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MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

PP# 3F2951: Metolachlor on sorghum forage and fodder. Evaluation of analytical methods and residue data.
Accession numbers 071904 and 071905

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Ciba-Geigy Corporation proposes tolerances for residues of the herbicide metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide] and its metabolites determined as 2-[(2-ethyl-6-methylphenyl)amino]-1-propanol (CGA-37931) and 4-(2-ethyl-6-methylphenyl)-2-hydroxy-5-methyl-3-morpholinone (CGA-49751), each compound expressed as parent, on sorghum forage and fodder at 10 ppm.

Tolerances for sorghum forage and fodder (2 ppm) and grain (0.3 ppm) were established with PP#0F2098. The tolerances now proposed are required by an amended registration that would allow postemergent application to sorghum.

Metolachlor tolerances are established for several RAC's (40 CFR 180.368) at levels ranging from 0.02 ppm for meat, milk, poultry, and eggs to 3.0 ppm for peanut forage and hay. Several tolerances are pending including those for the liver and kidneys of cattle, horses, goats, hogs, and sheep (PP#2F2720).

Conclusions

1. The nature of the residue in both plants and animals is adequately understood. The residue of concern consists of parent plus 2-[(2-ethyl-6-methylphenyl)amino]-1-propanol (CGA-37913) and 4-(2-ethyl-6-methylphenyl)-2-hydroxy-5-methyl-3-morpholinone (CGA-49751).

2. Adequate analytical methods are available for enforcement of the proposed tolerances.

3. The methods used to determine residues of atrazine resulting from metolachlor-atrazine tank-mix appications are adequate for collection of residue data.

4. Because available residue data are limited we can make no conclusion as to an appropriate tolerance. The petitioner should submit additional residue data representative of the maximum proposed use in which application is made to sorghum as late in the season as the proposed label would allow. We consider two of the submitted residue experiments to be marginally useful because application was made 7-10 days after planting and contact with the herbicide would have been minimal.

5. The proposed tank mix with atrazine or use of Bicep™, a combination herbicide containing both metolachlor and atrazine, will not cause the existing tolerances for atrazine to be exceeded. (Tolerances are estsblished for atrazine on sorghum grain (0.25 ppm) and sorghum forage and fodder (15 ppm).)

6. Sorghum grain, forage, and fodder can find significant use as livestock feed items. We will make no conclusion as to the potential for secondary residues in in meat, milk, poultry, and eggs until the additional residue data (see conclusion 4, above) are available. We do expect, however, that the pending tolerances for the liver (0.05 ppm) and kidney (0.2 ppm) will need to be established before the proposed use on sorghum is allowed.

7. There are no Codex, Mexican, or Canadian tolerances for metolachlor on sorghum. Thus the question of compatibility does not arise.

Recommendation

We recommend against the proposed tolerances. For further consideration we require additional residue representing experiments in which the maximum proposed rate is applied to sorghum as late in the season as is allowed by the proposed label.

Detailed Considerations

Manufacture and Formulation

The manufacturing process and the composition of the technical material are discussed in our review of PP#8F2081 (memo of 4/2/79, A. Smith). Technical metolachlor is about 95% pure. The impurities are not expected to present a residue problem.

The formulation of metolachlor proposed for use on sorghum is Dual 8E, an emulsifiable concentrate containing 8 lb a.i./gallon. The inert ingredients are cleared under

180.1001 (c) or (d).

Proposed Use

Preplant and preemergent uses of metolachlor on sorghum were established with PP#8F2098 and are detailed in our review of that petition (memo of 4/5/78, A. Smith). The use now proposed is a post-emergence application of metolachlor (up to 2.5 lb. a.i./A) plus atrazine (up to 2.0 lb. a.i./A), either as a tank mix or as the combination product Bicep™, to sorghum at the 3 leaf stage before the plant reaches 6 inches in height, the rate depending on the soil type. Atrazine is registered for use on sorghum as a postemergent spray up to three weeks after the crop emerges at rates of up to 4 lb. a.i./A. Atrazine tolerances are established at 0.25 ppm on sorghum grain and at 15 ppm for forage and fodder.

Nature of the Residue

Studies designed to determine the metabolism of metolachlor in corn and soybeans were submitted with PP#s 5G1553, 6F1606, and 6G1708 and were discussed in our reviews of those petitions. In both soybeans and corn the major metabolic pathway involves conjugation with glutathione, formation of the mercaptan, conjugation of the mercaptan with glucuronic acid, hydrolysis of the methyl ether and conjugation of the alcohol with a neutral sugar.

Animal metabolism studies have been carried out in rats and goats using ^{14}C labeled metolachlor and in goats only using ^{14}C biosynthesized metabolites. These studies were discussed in our review of PP#5G1553 (memo of 2/12/74, D. Reed). They show that metolachlor is rapidly eliminated with only trace residues remaining in tissues (liver). Comparison of the urine metabolites with those found in corn indicates that, although the conjugating natural compounds are different, the hydrolyzed pesticide moieties are similar in plants and animals. The significant components of the residue consist of the parent and two of its metabolites: 2-[(2-ethyl-6-methylphenyl)amino]-1-propanol (CGA-37931) and 4-(2-ethyl-6-methylphenyl)-2-hydroxy-5-methyl-3-morpholinone (CGA-49751). The analytical method determines these components and their conjugates.

We conclude that the metabolism of metolachlor in plants is adequately understood.

Analytical Methods

The method used to collect residue data (Ciba-Geigy method AG-338) is a variation of Analytical Method AG-286 which has undergone a successful method trial (PP#5F1506, memos of 7/28/76 and 7/29/76, R.R. Watts). The method involves the hydrolysis (boiling overnight with 6N hydrochloric acid) of

metolachlor, its conjugates, and metabolite residues to CGA-37931 and CGA-49751, which are then determined separately.

CGA-49751 is partitioned into dichloromethane from an aliquot of the acid extract. The dichloromethane phase is washed with 5% sodium carbonate then chromatographed on 16% moisture silica gel. The CGA-49751 is then converted to the chloroethanol derivative which is partitioned into hexane and then cleaned up on a 16% moisture silica gel column. Quantitation is by GC equipped with a Dohrmann microcoulometric detector in the nitrogen mode.

CGA-37913 is partitioned into hexane from a second aliquot of the hydrolysis mixture which had been made basic with 50% sodium hydroxide solution. The hexane portion (containing the CGA-37913) is chromatographed on an 18% moisture alumia column, then on a silica gel column. Quantitation is by GC equipped with a Hall electrolytic conductivity detector specific for nitrogen.

The following recovery values are submitted:

	CGA-37913			CGA-49751		
	fort.(ppm)	rec.(%)	avg.	fort.(ppm)	rec.(%)	avg.
forage	0.03-1.0	83-97	90	0.05-1.0	82-95	91
fodder	0.03-1.0	87-97	90	0.05-1.0	87-98	90
grain	0.03-0.5	87-90	89	0.05-1.0	72-96	87

No residues were detected (<0.03 ppm CGA-37913, <0.05 ppm CGA-49751) in control samples of grain and forage. For fodder one control sample carried residues of 0.04 ppm CGA-37913 and 0.05 ppm CGA-49751. We have earlier concluded that this method would be suitable for enforcenment of sorghum tolerances; we reiterate this conclusion here.

Residues of atrazine that resulted from tank mix applications or applications of Bicep™ to sorghum were determined by Ciba-Geigy methods AG-281 and AG-295. These methods have been successfully tried out, are discussed in our review of PP#8F2098, and are suitable for collection of residue data.

Residue Data

Residue experiments were carried out in California, Nebraska, North Carolina, Oklahoma, and Texas. Applications were made to sorghum through the six leaf stage at the proposed maximum rate. In one California study the 2x rate was used. The results of these experiments are summarized below:

Plant part	rate*(lb. a.i./A)	PAI** (days)	PHI (days)	Residue (ppm) CGA-37913	CGA-49751	Total(max.)
forage	4.5	29	66	0.18,0.20	0.14,0.12	0.32
forage	9.0	29	66	0.28	0.17	0.45
forage	4.5	7	80	<0.03	<0.05	<0.08
forage	4.5	10	58	0.08,0.11	0.19,0.22	0.33
forage	4.5	29	62	0.48,1.9	0.91,2.6	4.5
forage	4.5	22	46	0.18,0.14	0.08,0.08	0.26
forage	9.0	22	46	0.28	0.09	0.37
fodder	4.5	28	132	0.11,0.12	0.08,0.09	0.21
fodder	9.0	28	132	0.09	0.11	0.20
fodder	4.5	7	94	<0.03	<0.05	<0.08
fodder	4.5	10	87	0.32,0.27	0.18,0.23	0.50
fodder	4.5	29	99	0.45,1.1	0.71,0.96	2.06
fodder	4.5	22	128	0.56,0.73	0.22,0.31	1.04
fodder	9.0	22	128	1.2	0.29	1.49
grain	4.5	28	132	<0.03	<0.05	<0.08
grain	9.0	28	132	<0.03	<0.05	<0.08
grain	4.5	10	87	0.08,0.05	<0.05	0.13
grain	4.5	29	99	<0.03	<0.05	<0.08
grain	4.5	22	128	0.10,0.03	<0.05	0.15
grain	9.0	22	128	0.1	<0.05	0.15

*lb. a.i. Bicep®; i.e., 4.5 lb. a.i./A means 2.5 lb. metolachlor plus 2.0 lb. a.i./A atrazine.
**PAI = planting to application interval

These data show no residues greater than the proposed tolerances but are not compelling in their support of those tolerances. Only five experiments represent the proposed use. Additionally, the maximum potential for residues would result from applications as late in the season as allowed by the label, but in two experiments the period between planting and application was ten days or less. We therefore require additional residue data from experiments in which the maximum proposed rate is applied to sorghum at the latest point in the growing season allowed by the proposed label, that is, when the plant reaches 6 inches in height.

Meat, Milk, Poultry, and Eggs

Sorghum grain, forage, and fodder can find significant use as livestock feed items. However, we will may no conclusion as to the potential for secondary residues in in meat, milk, poultry, and eggs until the additional residue data, requested above, are submitted. It is likely tha the pending (PP#2F2720) tolerances for liver (0.05 ppm) and kidney (0.2 ppm) will need to be established before the use on sorghum is approved.

Other Considerations

There are no Codex, Mexican, or Canadian tolerances for metolachlor on sorghum. Thus the question of compatibility does not arise.

INTERNATIONAL RESIDUE LIMIT STATUS

CHEMICAL Metolachlor
2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-methylethyl) acetamide

PETITION NO. 3F2951

CCPR NO. None

Codex Status

/ X / No Codex Proposal Step 6 or above

Residue (if Step 9): _____

Crop(s)	Limit (mg/kg)

CANADIAN LIMIT

Residue: _____

Crop	Limit (ppm)
None	

Proposed U.S. Tolerances

Parent plus metabolites determined as 2-[(2-ethyl-6-methylphenyl)amino]-1-propanol and 4-(2-ethyl-6-methylphenyl)-2-hydroxy-5-methyl-3-morpholinone

Residue: _____

Crop(s)	Tol. (ppm)
sorghum forage	10
sorghum fodder	10

MEXICAN TOLERANCIA

Residue: _____

Crop	Tolerancia (ppm)
None	

NOTES: