolism of [pyrazole-3-^{14}C]-AE 0317309 in the Lactating Goat. Unpublished Bayer CropScience Report No. MEAIM010.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412

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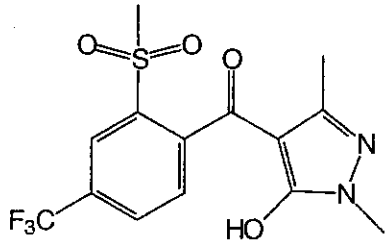
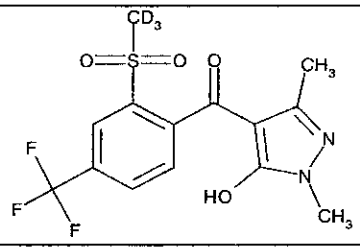
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole AE 0317309	(5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl] methanone	
d_3-pyrasulfotole d_3-AE 0317309	(5-Hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-[(methyl-d_3)sulfonyl]-4-(trifluoromethyl)phenyl]methanone	

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Primary Evaluator	Louise G Croteau Senior Evaluation Officer, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Ariff Ally, Ph.D. Section Head, FREAS Health Evaluation Division, PMRA	Date: 30 October, 2006
Approved by	Raj Bhula, Ph.D. Manager, Agricultural Residues Chemistry and Residues Program, APVMA	Date: 27/7/07
Peer Reviewer	Jennifer R Tyler, Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6/20/07
Approved by	George F Kramer, Ph.D., Senior Chemist Registration Action Branch 1 (RAB1) Health Effects Division (HED) United States Evnironmental Protection Agency (U.S. EPA)	Date: 6-20-07

STUDY REPORTS:

MRID No. 46801812 Lam, C. K., and Qadri, S. S. 28 February 2006. Validation of Bayer CropScience Method AI-005-A05-01. Analytical Method for the Determination of Residues of AE B197555 in Poultry and Eggs Using LC/MS/MS. Unpublished Bayer CropScience Study Number: RAAIP012. 91 pages.

MRID No. 46801813 Nelson, S. 1 March 2006. Independent Method Validation of the Analytical Method AI-005-A05-01 for the Determination of Residues of AE 0317309 in Poultry and Eggs Using LC/MS/MS. Unpublished Enviro-Test Laboratories Report Number 06BAY27.REP. 78 pages.

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EXECUTIVE SUMMARY:

Bayer CropScience developed a high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS) method (AI-005-A05-01) as the data gathering and enforcement method for residues of the metabolite pyrasulfotole-benzoic acid (AE B197555) in/on poultry tissues, including eggs.

Briefly, the poultry tissues are extracted twice using acetonitrile (ACN)/2M hydrochloric acid (HCl) (2/1, v/v). The samples are heated to 60°C for at least 30 minutes; afterwards the samples are cooled down and centrifuged. In the case of eggs, samples are extracted twice with ACN, and partitioned with n-hexane. The stable isotopic internal standard is added to the sample extract and mixed. An aliquot is purified by C18 solid-phase extraction (SPE). The solvent is removed from the samples and the residues are reconstituted in methanol/10mM ammonium acetate for analysis using HPLC-MS/MS.

The limit of quantitation (LOQ) is 0.010 ppm for poultry matrices, including eggs. The proposed enforcement method was adequately validated for the determination of pyrasulfotole-benzoic acid (AE B197555) in poultry liver, muscle, skin and eggs. A successful independent laboratory validation (ILV) was completed with samples of breast muscle and eggs.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the analytical method test data are classified as scientifically acceptable.

The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document [DP# 333412], in Canada's Regulatory Decision Document, and in Australia's Residues Evaluation Report.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided.

A. BACKGROUND INFORMATION

Pyrasulfotole ((5-hydroxy-1,3-dimethyl-1*H*-pyrazol-4-yl)[2-(methylsulfonyl)-4-(trifluoromethyl) phenyl]methanone) is a postemergence dicot herbicide for use in cereal crops. Pyrasulfotole is an effective inhibitor of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPDase) and consequently blocks the pathway of prenylquinone biosynthesis in plants. The end-use products are applied to the target weeds and act primarily through leaf uptake and translocation to the target site. The first symptoms appear three to five days after application. Bleaching and discoloration appear initially and symptoms progress to tissue necrosis and plant death within two weeks.

TABLE A.1. Test Compound Nomenclature.

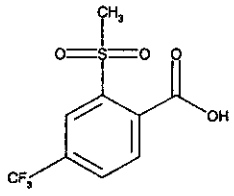
Compound	Chemical Structure
	
Common name	Pyrasulfotole-benzoic acid
Company Experimental name	AE B197555
IUPAC name	2-mesyl-4-trifluoromethylbenzoic acid
CAS name	2-(methylsulfonyl)-4-(trifluoromethyl)benzoic acid
CAS #	142994-06-7
End-use product/(EP)	Not applicable

TABLE A.2. Physicochemical Properties of Pyrasulfotole-benzoic acid

Parameter	Value	Reference
Dissociation constant (pK_a)	1.77	1
n-Octanol-water partition coefficient $Log(K_{OW})$	0.10 at pH 4.4	2

B. MATERIALS AND METHODS

B.1. Data-Gathering Method

B.1.1. Principle of the Method:

The poultry tissues are extracted twice using ACN/2M HCl (2/1, v/v). The samples are heated to 60°C for at least 30 minutes, and afterwards the samples are cooled down and centrifuged. The stable isotopic internal standard (IS) is added to the sample extract and mixed. An aliquot is purified by C18 SPE. The solvent is removed from the samples and the residues are reconstituted in methanol/10mM ammonium acetate for analysis using HPLC-MS/MS.

Egg samples are extracted twice with ACN. The supernatants are combined in a separatory funnel and the stable isotopic internal standard is added. The extract is partitioned with n-hexane. An aliquot of the ACN phase is concentrated to dryness and reconstituted for analysis using HPLC-MS/MS.

The LOQ for pyrasulfotole-benzoic acid was 0.01 ppm for poultry tissues and eggs. Residues of pyrasulfotole-benzoic acid were monitored and quantitated in selected reaction monitoring (SRM) mode by a tandem MS operated in negative electrospray ionization $(M-H)^-$ from m/z of 267 to 159. The confirmation ion was monitored in negative electrospray ionization $(M-H)^-$ from m/z of 267 to 223. Quantitation of pyrasulfotole-benzoic acid was based on duplicate, five level calibration curves with concentrations of 5, 10, 20, 100 and 500 ppb.

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TABLE B.1.1. Summary Parameters for the Analytical Method Used for the Quantitation of AE B197555 Residues in Poultry and Eggs.

Method ID	AI-005-A05-01
Analyte(s)	Pyrasulfotole-benzoic acid (AE B197555) including deuterated internal standard
Extraction solvent/technique	Tissues: Extract twofold ACN:2M HCl (2:1)/ Heat to 60°C for tissues. Eggs: Extract twofold ACN
Cleanup strategies	Tissues: Extract, centrifuge, C-18 extraction and concentrate for HPLC-MS/MS. Eggs: Liquid-liquid partition with hexane and concentrate for HPLC-MS/MS.
Instrument/Detector	HPLC separation using a C-18 column (50mm x 2mm x 3µm). Tandem Mass Spectrometer with negative electrospray ionization Confirmation ion was monitored by negative electrospray ionization
Standardization method	Multi-point linear regression curve versus stable isotopic internal standard.
Stability of std solutions	Up to 274 days (~ 9 months)
Retention times	≈ 5.1 minutes for AE B197555

B.2. Enforcement Method

The enforcement method is the same as the data-gathering method described in Section B.1.

C. RESULTS AND DISCUSSION

C.1. Data-Gathering Method

Poultry metabolism studies conducted using [phenyl-UL-^{14}C]-AE 0317309 and [pyrazole-3-^{14}C]-AE 0317309 in laying hen indicated that the metabolism of pyrasulfotole (AE 0317309) was not extensive. The only residue that poultry would be exposed to as a result of a cereal grain diet from a pyrasulfotole treated cereal would be pyrasulfotole-benzoic acid (AE B197555). The results presented in TABLE C.1.1 demonstrate the method validation.

The precursor ion (m/z 267) from AE B197555 is formed from the negative ionization of parent (MW = 268) in the first quadrupole analyzer. The product ion (m/z 159) is formed by collision-induced dissociation (CID) of the precursor ion with argon gas in the collision cell (Q2) and is analyzed in the third quadrupole analyzer (Q3). In addition, a second confirmation ion may be monitored using the negative ionization mode from m/z of 267 to 223. Consequently, the method is selective and specific when HPLC separation is coupled with the two possible ion transitions.

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TABLE C.1.1. Recovery Results from Method Validation of Poultry Tissues and Eggs Using the Data-Gathering Analytical Method.

Matrix	Spike Level (ppm)	Recoveries, %	Mean	Std Dev	RSD
Eggs	0.01	85, 97, 92, 100, 87, 79, 84	89	7.6	8.6
	0.10	100, 101, 99	100	1.4	1.4
Liver	0.01	112, 105, 110, 107, 106, 111, 105	108	3.0	2.8
	0.10	112, 115, 110	112	2.4	2.2
Muscle	0.01	112, 100, 102, 107, 116, 106, 112	108	5.7	5.3
	0.10	114, 113, 111	112	1.4	1.3
Skin	0.01	111, 104, 102, 100, 109, 109, 103	106	4.2	4.0
	0.10	113, 112, 113	113	0.4	0.4

TABLE C.1.2. Characteristics for the Data-Gathering Analytical Method Used for the Quantitation of AE B197555 Residues in Poultry and Eggs.

Analyte	Pyrasulfotole-benzoic acid (AE B197555)
Equipment ID	Phenomenex Gemini C-18, 50 x 2.0 mm, 3 µm; Finnigan Quantum Discovery LC-MS/MS
Limit of quantitation (LOQ)	Tissues = 0.010 ppm; Eggs = 0.010 ppm
Limit of detection (LOD)	The LODs of AE B197555 from the chicken egg, liver, muscle (dark and white meat combined) and skin were 0.00271, 0.00095, 0.00182 and 0.00139 ppm respectively.
Accuracy/Precision	The recoveries from validation tests varied from 79% to 116% over all the spike levels and sample matrices. The average recoveries, standard deviation and relative standard deviation (RSD) for 0.01 ppm of AE B197555 from chicken egg, chicken liver, chicken muscle and chicken skin were 89 ± 8% (RSD=8.6%), 108 ± 3% (RSD=2.8%), 108 ± 6% (RSD=5.3%) and 106 ± 4% (RSD=4.0%) respectively.
Reliability of the Method/ [ILV]	An ILV was conducted to verify the reliability of method No. AI-005-A05-01 for the determination of AE B197555 residues in poultry matrices. The values obtained are indicative that the method is reliable.
Linearity	The detector response was linear in solvent for AE B197555 in the range of 0.005 to 0.50 ppm with coefficients of determination (r^2) greater than 0.99.
Specificity	The method employs a highly specific and selective detector (HPLC-MS/MS). The control chromatograms generally often have no peaks above the chromatographic background and the spiked sample chromatograms contain only the analyte peak of interest within the retention window. Peaks were well defined and symmetrical.

C.2. Enforcement Method

The enforcement method is the same as the data-gathering method described in Section C.1.

C.3. Independent Laboratory Validation

An ILV was performed to evaluate of the ruggedness, usability, and potential weaknesses of the method of analysis for AE B197555 residue in poultry tissues and eggs. The matrices selected for

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the ILV were chicken breasts (boneless and skinless) and eggs.

The accuracy of the method is considered to be acceptable as the mean recoveries for all sample materials and all spiking levels are in the range of 70–114%. The results of the ILV are presented in TABLE C.3.1.

TABLE C.3.1. Recovery Results Obtained by an Independent Laboratory Validation of the Enforcement Method for the Determination of AE B197555 in Poultry Matrices

Sample Material	Spiking Level [ppm]	Recovery Values [%]					Mean Value [%]	RSD [%]
Eggs	0.01	96	91	92	77	82	88	8.9
	0.02	114	90	91	95	85	95	11.8
	0.10	88	88	99	91	100	93	6.3
Breast	0.01	111	72	112	105	106	101.2	16.4
	0.02	105	102	93	98	88	97	7.0
	0.10	88	92	96	85	100	92	6.5

D. CONCLUSION

Adequate method validation data have been submitted for the HPLC-MS/MS method (AI-005-A05-01) for the determination of residues of the metabolite pyrasulfotole-benzoic acid in poultry tissues and egg matrices. The validation data are representative of the expected residue levels for the poultry commodities. The LOQ for pyrasulfotole-benzoic acid is 0.010 ppm for poultry liver, muscle, skin and eggs.

E. REFERENCES

1. Mills, E.A.M. (2003).The determination of the pKa for the isoxaflutole metabolite RPA203328. Unpublished Bayer CropScience Document No. C036496.

2. Certon, A. and Cousin, J. (1994). RPA202248, RPA203328, RPA205834 Octanol/water Partition coefficients (Summary). Unpublished Bayer CropScience Document No. C016455.

F. DOCUMENT TRACKING

RDI: Louise G Croteau (6 September 2006); RAB1 Chemists (29 November 2006); George Kramer (29 November 2006)
Petition Number: 6F7059
DP#: 333412

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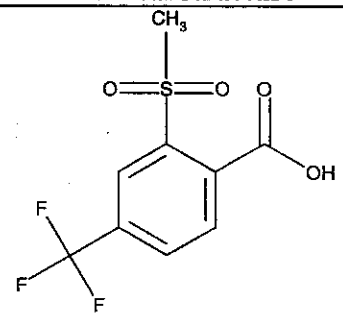
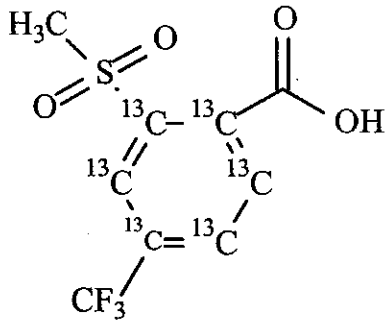
APPENDIX 1

Reference standards.

Common name/code	Chemical name	Chemical structure
pyrasulfotole-benzoic acid AE B197555	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic acid	
[phenyl-$^{13}C_6$]AE B197555 AE B197555-IS	2-(Methylsulfonyl)-4-(trifluoromethyl)benzoic-*1,2,3,4,5,6-13C6* acid	

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