5/13/87

Shaughnessy No.: 122101
Date out of EAB: MAR 23 1987

To: Lois Rossi
Product Manager 21
Registration Division (TS 767C)

From: Emil Regelman, Supervisory Chemist
Review Section #3
Exposure Assessment Branch
Hazard Evaluation Division (TS 769C)

Attached, please find the EAB review of...

Reg./File # 100-617

Chemical Name: Propiconazole (Tilt)

Type Product: Fungicide

Product Name: Tilt

Company Name: Ciba-Geigy

Purpose: review of additional environmental data

Action Code: 331

EAB # (s): 70298

Date Received: 3/4/87

TAIS Code: ______

Date Completed: MAR 23 1987

Total Reviewing Time: 5 Days

Monitoring Study Requested: ______

Monitoring Study Volunteered: ______

Deferrals to: ______ Ecological Effects Branch

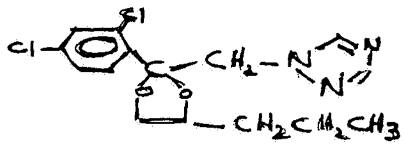
______ Residue Chemistry Branch

______ Toxicology Branch

1. CHEMICAL:

chemical name: 1-[[2-(2,4-Dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl] methyl] -1H-1,2,4-triazole

common name: propiconazole
trade name: Tilt
structure:



CAS #
Shaughnessy #: 122101

2. TEST MATERIAL: see below

3. STUDY/ACTION TYPE:
submission of additional data re environmental fate

4. STUDY IDENTIFICATION:

Honeycutt, R.C. Additional Environmental Fate Information on Aquatic Field Dissipation and Rotational Crops Related to the Use of Tilt on Rice. CIBA-GEIGY Report no. EIR-86015, dated 9/26/86.
Honeycutt, R.C. Additional Residue Information on Terrestrial Rotational Crops Grown After Use of Propiconazole on Wheat, Barley, or Rye. CIBA-GEIGY Report no. EIR-86016, dated 9/26/86.
Honeycutt, R.C. The Fate of Propiconazole Under Aquatic Laboratory and Aquatic Field Conditions. dated 2/12/ [87]

5. REVIEWED BY:

Typed Name: E. Brinson Conerly
Title: Chemist, Review Section 3
Organization: EAB/HED/OPP

E. Brinson Conerly
3/20/87

6. APPROVED BY:

Typed Name: Emil Regelman
Title: Supervisory Chemist, Review Section 3
Organization: EAB/HED/OPP

MAR 23 1987

7. CONCLUSIONS:

The applicant has presented evidence supporting the following conclusions:

1) Laboratory aquatic metabolism, aerobic or anaerobic, shows the compound to be strongly adsorbed (45% after 12 months), and metabolized very little (50% parent compound, 5% metabolite after 12 months).
2) Plant uptake and metabolism in rotational crops result in two major metabolites, quantities varying among different tissues, which are the alanine and acetic acid triazole conjugates.

3) Little would be gained from the Agency's requiring a more definitive series of analyses.
4) Note EPA comment 4 below. The radiochemical purity of the test material must be clarified.

8. RECOMMENDATIONS:

The following previously pending requirements may be considered fulfilled:

field dissipation, aquatic
field rotational crop accumulation

The aquatic metabolism study which is in progress should be submitted when complete. Per the review of 6/20/86, anaerobic soil metabolism data must be submitted, but is deferred until registration has been granted.

9. BACKGROUND:

EPA staff (Regelman, Conerly, Hundemann) and CIBA-GEIGY representatives (Larry Ballantine, Richard Honeycutt, and Richard Conn) met 2/6/87 to discuss propiconazole review of 12/24/87.

Salient points were the following:

1) There were three volumes, numbered 6, 7, and 8, in the submission sent to EAB. CIBA-GEIGY believed that Volume 7 of their submission had not been reviewed.

2) CIBA-GEIGY believes that data already submitted together with preliminary results from a new study on aquatic metabolism should be sufficient for a favorable EAB decision.

Although the studies in Volume 7 were reviewed, it is apparent that comments from CIBA-GEIGY which were in that volume were not specifically answered.

Per CIBA-GEIGY, the data may be summarized as follows:

1) The 1982 laboratory aquatic metabolism study showed that after 12 months 50% of the applied material was parent compound, 45% was unextractable from sediment, and 5% was a metabolite.
2) The 1987 study repeating the above shows similar results.
3) 1982 field studies show a 4-8 day half life in water, with rapid adsorption to sediment.
4) The analytical method used is adequate, since it accounts for both the parent and the only metabolite, and also some nonextractables. Therefore, it represents a "worst-case" situation.

Original EAB comments in Volume 7, CIBA-GEIGY response, and EAB replies are as follows:

1) EPA Comment: Referring to Staley, Madrid, and Cassidy: 1982 The Uptake of Triazole, ^{14}C-CGA-64250 and Its Soil Degradation Products in Field Rotational Winter Wheat, Lettuce, Corn and Carrots. (combines two comments)

This study is scientifically valid [but] degradates were not adequately characterized. The only degradates conclusively identified were the major degradates in the corn kernel and wheat grain.

CIBA-GEIGY Response

...Study results show propiconazole metabolism proceeds through hydroxylation of the n-propyl group on the dioxolane ring to give 4- hydroxy isomers which give sugar conjugates. Further metabolism involves deketalization of the dioxolane ring yielding the alkanol. Subsequent metabolism involves cleavage of the alkyl bridge to form 1,2,4-triazole and the phenol moiety. The low quantities of phenyl-related radioactivity in crops treated with phenyl ^{14}C- propiconazole strongly supporte the conclusions that the phenyl moiety is mineralized to $^{14}CO_2$.

Triazole is conjugated with serine to form the alanine conjugate [which is] further metabolized to the acetic acid conjugate.

EAB Reply:

This deficiency is resolved. Although the presentation could be improved, the information is there. The data indicate that two major metabolites, in varying amounts, account for essentially all activity in all tissues of mature crops-- the alanine and acetic acid conjugates mentioned. Detailed results are attached.

2) EPA Comment: Referring to the above study.

Adequate meteorological data for the test site were not provided.

CIBA-GEIGY Response

Weather data were collected from the nearest reporting station at Stoneville, Mississippi (three miles from site).

EAB Reply

This deficiency is resolved.

3) EPA Comment: Referring to the above study.

The test substance was formulated and applied as an EC rather than as an analytical grade.

CIBA-GEIGY Response

Analytical propiconazole is difficult to apply when dissolved in solvents.... The fate of propiconazole analytical grade or formulated is the same in soil... [An EC] formulation was used for spraying in the field [and] an ethanolic solution was blended with soil for the greenhouse study.

EAB Reply

This deficiency is resolved.

4) EPA Comment: Referring to Madrid and Cassidy: 1983. Soil Uptake of Phenyl ^{14}C vs. Triazole ^{14}C-CGA-64250 in Target Peanuts Followed by Rotational Winter Wheat and Corn. A Side by Side Comparison in the Greenhouse.

[Combines two comments]

This study is scientifically valid [but it] does not fulfill EPA Data Requirements...because the purity of the test substance was not specified.

CIBA-GEIGY Response

The purity of the test substance is given in the... [attached] memo.

EAB Reply

This deficiency is not yet resolved. The memo indicates that the radiopurity measurement on the phenyl-labelled material was almost a year old -- this is not acceptable unless data are available to demonstrate stability of the compound (not just the ring) over such a long period.

5) EPA Comment: Referring to the above study.

Rotational crops were analyzed only at maturity.
Soil residues were not characterized.
No data for root and leafy vegetable crops were generated.
A number of degradates were isolated but were not identified.

CIBA-GEIGY Response

Characterization of radioactivity in rotation crops: The metabolism of propiconazole in rotation crops was determined...and reviewed. The purpose of the... report was to compare the metabolism of triazole ^{14}C-propiconazole to phenyl-^{14}C-propiconazole in target and rotational crops. [Emphasis added]. ...the metabolism of propiconazole in rotational crops...was the same as...in target crops.

Characterization of radioactivity in rotation crop soil: Overall extractable radioactivity decreased with time. ... Extractable radioactivity was comprised of the cis and trans propiconazole isomers. The ketone and alkanol ...metabolites were not found in soil.

EAB Reply

This deficiency is resolved. The study fulfills its stated purpose.

6) EPA Comment - Referring to Cheung, Kahrs, and Nixon. Field Rotational Crop Studies on Propiconazole in Alabama. SE-FR-306-80 (combines two comments)

This study is scientifically valid [but] the methods did not distinguish between propiconazole and its degradates in the rotational crops.

CIBA-GEIGY Response

CIBA-GEIGY acknowledges that the total triazole and total DCBA method do not specifically account for individual metabolites in field rotation crops. However, these methods do measure the maximum contributed residue (MCR) of the mixture of propiconazole and its metabolites in rotation crops. Also, since each method accounts for parent and metabolites, these methods provide a measure of the maximum parent residues that are present in the crop.

EAB Reply

This deficiency is resolved. The two major metabolites have been identified as acid conjugates of triazole.

7) EPA Comment - Referring to the same study as above.

Propiconazole was characterized in the soil, but the 2,4-dichlorobenzene degradates were not distinguished and the 1,2,4-triazole degradates were not considered, although 1,2,4-triazole is a major soil degradate.

CIBA-GEIGY Response

CIBA-GEIGY acknowledges that 2,4-dichlorobenzene degradates were not distinguished and 1,2,4-triazole degradates were not considered. However, this did not detract from the scientific validity of the rotation crop studies. Data from aerobic soil metabolism studies show that phenyl ring related metabolites... exist only for a short time at low levels in soil... [and] are not expected to to be detected in field soil... Data ...show that 1,2,4-triazole while a major metabolite in laboratory soil was not a major metabolite under field conditions.... In addition the large amounts of foliage present at application time intercept the majority of the Propiconazole and only a small portion would reach the soil. CIBA-GEIGY concludes that there is no scientific basis for measuring 2,4-dichlorobenzene or 1,2,4-triazole related metabolites in the rotation crop soil and failure to do so does not affect the interpretation of the rotation crop study.

EAB Reply

This deficiency is resolved. Data are included which show that the half-life in soil for parent + degradates is less than two weeks.

8) EPA Comment

The meteorological data provided by the registrant were inadequate.

CIBA-GEIGY Response

Weather data was [sic] collected from the nearest reporting station (Montgomery, Alabama) forty-five miles [emphasis added] from the test site...

EAB Reply

This deficiency is resolved, since it conforms to the letter of the requirement. However, we note that the actual weather conditions at the growing site may have been somewhat different.

9) EPA Comment: Referring to Cheung, Kahrs, and Nixon. Field Rotational Crop Studies on Propiconazole in Nebraska. 4-FR-1-80.

This study is scientifically valid [but] winter wheat and corn were not analyzed for propiconazole. However since residues... were not detected in either crop, it is reasonable to assume that propiconazole was below measurable concentration in the plants.

CIBA-GEIGY Response

CIBA-GEIGY concurs...

EAB Reply

No reply is necessary, since applicant and Agency agree.

10) EPA Comment: Referring to the above study.

Residues containing the 1,2,4-triazole moiety were detected but not characterized in the sugar beets and lettuce. Corn and winter wheat were not analyzed for residues containing the 1,2,4-triazole moiety.

CIBA-GEIGY Response

Residues of 1,2,4-triazole in lettuce can be characterized using the previous method of estimating metabolites in rotation crops. Rotation leaf lettuce contained 0.25 ppm total triazole from an application of 200 gm ai/A. Adjusting for the rate of application of 50 gm ai/A, the maximum contributed residue would be 0.06 ppm total triazole and <0.05 ppm for metabolites F, G, H, and J. The major metabolite I (triazole acetic acid) would be <0.05 ppm in rotation lettuce. Parent propiconazole would not be detectable in lettuce leafs [sic].

Using mature carrot tops as a surrogate crop and adjusting the rate ...to 50 gm/A, the maximum contributed residue for sugar beet tops would be ...0.09 ppm for total triazole residues. ... At 50 g ai/A the only metabolite >0.05 ppm would be triazole acetic acid (0.06 ppm).

Summary of Rotation Crop Residue Data Following Treatment of Terrestrial Crops with Propiconazole at 50 g ai/A - A summary of data is attached.

EAB Reply

This deficiency is resolved. However, we note that these "data" are derived from actual field data where a different application rate was used, and data from a different crop used for extrapolation.

11) EPA Comment: Referring to the above study

The soil was not analyzed for residues containing the 1,2,4-triazole moiety.

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CIBA-GEIGY Response

CIBA-GEIGY acknowledges that 1,2,4-triazole degradates were not measured. However, this did not detract from the scientific validity of the rotation crop studies....Data from validated field dissipation studies ...showed that 1,2,4-triazole while a major metabolite in laboratory soil...is not a major metabolite under field conditions... In addition, the large amount of foliage present at application time would intercept the majority of the propiconazole, and it did not reach the soil...

EAB Reply

This deficiency is resolved.

11) EPA Comment:

The meteorological data provided by the registrant were inadequate because the data were not for the study site.

CIBA-GEIGY RESPONSE:

Weather data was [sic] collected from the test site for the years 1976-1983. A summary of these is found in Table 13.

EAB REPLY

This deficiency is resolved.

The following are comments from the previously reviewed Volume 6 which were deemed unresolved in the review of 12/24/86.

1) EPA COMMENT: Re Cheung, Kahrs, and Nixon. Field Rotational Crop Studies on Propiconazole in Mississippi. 3-FR-5-80

...The formation and decline of degradates were inadequately addressed, degradates were not characterized.

CIBA-GEIGY RESPONSE

...^{14}C-nonextractables were 30% of applied radioactivity, while 51% of the applied dose was extractable ^{14}C propiconazole. The extractable (substantially characterized) metabolite made up 2% of the dose in the 1987 anaerobic study... additional data on the fate of propiconazole in aquatic systems are not needed.

EAB REPLY

This deficiency is provisionally resolved. The applicant will shortly be submitting additional data, which has been presented informally at the 2/6/87 meeting.

2) EPA COMMENT: re Cheung, Kahrs, and Nixon. Field Rotational Crop Studies on Propiconazole in Texas. SW-FR-805-80. (combines two comments)

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The additional information still does not provide characterization of quantification of specific degradates in soil, but only of parent compound. The formation and decline of degradates were not characterized.

CIBA-GEIGY RESPONSE: no specific written response since the 2/6/87 meeting.

EAB REPLY

This deficiency is resolved. See EPA reply in # 7 above.

3) EPA COMMENT: re the Mississippi study above.

Residues...were not identified; the methods were nonspecific.

CIBA-GEIGY RESPONSE: no specific written response since the 2/6/87 meeting.

EAB REPLY

This deficiency is resolved.

4) EPA COMMENT: re the study above

Soil samples were not analyzed for residues containing the 1,2,4triazole moiety. Water samples were not analyzed for residues containing 2,4-dichlorobenzene (128 + 128 gm ai/A treatment) and residues containing 1,2,4-triazole. Cabbage and sweet potato samples were not analyzed for propiconazole or residues containing the 2,4-dichlorobenzene moiety (256 + 256 g ai/A only.

CIBA-GEIGY RESPONSE

The laboratory aquatic metabolism study showed no metabolism of propiconazole in water and only one minor metabolite in soil sediment, which was less than 5% of the applied dose. [The metabolite] would not have been detectable under current methodology.

[Analyzing cabbage and sweet potato samples] was not necessary for two reasons:

1) The DCBA method was performed... and DCBA would account for propiconazole as well as metabolites.
2) Rotation crop metabolites contain mainly the triazole moiety; therefore, the total 1,2,4-triazole method was run on all samples.

EAB REPLY

This deficiency is resolved.

5) EPA COMMENT: re the Texas study above

...the methods were nonspecific, degradates were not identified;... Residues containing the 2,4-dichlorobenzene moiety and those containing the 1,2,4-triazole moiety were not identified; the methods were nonspecific.

CIBA-GEIGY RESPONSE:

CIBA-GEIGY acknowledges that the total triazole and total DCBA method do not specifically account for individual metabolites in field rotation crops. However, these methods do measure the maximum contributed residue (MCR) of the mixture of propiconazole and its metabolites in field rotation crops. Also, since each method accounts for parent and metabolites, these methods provide a measure of the maximum parent residue that could be present in the crop.

EAB REPLY

This deficiency is resolved.

6) EPA COMMENT: re the Texas study

Soil samples were not analyzed for propiconazole only for the first 28-31 days and were analyzed for degradates containing the 1,2,4-triazole moiety on about day 30 of the study. Water samples were not analyzed for degradates of propiconazole. Wheat samples were not analyzed for propiconazole or degradates containig the 1,2,4-triazole moiety; sorghum samples from the 256 + 256 gm ai/A treatment were not analyzed for propiconazole.

CIBA-GEIGY RESPONSE:

CIBA-GEIGY acknowledges that soil or water samples were not analyzed for residues containing parent ot 1,2,4-triazole at every interval. ...[However] DCBA analysis was performed on most samples at most time intervals. Further, previous anaerobic aquatic metabolism studies established that little or no metabolism of propiconazole would occur in water or soil under aquatic conditions..... DCBA analysis is consistent with the aquatic soil metabolism results - i.e. adsorption from water to sediment and eventual dissipation of extractable material from sediment.

CIBA-GEIGY also acknowledges that wheat samples were not analyzed for propiconazole. This was not necessary since the DCBA method was performed, and it accounts for parent. Sorghum samples at the 2x rate were not analyzed for propiconazole for the same reason. CIBA-GEIGY feels that adequate analysis was performed on sorghum and wheat, and the absence of specifically pointed out data does not detract from the validity or conclusions of the study.

EAB REPLY

This deficiency is resolved.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

10.1 A. STUDY IDENTIFICATION

Honeycutt, R.C. Additional Environmental Fate Information on Aquatic Field Dissipation and Rotational Crops Related to the Use of Tilt on

Rice. CIBA-GEIGY Report no. EIR-86015, dated 9/26/86.

D. STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES

This material is not a report of a scientific study, but a summary and discussion of previously reported results and conclusions. The points are as follows:

1) There is an adequate data base for assessing the environmental fate of propiconazole in aquatic food crops.

2) Residues of propiconazole did not accumulate in indicator rotation crops such as leafy vegetables and root crops.

3) Rotation grain crop fodder contained 0.08 ppm propiconazole indicating a label restriction would be required to prohibit feeding rotation grain crop fodder after treating rice with 0.34 lbs. ai/acre propiconazole.

4) The significance of exposure to residues of propiconazole and its metabolites in rotation crops following rice is important only if these compounds are shown to be toxicologically significant.

5) The rotation crop residues for total triazine and DCBA, although higher in the originally submitted rotation crop data (due to use of higher rates of propiconazole), may be reasonable to use as worst case exposure values. Use of currently proposed lower rates of propiconazole would lead to proportionately lower residues in rotation crops.

6) Review of the Aerobic Soil Metabolism and Aquatic Metabolism of Propiconazole - Considerable information on the laboratory aerobic soil and aquatic metabolism of propiconazole has been submitted previously.

7) Aerobic Soil Metabolism - Under aerobic laboratory conditions, propiconazole has a half-life of 30-112 days. Major metabolites in laboratory aerobic soil are CO_2 and 1,2,4-triazole. Nonextractables comprise up to 62% of the propiconazole metabolites in laboratory aerobic soil after one year.

8) Aerobic/Anaerobic Aquatic Metabolism - Although the aerobic portion of a study was judged invalid, the anaerobic portion showed that the half-life of propiconazole in a Texas water-sediment system under aquatic conditions was nine months and that little or no metabolism occurred. Propiconazole readily binds to soil (40% bound after one year) and the only metabolite, the ketone of propiconazole, occurred at <5% of the theoretical dose. Preliminary indications from a more recent study show the same results.

9) Review of the Field Dissipation of Propiconazole - Twenty-two individual field dissipation trials on propiconazole have been submitted previously. Seventeen of these studies show good first order kinetics with a half-life of propiconazole ranging from 66 to 229 days. These data indicate that propiconazole dissipates rapidly from the field soil

and will not build up after repeated applications.

10) Review of the Metabolism of Propiconazole in Rotation Crops Propiconazole metabolism in rotational crops proceeds through hydroxylation of the n-propyl group on the dioxolane ring to give four -hydroxy isomers which form sugar conjugates. Further metabolism involves deketalization of the dioxolane ring yielding the alkanol. Hydroxylation and replacement of chlorine by a hydroxy group occurs to some extent. Subsequent metabolism involves cleavage of the alkyl bridge to form 1,2,4-triazole and a phenyl moiety which is thought to be mineralized to CO_2. Triazole is conjugated with serine to form the alanine conjugate which is further metabolized to the acetic acid conjugate, most likely through the lactic acid intermediate.

11) Estimation of Residues in Rotation Crops Based on Application Rates - Data show that there is a reasonable linear relationship between application rates and concentrations of total DCBA and total triazole in rotation crops. Total DCBA and triazole residues have been extrapolated to use rates using residue data from field studies performed at higher application rates.

E. REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS

The applicant's conclusions are in general supported by the evidence.

10.2 A. STUDY IDENTIFICATION

Honeycutt, R.C. Additional Residue Information on Terrestrial Rotational Crops Grown After Use of Propiconazole on Wheat, Barley, or Rye. CIBA-GEIGY Report no. EIR-86016, dated 9/26/86.

D. STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES

This document contains summaries and conclusions from a variety of previous studies. Points are as follows:

1) Propiconazole does not accumulate in indicator rotation crops such as cabbage, corn or sweet potatoes following wheat, barley or rye treated once at 0.11 lb (50 gm)/acre with propiconazole. In addition, dichlorophenyl-related metabolites do not accumulate in indicator rotation crops except winter wheat. Triazole-containing metabolites are detectable in most indicator field rotation crops.

2) The significance of exposure of rotational crops to residues of propiconazole and its metabolites is important only if these compounds are shown to be toxicologically significant. The rotation crop residues originally submitted are reasonable to use for worst case exposure values since they were done using higher application rates. Use of currently proposed lower rates of propiconazole would lead to proportionately lower residue in rotation crops.

3) Aerobic Soil Metabolism - Under aerobic laboratory conditions, propiconazole has a half-life of 30-112 days. Major metabolites

in laboratory aerobic soil are CO_2 and 1,2,4-triazole. Nonextractables comprise up to 62% of the propiconazole metabolites in laboratory aerobic soil after one year.

4) Review of the Field Dissipation of Propiconazole - Twenty-two individual field dissipation trials on propiconazole have been submitted previously. Seventeen of these studies show good first order kinetics with a half-life of propiconazole ranging from 66 to 229 days. These data indicate that propiconazole dissipates rapidly from the field soil and will not build up after repeated applications.

5) Review of the Metabolism of Propiconazole in Rotation Crops: Propiconazole metabolism in rotational crops proceeds through hydroxylation of the n-propyl group on the dioxolane ring to give four -hydroxy isomers which form sugar conjugates. Further metabolism involves deketalization of the dioxolane ring yielding the alkanol. Hydroxylation and replacement of chlorine by a hydroxy group occurs to some extent. Subsequent metabolism involves cleavage of the alkyl bridge to form 1,2,4-triazole and a phenyl moiety which is thought to be mineralized to CO_2. Triazole is conjugated with serine to form the alanine conjugate which is further metabolized to the acetic acid conjugate, most likely through the lactic acid intermediate.

E. REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS

The applicant's conclusions are in general supported by the evidence.

10.3 A. STUDY IDENTIFICATION

Honeycutt, R.C. The Fate of Propiconazole Under Aquatic Laboratory and Aquatic Field Conditions. dated 2/12/ [87]

D. STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES

1) 1982 Laboratory Aquatic Metabolism Study: An aquatic metabolism study with ^{14}C propiconazole (labelled in the triazole ring) was completed...in 1982. The anaerobic portion shows rapid disappearance of propiconazole from the water phase and rapid adsorption to sediment (K_{om} = 770). By twelve months 45% of the applied radioactivity was nonextractable materials while 50% of the applied dose was extractable ^{14}C propiconazole. A minor ^{14}C-metabolite comprised 5% of the applied dose.

2) 1987 Laboratory aquatic Metabolism Study: At the request of EPA, CIBA-GEIGY repeated the laboratory aquatic metabolism study with ^{14}C propiconazole (triazole ring label). The results are strikingly similar to the results of the 1982 study... ^{14}C non-extractables were 30% of applied radioactivity while 51% of the applied dose was extractable ^{14}C-propiconazole. The extractable (substantially characterized) metabolite (CGA-91305) made up 2% of the dose in the 1987 anaerobic study. The 1987 laboratory aquatic aerobic study results are also strikingly similar to the 1982 anaerobic and 1987 anaerobic study results.

3) 1982 Propiconazole Field Aquatic Studies: Aquatic field dissipation studies on propiconazole...were completed in 1982 by CIBA-GEIGY. These studies have been submitted previously... Half-life values for propiconazole in the water (4-8 days) in the four aquatic field plots (1X and 2X) are strikingly similar to disappearance rates of propiconazole in water for the laboratory aquatic metabolism studies in 1982 and 1987 ($t_{1/2}$ = 11-17 days).

   The rapid adsorption of propiconazole to sediment is demonstrated in both laboratory and field aquatic studies.

4) Use of the DCBA Total Method to Determine Fate of Propiconazole and Metabolites in Water and Soil: The total DCBA method adequately defines the fate of propiconazole and its metabolites in rice-field water and sediment. The DCBA method accounts for parent and metabolites containing the phenyl ring. Under aquatic conditions only parent and CGA-91305 (both containing the phenyl ring) are present in water/sediment. The DCBA method presumably would account for not only extractable parent/metabolites but also some bound (nonextractable) residue since the DCBA method is exhaustive and rigorous using a digestive process.

   A second advantage of the DCBA method is that it can account for small amounts of several metabolites which may be present at concentrations too low to be detected by an individual metabolite method. For example, the CGA-91305 metabolite is expected to occur at 5% or 0.010 ppm concentrations in rice sediment after application o of 0.34 lb. ai/acre propiconazole. This quantity can be calculated from previous field studies which show propiconazole to reach a maximum of 0.77 ppm in rice-field sediment after an application of of 1.1 lbs. ai/acre.
   The total DCBA method can account for...phenyl-ring-related metabolites which may occur at such low concentrations in sediment.

E. REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS

The applicant's conclusions are in general supported by the evidence.

11. COMPLETION OF ONE-LINER: n.a.

12. CBI APPENDIX: attached

^{14}C-Propiconazole Metabolites in Rotation Winter Wheat Following Treatment of Peanuts at 440 g ai/A

Age (Weeks)	8	25	-30-	Mature	
Plant Part	Forage	Forage	Stalks	Husks	Grain
PPM	8.25	3.28	1.66	2.58	7.39
			% ^{14}C		
Propiconazole	0.7	-*	-*	-*	-*
CGA-91305 (Alkanol-Met. A) / CGA-118244 (β-hydroxy isomers) B B[1] C C[1]	2.1	-*	-*	-*	-*
Metabolite F (conjugate of CGA-91305)	4.4	0.9	2.7	0.9	0.1
Metabolite G (conjugate of CGA-118244) isomer	8.8	0.6	1.2	1.4	1.0
Metabolite H (conjugate of CGA-118244) isomer	5.0	1.9	3.1	2.1	1.2
CGA-131013 (Triazole Alanine Met. J)	8.6	7.9	10.1	43.1	47.3
Triazole Acetic Acid (Met. I)	45.0	45.5	36.0	45.5	28.6
Triazole Lactic Acid** (Met. I[1])	17.0	20.3	35.8		
Nonextractable	6.1	4.8	14.7	21.3	11.9

*Radioactivity too low for TLC characterization
**Identified as a triazole plant metabolite but not confirmed as I[1]

^{14}C-Propiconazole Metabolites in Rotation Corn Following Treatment of Peanuts at 440 g ai/A

Age (Weeks)	13	25 - Mature		
Plant Part	Forage	Stalks	Cobs	Kernel
PPM	3.55	1.33	2.31	13.18
		% ^{14}C		
Propiconazole	-*	-*	-*	-*
CGA-91305 (Alkanol - Met. A)	-*	-*	-*	-*
CGA-118244 (β-hydroxy isomers) B B[1] C C[1]	--*	-*	-*	-*
Metabolite F (conjugate of CGA-91305)	1.8	2.3	0.3	0.4
Metabolite G (conjugate of CGA-118244) isomer	0.26	0.6	1.3	0.2
Metabolite H (conjugate of CGA-118244) isomer	0.53	0.5	0.8	0.4
CGA-13013 (triazole alanine Met. J)			8.9	79.4**
Triazole Acetic Acid (Met I)	46.9	49.0	68.7	2.4
Triazole Lactic Acid*** (Met I[1])	11.5	10.3		
Nonextractable	3.3	25.7	15.5	11.0

*Radioactivity too low for TLC characterization.
**Includes triazole lactic acid - Metabolite I[1].
***Identified as a triazole plant metabolite but not confirmed as I[1]

^{14}C-Propiconazole Metabolites in Rotation Lettuce Following Treatment of Peanuts at 440 g ai/A

Age (Weeks)	13
Plant Parts	Head
PPM	7.35
	% ^{14}C
Propiconazole	-*
CGA-91305 (Alkanol - Met. A)	-*
CGA-118244 (β-hydroxy isomers) B B[1] C C[1]	-*
Metabolite F (conjugate of CGA-91305)	2.9
Metabolite G (conjugate of CGA-118244) isomer	0.7
Metabolite H (conjugate of CGA-118244) isomer	1.2
Metabolite J Triazole alanine CGA-13013	6.7
Metabolite I Triazole Aectic Acid**	67.9
Metabolite I[1] Triazole Lactic Acid	4.9
Nonextractable	6.1

*Radioactivity too low for TLC characterization.
**Identified as a triazole plant metabolite but not confirmed as I[1].

^{14}C-Propiconazole Metabolites in Rotation Carrots Following Treatment of Peanuts at 440 g ai/A

Age (Weeks)	13	20 - Mature	
Plant Parts	Tops	Tops	Roots
PPM	2.97	5.87	1.30
		% ^{14}C	
Propiconazole	-*	-*	-*
CGA-91305 (Alkanol - Met. A)	-*	-*	-*
CGA-118244 (β-hydroxy isomers) B B[1] C C[1]	-*	-*	-*
Metabolite F (conjugate of CGA-91305)	2.4	2.0	-
Metabolite G (conjugate of CGA-118244) isomer	0.7	0.5	-
Metabolite H (conjugate of CGA-118244) isomer	0.4	0.7	-
Metabolite J Triazole alanine CGA-13013	8.1	9.1	-
Meabolite I Triazole Acetic Acid	64.2	66.3	-
Metabolite I[1] Triazole Lactic Acid**	8.1	9.1	-
Nonextractable	4.9	5.1	3.8
Aqueous Soluble	-	-	95.0
Organic Soluble	-	-	2.2

*Radioactivity too low to characterize.
**Identified as a triazole plant metabolite but not confirmed as I[1]

Rates of Application of Tilt vs. Amounts of DCBA and Total Triazole in Rotation Crops

Location Crop	Plant Part	DCBA (PPM) 1X	DCBA (PPM) 2X	DCBA Ratio	Total Triazole (PPM) 1X	Total Triazole (PPM) 2X	Total Triazole Ratio
GA Cabbage	Forage	0.38	-	-	0.82	2.3	2.8
	Head	0.09	-	-	1.2	5.7	4.8
MS Cabbage	Head	<0.05	<0.05	-	2.2	6.3	2.9
NC Cabbage	Forage	0.14	-	-	0.85	-	-
	Head	<0.05	0.08	-	0.73	3.1	4.2
TX Cabbage	Forage	0.76	-	-	7.0	7.5	1.1
	Head	0.15	-	-	8.0	17.0	2.1
Ms Corn	Forage	<0.05	<0.05	-	3.9	6.4	1.6
	Fodder	0.11	0.28	2.5	6.8	18.0	2.6
	Kernel	<0.05	<0.05	-	15.0	26.0	1.7
NC Corn	Forage	0.6	0.15	0.25	0.75	2.1	2.8
	Fodder	0.09	0.15	2.1	1.7	2.1	1.8
	Kernel	<0.05	<0.05	-	2.1	14	6.6
TX Corn	Forage	0.26	-	-	2.7	5.4	2.0
	Fodder	0.19	-	-	12	23.0	1.9
	Kernel	0.06	-	-	39	94	2.4
,S Winter Wheat	Forage	1.2	1.5	1.3	4.8	8.0	1.7
	Straw	0.9	2.3	2.6	4.3	8.2	1.9
	Grain	?	?	3.0	10	28	2.8
NC Winter Wheat	Forage	0.36	0.66	1.8	2.1	4.0	1.9
	Straw	<0.05	0.07	-	1.2	2.5	2.1
	Grain	0.13	0.24	1.8	4.9	8.8	1.8
GA Sweet Potatoes	Forage	0.31	-	-	17	21	1.2
	Tops	0.12	-	-	3.1	14	4.5
	Roots	<0.05	-	-	2.4	17	7.1
MS Sweet Potatoes	Forage	0.32	0.11	0.34	6.3	4.0	0.63
	Tops	1.2	0.2	-	2.0	2.2	1.1
	Roots	<0.05	<0.05	-	2.3	7.3	3.1
NC Sweet Potatoes	Forage	0.18	0.09	0.5	1.0	2.1	2.1
	Tops	0.10	0.12	1.2	0.7	1.6	2.3
	Roots	<0.05	<0.05	-	0.4	0.31	0.8
TX Sweet Potatoes	Forage	0.11	-	-	3.9	6.6	1.7
	Tops	0.16	-	-	10.3	6.1	0.6
	Roots	<0.05	-	-	2.1	4.9	2.3

Estimation of Maximum Contributed Residues of Propiconazole and Metabolites in Rotation Crops

Rotation Crop	Plant Part	Treatment to Planting Interval (Days)	MCR[1] 1,2,4-Triazole Moiety	MCR[1] DCBA Moiety	MCR[2] Propiconazole
Winter Wheat	Immature	9	-	<0.05	<0.05
	Straw	9	-	<0.05	<0.05
	Grain	9	-	<0.05	<0.05
Corn	Immature	238	-	<0.05	<0.05
	Fodder	238	-	<0.05	<0.05
	Grain	238	-	<0.05	<0.05
Sugar Beets	Immature	257	0.11	<0.05	<0.05
	Root	257	0.13	<0.05	<0.05
	Top	257	0.09	<0.05	<0.05
Lettuce	Immature	278	<0.05	<0.05	<0.05
	Leaf	278	0.06	<0.05	<0.05

[1]MCR calculated by multiplying the 1X residue on p. 21 (6-20-86 EPA Review) by 50/100 to adjust for current proposed rate of propiconazole of 50 g ai/Acre.

[2]MCR Propiconazole derived from MCR DCBA since DCBA accounts for parent.

Summary of Rotation Crop Residues Expected After Treatment of Terrestrial Crops With 50 g ai/Acre Propiconazole

Rotation Crop (Location)	Plant Part	Treatment to Planting Interval (Days)	Residue (PPM) Propiconazole	Acetic Acid	Triazole Alanine	Triazole Lactic Acid[1]
Cabbage (Alabama)	30 day	175	<0.05	-	-	-
	Head	175	<0.05	0.11	<0.05	<0.05
Corn (Alabama)	Immature	209	<0.05	0.23	-	0.06
	Fodder	209	<0.05	0.38	-	0.08
	Grain	209	<0.05	0.06	2.1	-
Sweet Potato (Alabama)	Immature	217	<0.05	0.53	0.07	0.07
	Root	217	<0.05	-	-	-
Winter Wheat (Alabama)	Top	217	<0.05	0.32	<0.05	<0.05
	Immature	28	0.18	-	-	-
	Immature	28	<0.05	-	-	-
	Straw	28	0.06	-	-	-
	Grain	28	<0.05	-	-	-
Winter Wheat (Nebraska)	Immature	9	<0.05	-	-	-
	Straw	9	<0.05	-	-	-
	Grain	9	<0.05	-	-	-
Corn	Immature	238	<0.05	-	-	-
	Fodder	238	<0.05	-	-	-
	Grain	238	<0.05	-	-	-
Sugar Beets (Nebraska)	Immature	257	<0.05	0.06	<0.05	<0.05
	Root	257	<0.05	-	-	-
	Top	257	<0.05	<0.05	<0.05	<0.05
Lettuce (Nebraska)	Immature	278	<0.05	<0.05	<0.05	<0.05
	Mature Leaf	278	<0.05	<0.05	<0.05	<0.05

[1]Identified as a triazole plant metabolite but not confirmed as I[1]

Estimation of Propiconazole and Metabolites in Field Rotation Sugar Beets

Estimated Residues (PPM)[3]

Plant Part	Immature[4] Forage	Top	Roots
MCR[1,2] - Propiconazole (PPM)	<0.05	<0.05	<0.05
MCR[1] - DCBA (PPM)	<0.05	<0.05	<0.05
MCR[1] - Total Triazole (PPM)	0.11	0.09	0.13
CGA-91305 + CGA-118244	-	-	-
Metabolite F (conjugate of CGA-91305)	<0.05	<0.05	-
Metabolite G (conjugate of CGA-118244 isomer)	<0.05	<0.05	-5
Metabolite H (conjugate by CGA-118244 isomer)	<0.05	<0.05	-
Metabolite I Triazole Acetic Acid	0.07	0.06	-
Metabolite I[1] Triazole Lactic Acid[6]	<0.05	<0.05	-
Metabolite J Triazole Alanine	<0.05	<0.05	-
Nonextractable Metabolites	<0.05	<0.05	-

[1]MCR = Maximum Contributed Residue. These values were derived from EPA values on page 21 of the 6-20-86 EPA review, (e.g., 0.46 ÷ 4 = 0.11).
[2]Parent <0.05 since DCBA <0.05.
[3]Estimated residues from Table 4. e.g., for Metabolite I, 0.11 X 0.642 Table (4) = 0.07.
[4]Use 13 week metabolism data for immature.
[5]No metabolism data for roots.

[illegible] in Field Rotation Lettuce

Estimated Residues (PPM)[3]

Plant Part	Immature Forage	Mature Leaf
MCR[1,2] - Propiconazole (PPM)	<0.05	<0.05
MCR[1] - DCBA (PPM)	<0.05	<0.05
MCR[1] - Total Triazole (PPM)	<0.05	0.06
CGA-91305 + CGA-118244	-	-
Metabolite F (conjugate of CGA-91305)	<0.05	<0.05
Metabolite G (conjugate of CGA-118244 isomer)	<0.05	<0.05
Metabolite H (conjugate by CGA-118244 isomer)	<0.05	<0.05
Metabolite I Triazole Acetic Acid	<0.05	<0.05
Metabolite I[1] Triazole Lactic Acid[4]	<0.05	<0.05
Metabolite J Triazole Alanine	<0.05	<0.05
Nonextractable Metabolites	<0.05	<0.05

[1]MCR = Maximum Contributed Residue. These values were derived from EPA values on page 21 of the 6-20-86 EPA review, (e.g., 0. ÷ 4 = 0.06).

[2]Parent <0.05 since DCBA <0.05.

[3]Estimated residues from Table 3.

[4]Identified as a triazole plant metabolite but not confirmed as

[14]C-Triazole Propiconazole Formulated as 3.6EC From the Field Plot, 0-3"

Weeks After 1st Soil Spray	PPM	Ext.	Parent	Non Ext.
8	1.58	72	46	24
14	1.32	55	39	33
16	1.52	53	32	38
47	0.77	40	12	52
55	0.70	30	16	66

Analytical Grade Product Soil Data from the Greenhouse, 0-3"

Phenyl - [14]C-Propiconazole

21.5	1.19	63	46	30
36	1.00	85	-	26
41.4	0.95	59	49	37

Analytical Grade Product Soil Data from the Greenhouse, 0-3"

Triazole - [14]C-Propiconazole

21.5	1.89	73	71	27
36	1.32	73	-	32
41.4	1.09	68	48	32

Estimation of Maximum Contributed Residues of Propiconazole and Metabolites in Rotation Crops

Rotation Crop	Plant Part	Treatment to Planting Interval (Days)	MCR[1] 1,2,4-Triazole Moiety ppm	MCR[1] DCBA Moiety ppm	MCR[1] Propi-conazole[4] ppm
Cabbage	30-day	175	0.20	<0.05	<0.05
	Head	175	0.16	<0.05	<0.05
Corn	Immature	209	0.49	<0.05	<0.05
	Fodder	209	0.78	<0.05	<0.05
	Grain	209	2.6	<0.05	<0.05
Sweet Potato	Immature	217	0.83	<0.05	<0.05
	Root	217	0.75	<0.05	<0.05
	Top	217	0.48	<0.05	<0.05
Winter Wheat	Immature[2]	28	-	0.18	0.18
	Immature[3]	28	-	<0.05	<0.05
	Straw	28	-	0.06	0.06
	Grain	29	-	<0.05	<0.05

[1]These data are taken from Table 3, page 15 of the EPA 6-20-83 review. The numbers were divided by 4 because the current recommended rate of Tilt on rye, wheat or barley is 50 g ai/acre.

[2]91 days between treatment and harvest.

[3]179 days between treatment and harvest.

[4]From DCBA data, DCBA accounts for parent.

Estimation of Propiconazole and Metabolites in Field Rotation Sweet Potatoes[1]

Estimated Residues (PPM)

Plant Part	Immature[2]	Roots	Top
MCR Propiconazole (PPM)	<0.05	<0.05	<0.05
MCR - DCBA (PPM)	<0.05	<0.05	<0.05
MCR - Total Triazole (PPM)	0.83	0.75	0.48
CGA-91305 + CGA-118244	<0.05	<0.05	<0.05
bolite F (jugate of CGA-91305)	<0.05	-	<0.05
Metabolite G (conjugate of CGA-118244 isomer)	<0.05	-[3]	<0.05
Metabolite H (conjugate by CGA-118244 isomer)	<0.05	-[3]	<0.05
Metabolite I Triazole Acetic Acid	0.53	-[3]	0.32
Metabolite I[1] Triazole Lactic Acid[4]	0.07	-[3]	<0.05
Metabolite J Triazole Alanine	0.07	-[3]	<0.05
Nonextractable	<0.05	<0.05	<0.05

[1]Values were estimated using the MCR values Table 7 and metabolism data from Table 4 (using carrots as a surrogate crop).

[2]Use 13 week tops - Table 4.

[3]No metabolism data for roots

[4]Identified as a triazole plant metabolite but not confirmed as I[1]

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Estimation of Propiconazole and Metabolites in Field Rotation Cabbage

Estimated Residues (PPM)

Plant Part	Head
MCR Propiconazole (PPM)	<0.05
MCR DCBA (PPM)	<0.05
MCR Total Triazole (PPM)	0.16
CGA-91305 + CGA-118244	-
Metabolite F (conjugate of CGA-91305)	<0.05
Metabolite G (conjugate of CGA-118244 isomer)	<0.05
Metabolite H (conjugate by CGA-118244) isomer	<0.05
Metabolite I Triazole Acetic Acid	0.11
Metabolite I[1] Triazole Lactic Acid[2]	<0.05
Metabolite J Triazole Alanine	<0.05
Nonextractable Metabolites	<0.05

[1]Lettuce rotation crop metabolism data from Table 3 was used as a surrogate to determine values for rotation cabbage grown after treatment at 50 g ai/acre.

[2]Identified as a triazole plant metabolite but not confirmed as I[1]

Estimation of Propiconazole and Metabolites in Field Rotation Corn

Estimated Residues (PPM)

Plant Part	Immature Forage	Stalk (Fodder)	Grain
MCR[1],[2] - Propiconazole (PPM)	<0.05	<0.05	<0.05
MCR[1] - DCBA (PPM)	<0.05	<0.05	<0.05
MCR[1] - Total Triazole (PPM)	0.49	0.78	2.6
CGA-91305 + CGA-118244	-	-	-
Metabolite F (conjugate of CGA-91305)	<0.05	<0.05	<0.05
Metabolite G (conjugate of CGA-118244 isomer)	<0.05	<0.05	<0.05
Metabolite H (conjugate by CGA-118244 isomer)	<0.05	<0.05	<0.05
Metabolite I Triazole Acetic Acid.	0.23	0.38	0.06
Metabolite I[1] Triazole Lactic Acid[5]	0.06	0.08	-[4]
Metabolite J Triazole Alanine	-	-	2.1[4]
Nonextractable Metabolites	<0.05	0.20	0.29

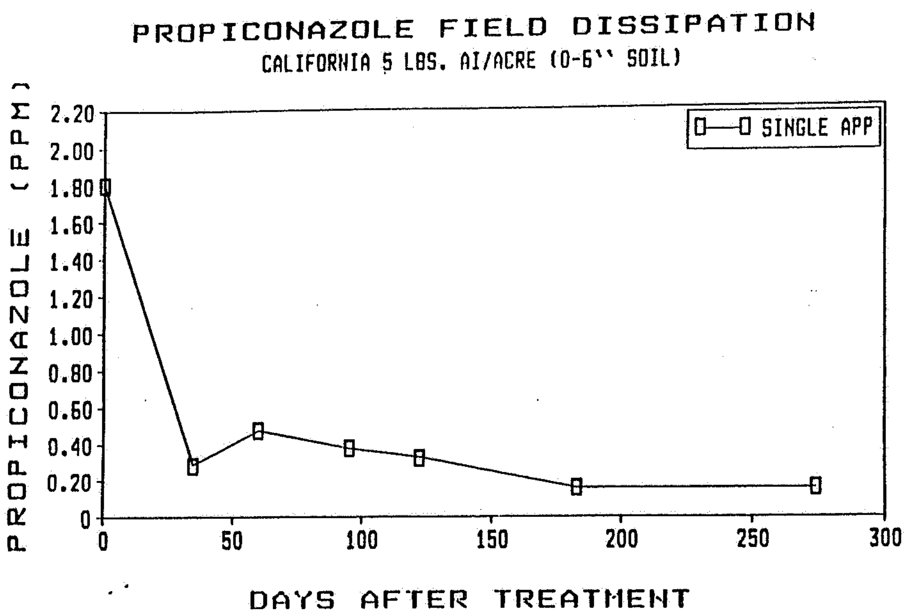
[1]MCR = Maximum Contributed Residue. These values were derived from EPA values on page 15 of the 6-20-86 EPA review, (e.g., 1 + 4 = 0.49).

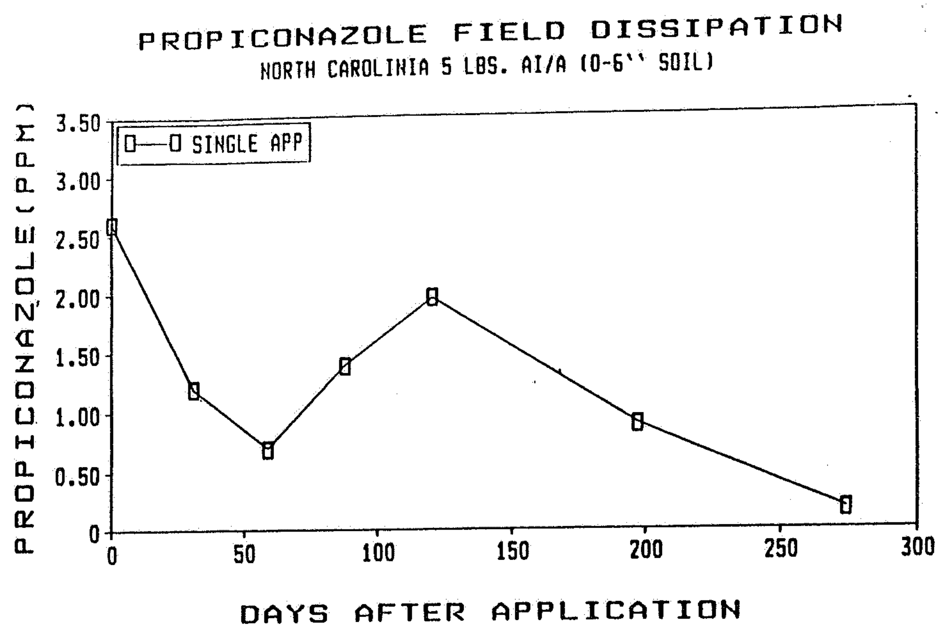
[2]Parent <0.05 since DCBA <0.05.

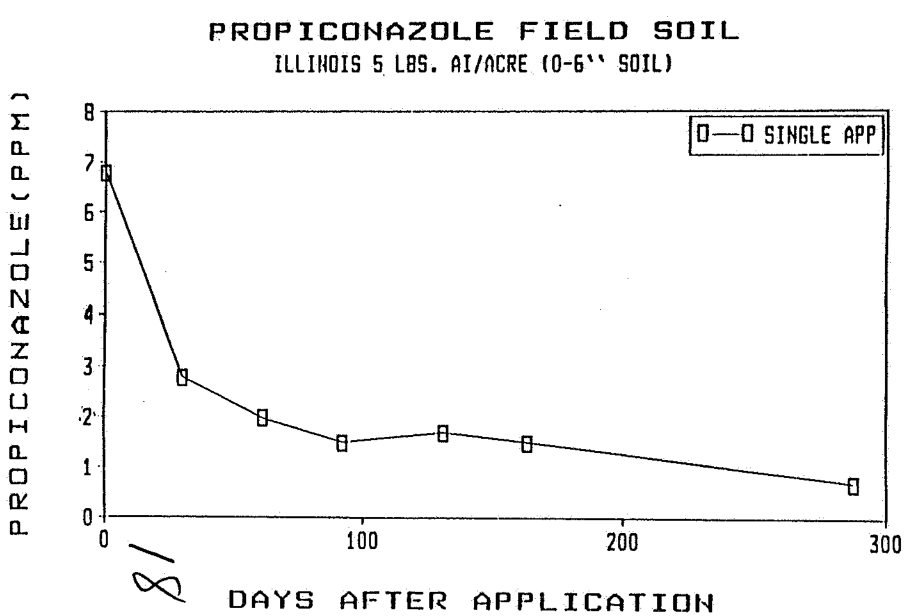
[3]Estimated residues from Table 2. e.g., for Metabolite I 0.49 (Table 8) X 0.469 Table (2) = 0.23.

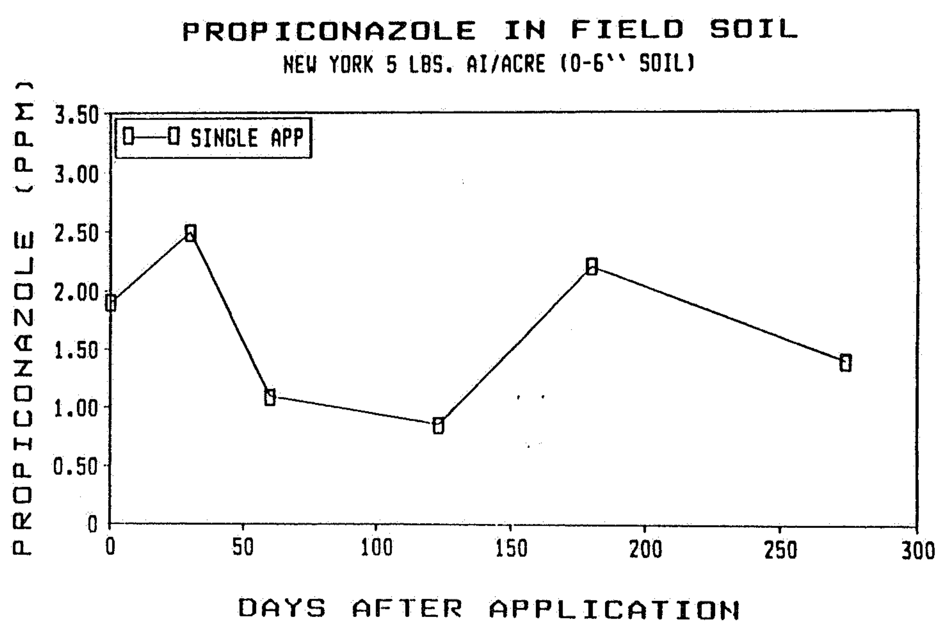
[4]Includes triazole lactic acid in TLC zone.

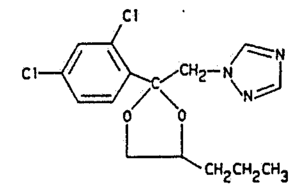
[5]Identified as a triazole plant metabolite but not confirmed as


PROPICONAZOLE FIELD DISSIPATION
CALIFORNIA 5 LBS. AI/ACRE (0-6'' SOIL)
SINGLE APP
PROPICONAZOLE (PPM)
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0
0
50
100
150
200
250
300
DAYS AFTER TREATMENT


PROPICONAZOLE FIELD DISSIPATION
NORTH CAROLINIA 5 LBS. AI/A (0-6'' SOIL)
SINGLE APP
PROPICONAZOLE (PPM)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0
0
50
100
150
200
250
300
DAYS AFTER APPLICATION


PROPICONAZOLE FIELD SOIL
ILLINOIS 5 LBS. AI/ACRE (0-6'' SOIL)
SINGLE APP
PROPICONAZOLE (PPM)
8
7
6
5
4
3
2
1
0
0
100
200
300
DAYS AFTER APPLICATION

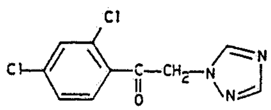

PROPICONAZOLE IN FIELD SOIL
NEW YORK 5 LBS. AI/ACRE (0-6'' SOIL)
SINGLE APP
PROPICONAZOLE (PPM)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0
0
50
100
150
200
250
300
DAYS AFTER APPLICATION



CGA-64250

1-[[2-(2,4-Dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole

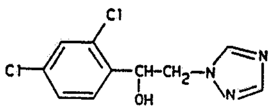
$C_{15}H_{17}Cl_2N_3O_2$



CGA-91304, ketone

1-(2,4-Dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)ethanone

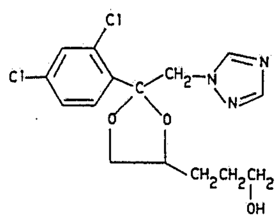
$C_{10}H_7Cl_2N_3O$



CGA-91305, alkanol

-(2,4-Dichlorophenyl)-1H-1,2,4-triazole-1-ethanol

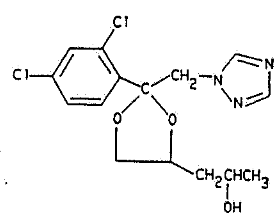
$C_{10}H_9Cl_2N_3O$



CGA-118245, α-hydroxy

2-(2,4-Dichlorophenyl)-2-(1H-1,2,4-triazol-1-ylmethyl)-1,3-dioxolane-4-propanol

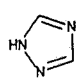
$C_{15}H_{17}Cl_2N_3O_3$



CGA-118244, β-hydroxy

2-(2,4-Dichlorophenyl)- -methyl-2-(1H-1,2,4-triazol-1-ylmethyl)-1,3-dioxolane-4-ethanol

$C_{15}H_{17}Cl_2N_3O_3$



CGA-71019, Triazole

1H-1,2,4-triazole

$C_2H_3N_3$

Figure 1: CHEMICAL NAMES AND STRUCTURES

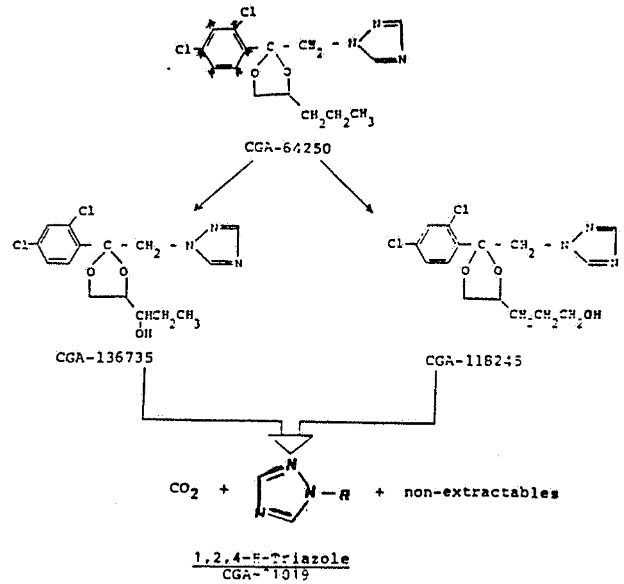


Figure 2: SOIL METABOLISM OF CGA-64250

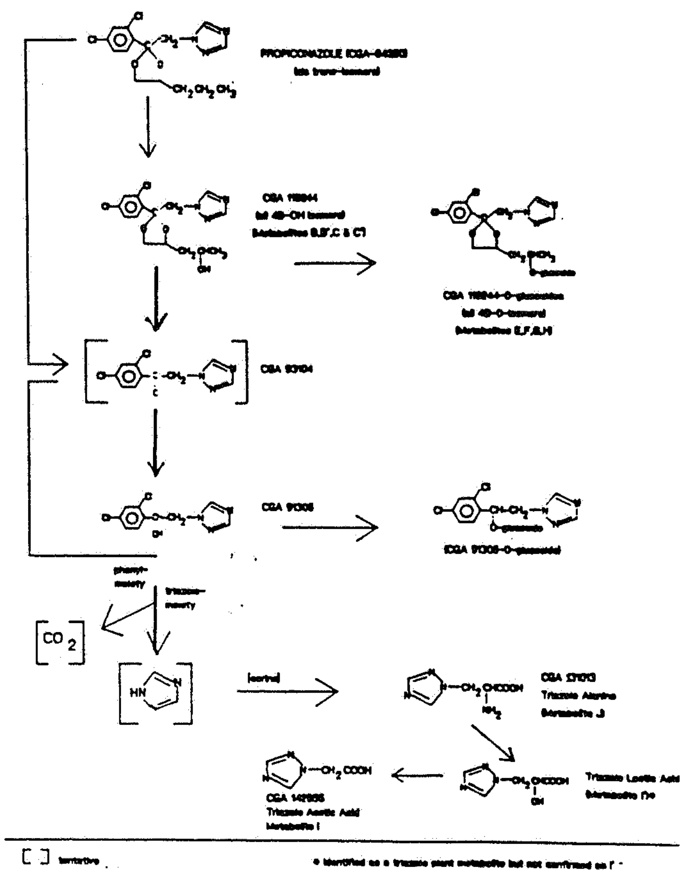
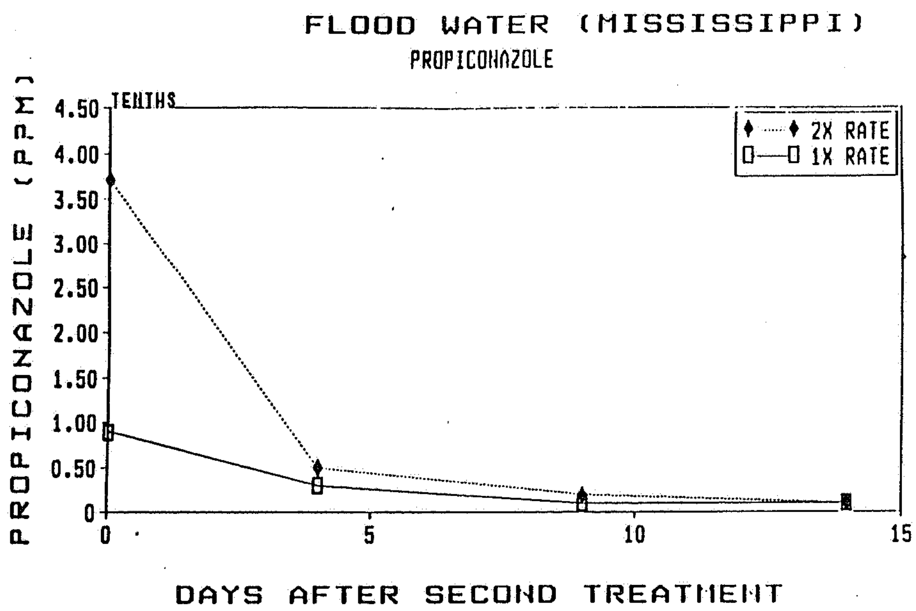
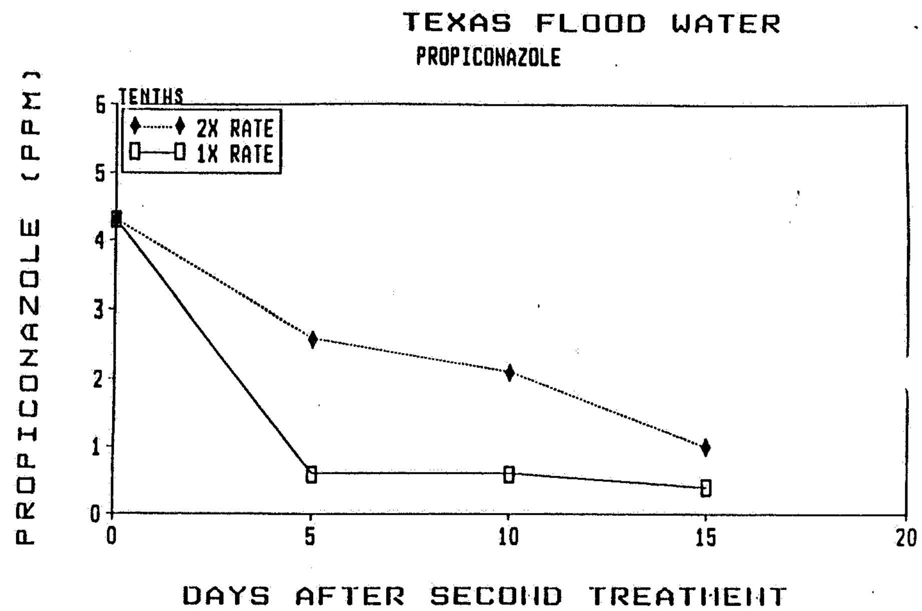
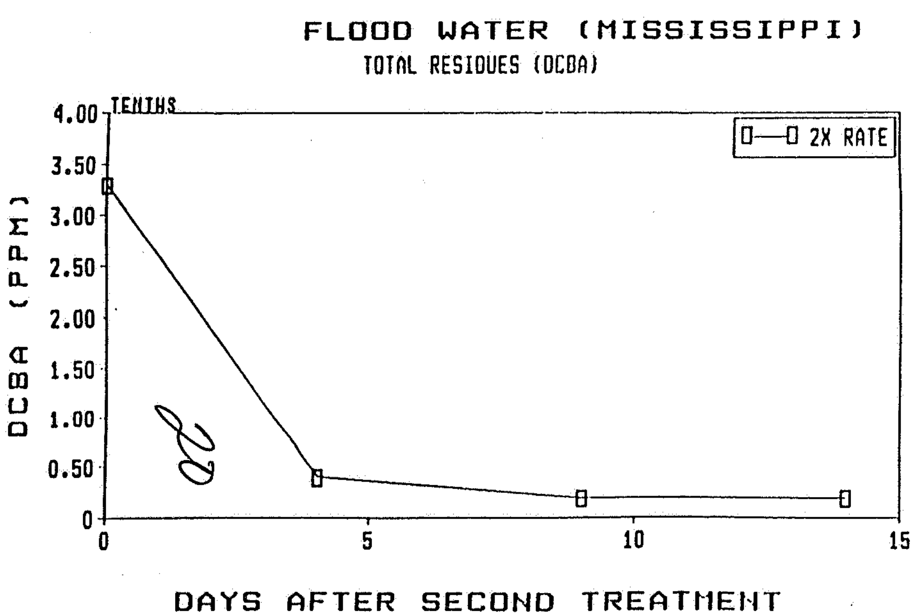
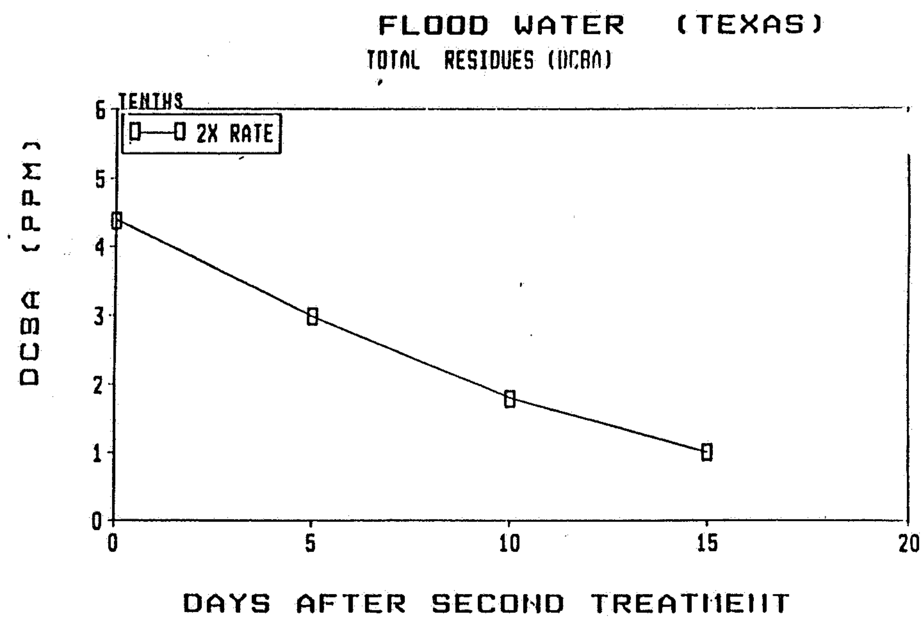


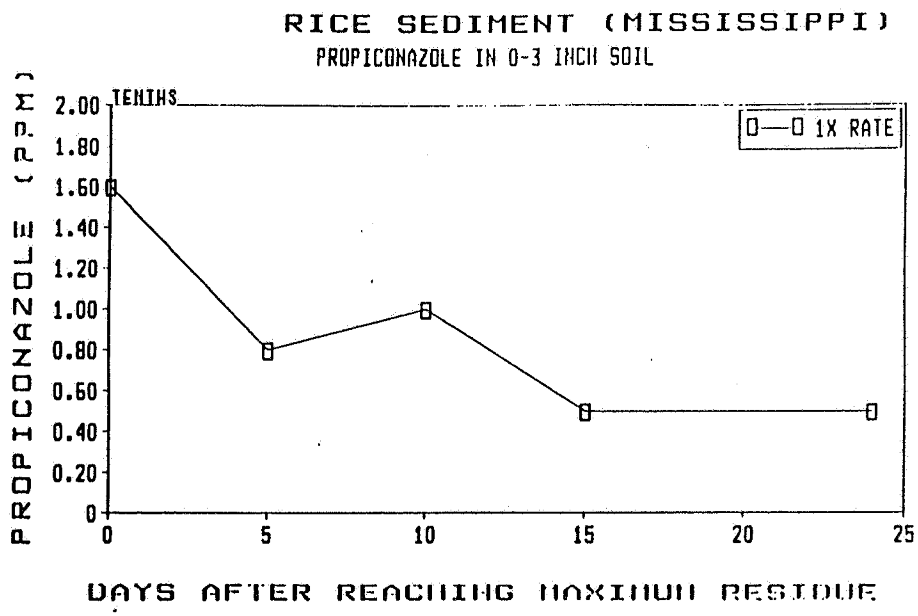
FIGURE 3: METABOLIC PATHWAY OF PROPICONAZOLE IN TARGET AND ROTATIONAL CROPS

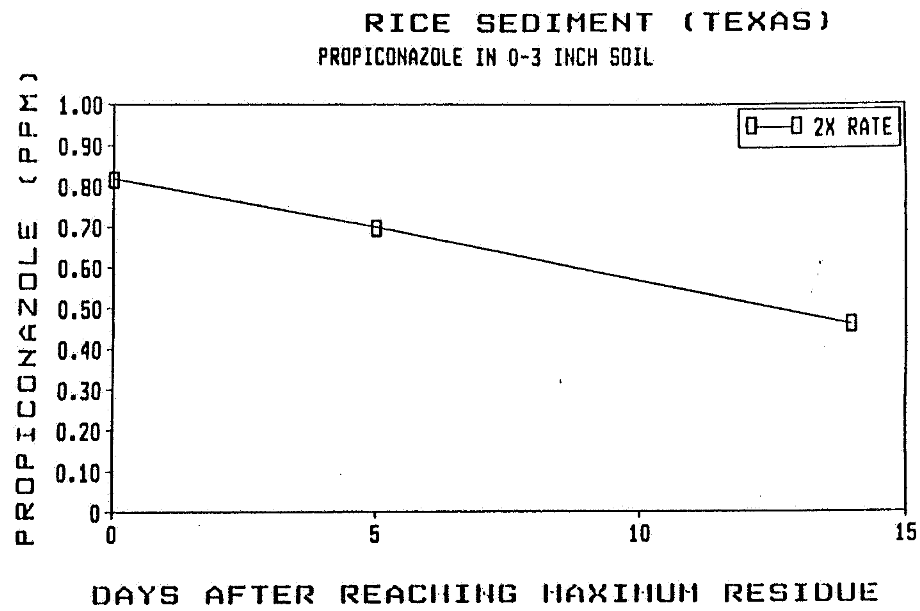

FLOOD WATER (MISSISSIPPI)
PROPICONAZOLE
PROPICONAZOLE (PPM)
TENTHS
2X RATE
1X RATE
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0
0
5
10
15
DAYS AFTER SECOND TREATMENT


TEXAS FLOOD WATER
PROPICONAZOLE
PROPICONAZOLE (PPM)
TENTHS
2X RATE
1X RATE
6
5
4
3
2
1
0
0
5
10
15
20
DAYS AFTER SECOND TREATMENT

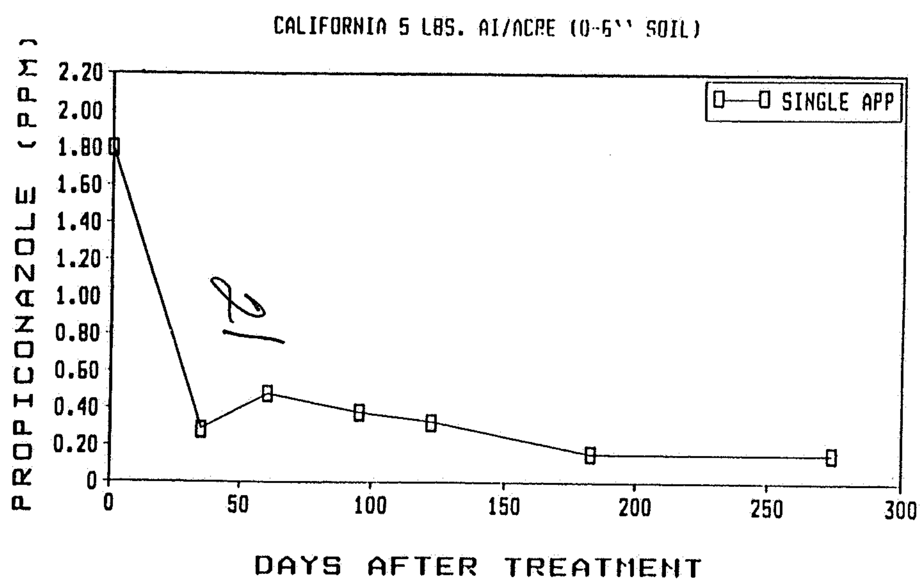

FLOOD WATER (MISSISSIPPI)
TOTAL RESIDUES (DCBA)
DCBA (PPM)
TENTHS
2X RATE
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0
0
5
10
15
DAYS AFTER SECOND TREATMENT

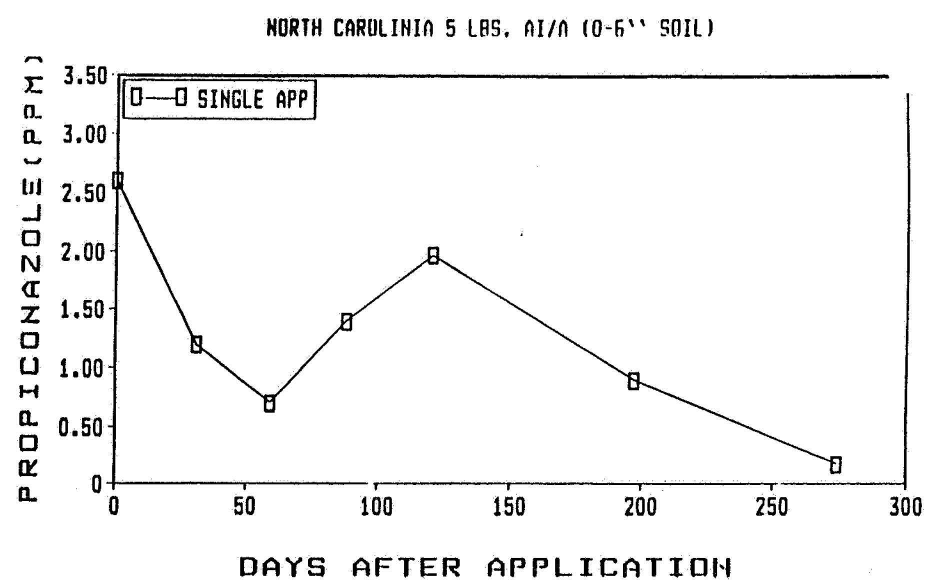

FLOOD WATER (TEXAS)
TOTAL RESIDUES (DCBA)
DCBA (PPM)
TENTHS
2X RATE
6
5
4
3
2
1
0
0
5
10
15
20
DAYS AFTER SECOND TREATMENT





PROPICONAZOLE FIELD DISSIPATION





Summary of Observed CGA-64250 Dose in Texas Anaerobic Metabolism Study[1]

Sampling Days	Levels of ^{14}C-Propiconazole (PPM) Centrifuged Water Original	Centrifuged Water Split[3]	Soil/Sediment[2] Original	Soil/Sediment[2] Split[3]
0 day	2.3	--	[4]	--
1	2.9	--	9.0	--
3	1.9	--	21.1	--
7	1.4	--	20.0	--
14	1.1	--	33.0	--
1 month	1.0	--	31.6	--
3	1.0	--	34.7	--
6	1.0	--	42.4	--
9	1.1	--	36.9	--
9 + 7 days	--	0.6	--	40.0
9 + 14 days	--	0.8	--	40.0
10	0.8	0.7	38.7	36.1
12	0.6	--	38.2	--

[1] ppm based on a CGA-64250 specific activity of 18.8 uCi/mg and a theoretical dose of 8.8 ppm based on the water.

[2] ppm based on grams of soil/sediment.

[3] Original incubation split and fortified with 1% glucose after 9 months of anaerobic incubation.

[4] Not assayed.

RATES OF APPLICATION OF TILT VS. AMOUNTS OF DCBA AND TOTAL TRIAZOLE IN ROTATION CROPS

Location	Crop	Plant Part	DCBA (PPM) 1x	DCBA (PPM) 2x	DCBA Ratio (2x/1x)	Total Triazole (ppm) 1x	Total Triazole 2x	Total Triazole Ratio (2x/1x)
GA	Cabbage	Forage	0.38	--	--	0.82	2.3	2.8
		Head	0.09	--	--	1.2	5.7	4.8
MS	Cabbage	Head	<0.05	<0.05	--	2.2	6.3	2.9
NC	Cabbage	Forage	0.14	--	--	0.85	--	--
		Head	<0.05	0.08	--	0.73	3.1	4.2
TX	Cabbage	Forage	0.76	--	--	7.0	7.5	1.1
		Head	0.15	--	--	8.0	17.0	2.1
MS	Corn	Forage	<0.05	<0.05	--	3.9	6.4	1.6
		Fodder	0.11	0.28	2.5	6.8	18.0	2.6
		Kernel	<0.05	<0.05	--	15.0	26.0	1.7
NC	Corn	Forage	0.6	0.15	0.25	0.75	2.1	2.8
		Fodder	0.09	0.15	2.1	1.7	2.1	1.8
		Kernel	<0.05	<0.05	--	2.1	14	6.6
TX	Corn	Forage	0.26	--	--	2.7	5.4	2.0
		Fodder	0.19	--	--	12	23.0	1.9
		Kernel	0.06	--	--	39	94	2.4
MS	Winter Wheat	Forage	1.2	1.5	1.3	4.8	8.0	1.7
		Straw	0.9	2.3	2.6	4.3	8.2	1.9
		Grain	0.14	0.42	3.0	10	28	2.8
NC	Winter Wheat	Forage	0.36	0.66	1.8	2.1	4.0	1.9
		Straw	<0.05	0.07	--	1.2	2.5	2.1
		Grain	0.13	0.24	1.8	4.9	8.8	1.8
GA	Sweet Potato	Forage	0.31	--	--	17	21	1.2
		Tops	0.12	--	--	3.1	14	4.5
		Roots	<0.05	--	--	2.4	17	7.1
MS	Sweet Potato	Forage	0.32	0.11	0.34	6.3	4.0	0.63
		Tops	1.2	0.2	--	2.0	2.2	1.1
		Roots	<0.05	<0.05	--	2.3	7.3	3.1
NC	Sweet Potato	Forage	0.18	0.09	0.5	1.0	2.1	2.1
		Tops	0.10	0.12	1.2	0.7	1.6	2.3
		Roots	<0.05	<0.05	--	0.4	0.31	0.8
TX	Sweet Potato	Forage	0.11	--	--	3.9	6.6	1.7
		Tops	0.16	--	--	10.3	6.1	0.6
		Roots	<0.05	--	--	2.1	4.9	2.3

Residues of CGA-64250 and Total DCBA in Flood Water - Mississippi - Rice Target Crop - AG-A 6143

Interval (Days)	CGA-64250 (PPM) 1x Rate[2]	CGA-64250 (PPM) 2x Rate	Total DCBA (PPM) 1x Rate	Total DCBA (PPM) 2x Rate
Before 1st applic.	<0.01	<0.01[1]	-	<0.01
0 1st applic.	0.04	0.34	-	
14	<0.01	<0.01	-	-
0 2nd applic.	0.09[3]	0.37[1]	-	0.33
4	0.03	0.05[1]	-	0.04
9	0.01	0.02	-	0.02
14	<0.01	0.01[1]	-	0.02
$t_{1/2}$ (days)	4.3	2.8	-	3.7
r	0.93	0.95	-	0.86

[1] Average values from AG-A 6143 and AG-A 6143 second report.
[2] 1x Rate = 0.28 lb. ai/acre; total 1x rate = 0.56 lb. ai/acre.
[3] Linear regression analysis was performed using the 0.09 ppm at the second application as the initial concentration (t=0).

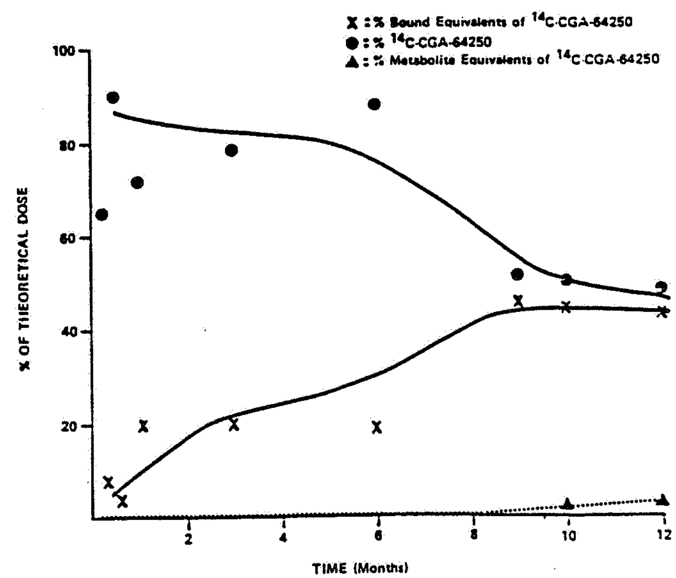


Figure 2. GRAPH OF RADIOACTIVE EQUIVALENTS OF ^{14}C-CGA-64250 FROM TEXAS ANAEROBIC METABOLISM OF CGA-64250

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Residues of Parent CGA-64250 and Total Residues in Mississippi Clay-Soil - AG-A 6145, Rice Target Crop

Interval Days	PPM CGA-64250 1x Rate[5] 0-3"	PPM CGA-64250 1x Rate 3-6"	PPM CGA-64250 2x Rate 0-3"	PPM CGA-64250 2x Rate 3-6"	PPM DCBA 1x Rate 0-3"	PPM DCBA 1x Rate 3-6"	PPM DCBA 2x Rate 0-3"	PPM DCBA 2x Rate 3-6"
Before first application	<0.05	-	<0.05	-	0.25	-	-	-
0	<0.05[4]	-	0.06	-	0.16	-	0.16	-
4	0.16		0.17		0.10		0.15	
9	0.08	-	0.77	-	0.21	-	0.46	-
14	0.10	-	0.15	-	0.22	-	0.40	-
19	<0.05	<0.05	<0.05	<0.05	0.17	<0.05	0.13	<0.05
28	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	0.16	<0.05
75	-	-	-	-	0.09[1]	0.14[1]	0.13[1]	0.19
222	-	-	-	-	0.12	<0.05	0.15	<0.05
257	-	-	-	-	0.07	0.08	0.07	<0.05
r	0.86	-	0.99	-	-	-	-	-
$t_{1/2}$ (days)	10.1	-	2.5	-	-	-	-	-

[1]Average values from AG-A 6145 Second Report and AG-A 6145 Third Report.

[2]Check 0-3" 0.18 ppm, 3-6" 0.14 ppm.

[3]DCBA check samples ranged from <0.05 to 0.25 ppm.

[4]Flood water 0.09 ppm CGA-64250.

[5]1x Rate = 0.28 lb. ai/acre; total 1x Rate = 0.56 lb. ai/acre (256 g ai/acre).

Residues of Parent CGA-64250 and Total Residues in Texas Clay Soil - AG-A 6250, Rice Target Crop

Interval Days	PPM CGA-64250 1X Rate[5] 0-3"	PPM CGA-64250 1X Rate 3-6"	PPM CGA-64250 2X Rate 0-3"	PPM CGA-64250 2X Rate 3-6"	PPM DCBA[1] 1X Rate 0-3"	PPM DCBA 1X Rate 3-6"	PPM DCBA 2X Rate 0-3"	PPM DCBA 2X Rate 3-6"
0 (first application)	-	-	-	-	-	-	-	-
14	<0.05	-	<0.05	-	<0.05	-	0.24	-
0 (second application)	-[4]	-	-	-	-	-	-	-
5	<0.05	-	<0.05	-	0.08	-	0.29	-
10	<0.05	-	<0.05	-	<0.05	-	<0.05	-
16	0.07	-	-	-	0.19	-	-	-
17	-	-	0.82	-	-	-	1.2	-
21	<0.05	<0.05	-	-	<0.05	0.19	-	-
22	-	-	0.70	<0.05	-	-	0.68	0.14
28	0.19	<0.05	-	-	0.18 (0.16)[3]	0.09 (<0.05)[3]	-	-
31	-	-	0.46	0.21	-	-	1.2 (0.35)[3]	0.28 (0.36)[3]
104	-	-	-	-	<0.05	<0.05	0.19	<0.05
253	-	-	-	-	0.37	0.14	1.5	0.56
290	-	-	-	-	0.27	0.11	1.0*	0.23
351	-	-	-	-	<0.05	<0.05	0.08*	<0.05
398	-	-	-	-	0.09	<0.05	0.56*	<0.05
$t_{1/2}$ (days)	-	-	17 (r = 0.99)	-	-	-	-	-

*Average value.
[1]Control DCBA <0.05-0.13 ppm.
[2]Control total triazole 0.32-0.37 ppm.
[3]Second analysis.
[4]Flood water 0.43 ppm - CGA-64250.
[5]1X Rate = 0.28 lb. ai/acre; total 1X Rate = 0.56 lb. ai/acre.

ESTIMATION OF MAXIMUM CONTRIBUTED RESIDUES OF PROPICONAZOLE AND METABOLITES IN ROTATION CROPS FROM 75 + 75 G AI/ACRE TREATMENT OF RICE (MISSISSIPPI)

Rotation Crop	Plant Part	Treatment to Planting Interval	MCR[1] 1,2,4-triazole Moiety ppm	MCR[1] DCBA Moiety ppm
Cabbage	Head	221	<0.25	<0.05
Sorghum	Forage	256	0.16	<0.05
	Fodder	256	0.39	0.08
	Grain	256	0.50	<0.05
Sweet Potato	Immature	256	0.21	--
	Root	256	0.28	<0.05
	Top	256	0.19	<0.05

[1]These data are taken from Table 3, page 27 of the EPA 6/20/86 review. The numbers were multiplied by 150/256 because the current recommended rate of Tilt on rice is 75 + 75 g ai/acre.

ESTIMATION OF PROPICONAZOLE AND METABOLITES IN FIELD ROTATION SORGHUM (MISSISSIPPI)

Plant Part	Estimated Residues (ppm)[3] Forage[5]	Stalks[6] (fodder)	Grain
MCR[1],[2]-Propiconazole (ppm)	<0.05	0.08	<0.05
MCR[1]-DCBA (ppm)	<0.05	0.08	<0.05
MCR[1]-Total Triazole (ppm)	0.16	0.39	0.50
CGA-91305 + CGA-118244	--	--	--
Metabolite F (Conjugate of CGA-91305)	<0.05	<0.05	<0.05
Metabolite G (Conjugate of CGA-118244 isomer)	<0.05	<0.05	<0.05
Metabolite H (Conjugate of CGA-118244 isomer)	<0.05	<0.05	<0.05
Metabolite I Triazole acetic acid	0.07	0.14	0.14[4]
Metabolite I[1] Triazole lactic acid[7]	<0.05	0.14	--[4]
Metabolite J Triazole alanine	<0.05	<0.05	0.24
Nonextractables	<0.05	0.06	0.06

[1]MCR = Maximum contributed residue. These values were derived from EPA values on page 27 of the 6/20/86 EPA Review, (e.g., 0.28 x 150/256 = 0.16).
[2]Parent <0.05 since DCBA <0.05.
[3]Estimated residues (e.g., for metabolite J, 0.50 (Table 13) x 0.473 Table (2) = 0.24
[4]Includes Triazole lactic acid in TLC zone.
[5]Use 25-week winter wheat forage as surrogate crop (Table 2).
[6]Use 30-week winter wheat stalks as surrogate crop (Table 2).
[7]Identified as a triazole plant metabolite, but not confirmed as I[1].

ESTIMATION OF PROPICONAZOLE AND METABOLITES IN FIELD ROTATION SWEET POTATOES (MISSISSIPPI)

Plant Part	Estimated Residues (ppm) Forage[1]	Tops[3] (fodder)	Roots
MCR-Propiconazole (ppm)	--	--	<0.05
MCR-DCBA (ppm)	--	--	<0.05
MCR-Total Triazole (ppm)	0.21	0.19	0.28
CGA-91305 + CGA-118244	--	--	--
Metabolite F (Conjugate of CGA-91305)	<0.05	<0.05	--
Metabolite G (Conjugate of CGA-118244 isomer)	<0.05	<0.05	--
Metabolite H (Conjugate of CGA-118244 isomer)	<0.05	<0.05	--
Metabolite I Triazole acetic acid	0.13	0.13	--
Metabolite I[1] Triazole lactic acid[4]	<0.05[2]	0.05[2]	--
Metabolite J Triazole alanine	<0.05[2]	<0.05[2]	--
Nonextractables	<0.05	<0.05	<0.05

[1]Use 13-week carrot tops as indicator crop (Table 5).
[2]Metabolite I[1] and J in same TLC zone.
[3]Use 20-week mature tops as indicator crop (Table 5)
[4]Identified as a triazole plant metabolite, but not confirmed as I[1].

ESTIMATION OF PROPICONAZOLE AND METABOLITES IN FIELD ROTATION CABBAGE (MISSISSIPPI)

Plant Part	Heads (ppm)
MCR-Propiconazole (ppm)	<0.05
MCR-DCBA (ppm)	<0.05
MCR-Total Triazole (ppm)	<0.25
CGA-91305 + CGA-118244	<0.05
Metabolite F (Conjugate of CGA-91305)	<0.05
Metabolite G (Conjugate of CGA-118244 isomer)	<0.05
Metabolite H (Conjugate of CGA-118244 isomer)	<0.05
Metabolite I Triazole acetic acid	<0.05
Metabolite I[1] Triazole lactic acid[1]	<0.05
Metabolite J Triazole alanine	<0.05

[1]Identified as a triazole plant metabolite, but not confirmed as I[1].

ESTIMATION OF MAXIMUM CONTRIBUTED RESIDUES OF PROPICONAZOLE AND METABOLITES IN ROTATION CROPS FROM 75 + 75 G AI/ACRE TREATMENT OF RICE (TEXAS)

Rotation Crop	Plant Part	Treatment to Planting Interval (days)	MCR[1] 1,2,4-triazole Moiety (ppm)	MCR[1] DCBA Moiety (ppm)
Sorghum	Fodder	251	3.90	<0.05
	Grain	251	1.11	<0.05
Winter Wheat	Fall Forage	58	--	0.05
	Spring Forage	58	--	<0.05
	Straw	58	--	<0.05
	Grain	58	--	<0.05

[1]These data are taken from Table 3, page 33, of the EPA 6/20/86 review. The numbers were multiplied by 150/256 because the current recommended rate of Tilt on rice is 75 + 75 g ai/acre.

ESTIMATION OF PROPICONAZOLE AND METABOLITES IN FIELD ROTATION SORGHUM (TEXAS)

Plant Part	Estimated Residue (ppm) Forage[1]	Stalks[1] (fodder)	Grain
MCR-Propiconazole (ppm)		<0.05	<0.05
MCR-DCBA (ppm)		<0.05	<0.05
MCR-Total Triazole (ppm)		3.90	1.11
CGA-91305 + CGA-118244	--	--	--
Metabolite F (Conjugate of CGA-91305)		0.10	<0.05
Metabolite G (Conjugate of CGA-118244 isomer)		0.05	<0.05
Metabolite H (Conjugate of CGA-118244 isomer)		0.10	<0.05
Metabolite I Triazole acetic acid		1.4	0.32[2]
Metabolite I[1] Triazole lactic acid[3]		1.4	--[2]
Metabolite J Triazole alanine		0.31	0.52
Nonextractable Metabolites		0.46	

[1]Use 30-week winter wheat stalks as surrogate crop (Table 2)
[2]Metabolite I and I[1] in same TLC zone.
[3]Identified as a triazole plant metabolite, but not confirmed as I[1].

SUMMARY OF PROPICONAZOLE, TRIAZOLE ACETIC ACID AND TRIAZOLE ALANINE METABOLITES IN ROTATION CROPS FOLLOWING RICE TREATED WITH PROPICONAZOLE

Rotation Crop (Location)	Part	Treatment to Planting Interval (days)	Residues (ppm) Propiconazole	Triazole Acetic Acid	Triazole Alanine	Triazo. Lactic Acid
Cabbage (Mississippi)	Head	221	<0.05	<0.05	<0.05	<0.05
Sorghum (Mississippi)	Forage	256	<0.05	0.07	<0.05	<0.05
	Fodder	256	0.08	0.14	<0.05	0.14
	Grain	256	<0.05	0.14[1]	0.24	--[1]
Sorghum (Texas)	Fodder	251	<0.05	1.4	0.31	1.4
	Grain	251	<0.05	0.32[1]	0.52	--[1]
Sweet Potato (Mississippi)	Immature Forage	256	--	0.13	<0.05[2]	<0.05[2]
	Root	256	<0.05	--	--	
	Top	256	--	0.13	<0.05[2]	<0.05[2]
Winter Wheat (Texas)	Fall Forage	58	<0.05	--	--	
	Spring Forage	58	<0.05	--	--	
	Straw	58	<0.05	--	--	
	Grain	58	<0.05	--	--	

[1]Metabolite I (Triazole acetic acid) + Triazole lactic quantitated as one zone TLC.
[2]Metabolite I[1] and J (Triazole analanine) quantitated together as one zone by TLC.