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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

SEP 5 1990

OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: PP No. 8F3672/8H5562. Glyphosate on Grain Sorghum. Review of Amendment Dated April 2, 1990. DEB Nos. 6740, 6741, 6742. HED Project No. 0-1392A. MRID Nos. 414720-00, -01, -02.

FROM: Stephanie H. Willett, Chemist *SHW*  
Tolerance Petition Section 2  
Dietary Exposure Branch  
Health Effects Division (H7509C)

THRU: Richard D. Schmitt, Ph.D., Branch Chief  
Dietary Exposure Branch  
Health Effects Division (H7509C) *Richard D Schmitt*

TO: Robert Taylor/Vickie Walters, PM 25  
Registration Division (H7505C)  
and  
Toxicology Branch-HFM Support  
Health Effects Division (H7509C)

Monsanto proposed the establishment of tolerances of glyphosate and its metabolite AMPA in sorghum grain at 5 ppm, fodder and forage at 20 ppm, and sorghum milling fractions excluding grits at 25 ppm in the subject petition. Several deficiencies were cited in the initial review, thereby placing the petition in reject status (see review of S. Willett, dated 11/18/88).

Several glyphosate tolerances are established in 40 CFR 180.364, 185.3500, and 186.3500. A Registration Standard was issued in 1986 where several data gaps were cited. A recent update to the standard indicates that most of the residue chemistry data gaps have been adequately addressed (see cover memo of R. Schmitt dated April 26, 1990). DEB recently recommended for the establishment of tolerances with an expiration date for field corn and revised tolerances for animal commodities (see PP No. 8F3673, memo of F. Griffith, 7/13/90).

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## Conclusions

1. The nature of the residue in animals is now adequately understood. The residues to be regulated in animal commodities are glyphosate and AMPA.
2. The petitioner's explanation as to why no FDA multiresidue method validation data are needed is acceptable. This data requirement is waived for glyphosate and AMPA.
3. The proposed tolerance level of 30 ppm for sorghum forage and fodder is now appropriate.
4. The tolerances for animal commodities are adequate to cover probable residues in animal commodities resulting from the proposed use on sorghum grain.
5. Glyphosate and AMPA residues in sorghum starch do not concentrate as a result of processing, and are in fact much lower than levels found in grain (<1%). Residues concentrated in bran, germ, and flour (up to 5X). Residues in grits were slightly lower than in grain. A food additive tolerance for sorghum milling fractions, excluding grits, at 25 ppm has been proposed. A food additive tolerance excluding grits and starch would be more appropriate. No feed additive tolerance was proposed. A revised Section F is needed.
6. Additional residue data for sorghum grain dust are now required for pesticides when the use involves a late season foliar application with measurable residues detected. Since this is a new data requirement, DEB will not withhold its recommendation for tolerances on sorghum and related commodities. As was the case in the DEB recommendation for establishment of tolerances for corn, DEB will recommend for the establishment of the proposed glyphosate tolerances with a 3 year expiration from the date of issuance on sorghum and related commodities (see PP No. 8F3673 memo of F. Griffith dated 7/13/90).

Additional residue data on sorghum grain dust are needed. Protocols should be submitted for review prior to the initiation of any studies.

## Deficiencies Remaining to be Resolved

A revised Section F is needed. Additional data will be needed for grain dust.

## Recommendations

If TOX considerations permit, DEB could recommend for the establishment of tolerances with a 3 year expiration date for glyphosate and AMPA in grain sorghum at 5 ppm, fodder and forage at 20 ppm, and food and feed additive tolerances for sorghum milling fractions, excluding grits and starch, at 25 ppm. A revised Section F is needed. Data on sorghum grain dust should be generated prior to the tolerance expiration date.

## Present Considerations

In response to the deficiencies outlined in the DEB memo of November 11, 1988, Monsanto has submitted additional processing and storage stability data, a revised Section F, and information pertaining to animal metabolism and enforcement methodology. The deficiencies will be summarized below, followed by the petitioner's response.

### Deficiency: Animal Metabolism

(see comment 24, memo of 11/18/88)

The nature of the residue in animals is not adequately understood. The petitioner should respond to the request for additional data as requested in the Registration Standard issued in 1986.

### Petitioner's Response

In a Monsanto letter from Elaine Dorward-King dated April 2, 1990, the petitioner responds that additional information has been submitted as requested in the Registration Standard. The information has been reviewed by the agency and was found adequate.

### DEB's Comments/Conclusions, re: Animal Metabolism

As the petitioner indicated, additional animal metabolism study data have been reviewed recently. As was concluded in the Registration Standard update (4/26/90 cover memo) and reviews of petitions for tolerances on soybeans (6F3380, W.T. Chin memo of 1/30/89) and corn (8F3673, memo of M. Flood dated 11/15/89), the nature of the residue in animals is now adequately understood. The residues to be regulated in animal commodities are glyphosate and AMPA.

This deficiency is resolved.

Deficiency: FDA Multiresidue Test Data  
(see comments 32 and 33, memo of 11/18/88)

Glyphosate and its metabolite AMPA have not been tested under PAM I Multiresidue Method Protocols.

Petitioner's Response

Monsanto has not conducted MRM testing on either parent glyphosate or AMPA because none of the methods are applicable. The compounds are too polar and too water soluble (see 4/2/90 letter of E. Dorward-King).

DEB's Comments/Conclusions, re: Multiresidue Test Data

As was also concluded in the July 13, 1990 memo of Francis Griffith concerning tolerances for corn, the petitioner's explanation as to why no FDA multiresidue method validation data are needed is acceptable. This data requirement may be waived for glyphosate and AMPA.

This deficiency is resolved.

Deficiency: Revised Section F  
(see comments 34 and 38, memo of 11/18/88)

Residues are not expected to exceed the proposed tolerances on sorghum grain and sorghum milling fractions (except grits), but may exceed the proposed tolerances on sorghum forage and fodder. A Section F revised to include the AMPA metabolite in the tolerance expression and increase the tolerance level to 30 ppm is needed.

Petitioner's Response

The revised Section F has been submitted as requested (RD 977, MRID 414720-00). The petitioner now proposes that 40 CFR 180.364 be revised to include tolerances for glyphosate and its metabolite AMPA for sorghum forage and fodder at 30 ppm.

DEB's Comments/Conclusions, re: Revised Section F

The Section F is now appropriate for the raw agricultural commodities of sorghum, and this deficiency is resolved. However, see our comments below concerning the sorghum processing study.

Deficiency: Adequacy of Animal Commodity Tolerances  
(see comment 42, DEB memo of 11/18/88)

The animal metabolism data and animal feeding study requested in the Registration Standard must be submitted prior to determining

the adequacy of the present animal commodity tolerances.

Petitioner's Response

None

DEB's Comments/Conclusions, re: Adequacy of Animal Commodity Tolerances

Additional ruminant and poultry metabolism and feeding studies were conducted as requested in the Registration Standard. Review of the data indicate that the residues to be regulated are glyphosate and AMPA (see previous discussion on animal metabolism).

DEB recently recommended for the establishment of revised tolerances for animal and poultry liver and kidney at 1.0 ppm in connection with the petition on corn, since some of the data indicated that the present 0.5 ppm tolerances may be exceeded as a result of the higher animal dietary burden resulting from use on corn (see memo F. Griffith dated 7/13/90). The tolerances are based on the results of studies conducted at feeding levels of 20 to 40 ppm (see memo of M. Flood dated 11/15/89).

The maximum dietary burden resulting from the proposed use on sorghum is 15 ppm for dairy cattle. Therefore, the tolerances are adequate to cover probable residues in animal commodities resulting from this use on sorghum grain.

This deficiency is resolved.

Deficiency: Sorghum Processing Study

(see comment 44, DEB review of 11/18/88)

No data were submitted on probable residue levels in sorghum starch. Additional processing study data are needed on sorghum starch from wet milling.

Petitioner's Response

Samples of sorghum grain treated at 0.75 lb/A (1X) from two field trials conducted in 1985 were processed into starch by the wet milling process, along with one untreated sample. Whole grain samples were steeped in an aqueous solution of 0.25% sulfur dioxide. The grain was steeped for 48 hours, and shaken frequently. The grain was drained and the steep water was collected for analysis. The grain was ground, screened and washed with water to completely separate the starch. After settling, the top water was decanted, the starch slurry centrifuged, the supernatant water removed, and the starch cake was dried. All the fractions were frozen after processing and kept in that state until analyzed (0°F for 4 to 5 years).

The starch samples and steep water were analyzed for glyphosate and AMPA by HPLC. The components are isolated from starch extracts by elution through Chelex<sup>®</sup> 100 resin in the Fe(III) form. The glyphosate and AMPA are eluted from the resin with hydrochloric acid and the iron is removed using an anion exchange resin. After concentration to dryness to remove the hydrochloric acid, samples are analyzed using a high pressure liquid chromatograph equipped with a o-phthalaldehyde post-column reactor and a fluorescence detector. When twelve samples of starch were fortified at levels ranging from 0.05 to 5 ppm of glyphosate and AMPA, recoveries ranged from 75 to 115% (average 92%) and 71 to 121% (average 92%), respectively. When two samples of steepwater were fortified at 1 ppm of glyphosate and AMPA, recoveries ranged from 103 to 104% (average 104%) and 78 to 88% (average 83%), respectively. The limit of quantitation was 0.05 ppm. A summary of the residue data follows.

Table 1. GLYPHOSATE RESIDUES IN MILO

Sample	Corrected ppm Glyphosate	Corrected ppm AMPA	Total Corrected ppm
control grain	NQ <sup>1</sup>	NQ	NQ
1 treated grain <sup>2</sup>	3.21	NQ	3.21
2 treated grain	1.26	NQ	1.26
control starch	NQ	NQ	NQ
1 treated starch	0.09	NQ	0.09
2 treated starch	NQ	NQ	NQ
control steepwater	NQ	NQ	NQ
1 steepwater	0.56	NQ	2.8 <sup>3</sup>
2 steepwater	0.18	NQ	0.90

1 - NQ = not quantifiable, <0.05 ppm

2 - The values for grain were taken from a previous submission. Samples were apparently not reanalyzed prior to processing.

3 - Steep water ppm have been corrected for dilution as follows:  
 wt milo grain: ml of SO<sub>2</sub> solution added (500 ml)  
 of  
 ppm found x 5 = actual ppm in steepwater

An interim storage stability report was also submitted (MRID No. 414720-02). Endogenous residues of glyphosate and AMPA were shown to be stable in a variety of matrices (corn grain, soybean forage, sorghum stover, clover, tomatoes, alfalfa seed, and potatoes) for up to 5 years. The stability of exogenous residues has been determined for up to 18 months. Glyphosate residues were found to be stable for that period, while AMPA residues declined by 35 to 40% after 18 months. The exogenous residue samples will be analyzed at 24 and 30 months to complete the study. The methodology used was the same as that which was previously described.

#### DEB's Comments/Conclusions, re: Sorghum Processing Study

The processing study data and supporting storage stability data are acceptable. Although the grain samples were stored for an extended period of time (4 to 5 years) and were not analyzed prior to processing, it was concluded in the recent registration standard update (4/26/90) that weathered residues of glyphosate and AMPA are stable for up to 44 months. Additionally, the mass balance for glyphosate as indicated by the levels present in starch and steepwater indicate that residues remained reasonably stable during storage.

The data indicate that residues of glyphosate and AMPA do not concentrate in sorghum starch, and are much lower than levels found in grain (<1%). Residues concentrated in bran, germ, and flour (up to 5X). Residues in grits were slightly lower than in grain. A food additive tolerance for sorghum milling fractions, excluding grits, at 25 ppm has been proposed. A food additive tolerance excluding grits and starch, would be more appropriate. No feed additive tolerance has been proposed.

The processing study deficiency is resolved. The petitioner should propose food and feed additive tolerances for sorghum milling fractions, excluding grits and starch, at 25 ppm in a revised Section F.

#### Other Considerations

##### Magnitude of the Residue in Sorghum Grain Dust

Additional residue data for milo grain dust are now required for pesticides when the use involves a late season foliar application with measurable residues detected. Since this is a new data requirement, DEB will not withhold its recommendation for tolerances on sorghum and related commodities. As was the case in the DEB recommendation for establishment of tolerances for corn, DEB will recommend for the establishment of the proposed glyphosate tolerances with a 3 year expiration from the date of issuance on sorghum and related commodities (see memo of F. Griffith dated



7/13/90).

Additional residue data on sorghum grain dust are needed. Protocols should be submitted for review prior to the initiation of any studies.

Compatibility With International MRL's

An updated International Residue Limit Status sheet is attached to this review. The Codex MRL for sorghum is 0.1 ppm, and the Canadian MRL is 0.1 for all food crops. Codex and Canadian MRL expressions are in terms of glyphosate only. No Mexican limits are established. Establishment of the proposed tolerances would produce incompatibility with Codex and Mexican MRL's.

Attachment: International Residue Limit Status Sheet

CM2:H7509C:X1439:SHWillett:shw-8/23/90  
cc: PP No. 8F3672, Circ., Willett, RF, C. Furlow (PIB/FOD)  
RDI: E. Haeberer, 8/30/90; R. Loranger, 9/4/90

INTERNATIONAL RESIDUE LIMIT STATUS

CHEMICAL Glyphosate

CODEX NO. 158

CODEX STATUS:

No Codex Proposal  
Step 6 or Above

PROPOSED U.S. TOLERANCES:

Petition No. 8F3672  
DEB Reviewer S. H. Willett 8/24/90

Residue (if Step 8): \_\_\_\_\_  
Glyphosate per se

Residue: glyphosate and  
its aminomethylphosphonic  
acid metabolite (AMPA)

<u>Crop(s)</u>	<u>Limit (mg/kg)</u>
<u>sorghum</u>	<u>0.1 *</u>

<u>Crop(s)</u>	<u>Limit (mg/kg)</u>
<u>sorghum grain</u>	<u>5</u>
<u>sorghum forage</u>	<u>30</u>
<u>sorghum fodder</u>	<u>30</u>
<u>sorghum milled fractions (except grits)</u>	<u>25</u>

CANADIAN LIMITS:

No Canadian Limit

Residue: \_\_\_\_\_  
glyphosate

MEXICAN LIMITS:

No Mexican Limit

Residue: \_\_\_\_\_

<u>Crop(s)</u>	<u>Limit (mg/kg)</u>
<u>all food crops **</u>	<u>0.1</u>

<u>Crop(s)</u>	<u>Limit (mg/kg)</u>
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NOTES

- \* At or about limit of determination
- \*\* At or about limit of determination.