



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

DATE: March 4, 2004

SUBJECT: **Trifluralin:** Residue Chemistry Chapter for the Tolerance
Reassessment Evaluation Decision (TRED) Document

DP Barcode: D296627
Case No.: 0179
PC Code: 036101
40 CFR: §180.207

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Summary

Trifluralin (α,α,α -trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) is a dinitroaniline herbicide registered for weed control on a wide variety of field, orchard, and vegetable crops, although it is used primarily on soybeans and cotton. Reregistration data for trifluralin are supported by the Trifluralin Data Development Consortium (TDDC). Trifluralin end-use products for food and feed crops include emulsifiable concentrates (EC, 36.4, 50.8% ai) and a granular formulation (G, 10% ai). These formulations may be applied using ground or aerial equipment, with the EC formulations being typically applied as aqueous dilutions. The time of application of trifluralin may be dormant, preplant, or pre-emergence; and application is typically followed by incorporation into the soil by mechanical means or with water.

Trifluralin was the subject of a Reregistration Standard Science Chapter dated 7/12/85 and a 10/29/91 Reregistration Standard Update. The Residue Chemistry Chapter for the trifluralin Reregistration Eligibility Decision (RED) was issued 10/20/94 and the complete RED was completed in April, 1996.

Current tolerances (ranging from 0.05 ppm to 2.0 ppm) are established for residues of trifluralin in/on numerous raw agricultural plant commodities [40 CFR §180.207]. Adequate GC/ECD methods are available for enforcing tolerances and collecting data on trifluralin residues in/on plant commodities. Tolerances for residues of trifluralin in livestock commodities have not been established.

The qualitative nature of the residue in plants is adequately understood based on field corn and mustard green metabolism studies, with supplemental metabolism data from carrot, cotton, peanut, soybean, and sweet potato studies. The residue of concern in plants is trifluralin *per se*.

The Agency previously determined that, based on estimates of very low dietary exposure to livestock, there was no expectation of finite residues occurring in livestock commodities (meats, eggs, and milk) and tolerances for livestock commodities were not required. However, based on the reassessed tolerances for alfalfa forage (3 ppm) and hay (2 ppm), the estimate of *possible* dietary exposure of trifluralin to ruminants has increased significantly. Therefore, in order to assess residue levels for tolerances, new metabolism and feeding studies in ruminants are now being required. The Agency continues to expect that finite residues of trifluralin will not occur in hog and poultry commodities since alfalfa is not a feed item for these non-ruminants.

With a few exceptions, adequate residue data are available from crop field trials and processing studies to support the registered food/feed uses of trifluralin. Although a substantial portion of the database for the magnitude, or level, of trifluralin residues in crops is considered questionable due to storage stability concerns, the Agency has determined that sufficient residue data are available for the reassessment of trifluralin tolerances for most crops based on one (or more) of the following reasons: (1) the early-season use pattern of trifluralin in most crops results in residues below the

enforcement method quantitation level (0.05 ppm); (2) bridging studies from more recent (adequate) field trials have residue levels that are similar to residue levels in the earlier field trials; (3) adequate residue data for some crops can be translated to a similar use on related crops; and (4) numerous processing studies, conducted at exaggerated rates, indicate that trifluralin residues in raw agricultural commodities (RACs) are likely to be nondetectable (<0.01 ppm) following treatment at 1x the maximum labeled rate.

Currently, rotational crop tolerances and plant-back intervals are not required for trifluralin. However, the HED Metabolism Assessment Review Committee concluded (meeting date 2/4/04) that, based on a reassessment of the trifluralin confined rotational study, a plant-back interval of 100 days will now be required unless a new confined rotational study is conducted at a 1x rate with a more comprehensive characterization/identification of metabolites.

Residue Chemistry Deficiencies

- A ruminant metabolism study and a ruminant feeding study are required to determine the appropriate tolerance expression and tolerance levels for ruminant commodities. An analytical method for determining trifluralin residues in ruminant fat, meat, meat byproducts, and milk is also required in conjunction with the required cattle feeding study.
- Due to concerns pertaining to storage stability of residues, new field trial data are required depicting trifluralin residues in/on wheat forage, hay, and straw following an application of the EC and G formulations at the maximum labeled rate.
- New grape, mint, and plum processing studies are required due to concerns pertaining to storage stability of residues.
- Residue data on rapeseed forage are required.

Regulatory Background

Trifluralin [2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine] is a selective, preemergence, dinitroaniline herbicide registered for the control of annual grasses and certain broadleaf weeds. The chemical nomenclature and properties of trifluralin are presented in Tables 1 and 2. Trifluralin is primarily used in soybeans and cotton, but is also registered for use on a variety of food and feed crops including: alfalfa, asparagus, barley, Brassica vegetables, bulb vegetables, celery, citrus fruits, corn (field), cotton, cucurbit vegetables, endive, flax, fruiting vegetables, grapes, hops, legume vegetables, peanuts, peppermint, root and tuber vegetables, rapeseed (canola), safflower, sorghum, spearmint, stone fruits, sugarcane, sunflower, tree nuts, and wheat.

The data provider for reregistration is the Trifluralin Data Development Consortium (TDDC), which consists of Dow AgroSciences LLC, Agan Chemical Manufacturers Ltd. (Israel), and Industria Prodotti Chimici S.P.A. (I.Pi.Ci., Italy). Trifluralin formulations registered to the members of the TDDC for use on food/feed crops include emulsifiable concentrate (EC) and granular (G) formulations, which are marketed under the trade names *Treflan*, *Flutrix*, and *Triflurex*.

Trifluralin is a FIFRA List A chemical and was the subject of an Agency "Special Review" based on risk criteria (carcinogenicity and mutagenicity). An Agency "Position Document" (PD 2/3) was published in 44 FR 50911 on 8/30/79 and a PD 4 was published in 47 FR 33777 on 8/4/82. The Special Review concluded that continued trifluralin registration will be allowed, if among other requirements, the total N-nitrosamine contamination is kept below 0.5 ppm for technical products. The Trifluralin Reregistration Standard Guidance Document was issued 4/87 based on the Trifluralin Reregistration Standard Science Chapter dated 7/12/85. A Trifluralin Product and Residue Reregistration Update was completed 10/29/91. The Product and Residue Chemistry Chapters for the Trifluralin Reregistration Eligibility Decision (RED) were issued 10/20/94 and the complete RED was issued 4/96.

Tolerances are established for residues of trifluralin [2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine] in/on numerous raw agricultural commodities [40 CFR §180.207]. These tolerances range from 0.05 ppm to 2.0 ppm. Adequate enforcement methods are available for the determination of trifluralin residues in/on plant commodities. Tolerances for residues of trifluralin in livestock commodities have not been established.

Table 1. Trifluralin Nomenclature	
Chemical structure	
Common name	Trifluralin
Molecular Formula	$C_{13}H_{16}F_3N_3O_4$
Molecular Weight	335.3
IUPAC name	α,α,α -trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine
CAS name	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine
CAS #	1582-09-8
PC Code	036101

Table 2. Physicochemical Properties of Trifluralin		
Parameter	Value	Reference
Melting point/range	42-49°C	Trifluralin Update dated 10/29/91
pH	5.9 ± 0.1 saturated aqueous solution	
Density or specific gravity (22 °C)	1.36 g/mL	D207577, 4/9/97, K. Dockter
Water solubility (25°C)	<1 ppm	D207577, 4/9/97, K. Dockter
Solvent solubility (25°C)	readily soluble in organic solvents such as acetone, acetonitrile, chloroform, dichloromethane, ethyl acetate, and toluene at >100 g/100 mL, and in hexane at 5-6.7 g/100 mL or methanol at 3.3-4 g/100 mL	D207577, 4/9/97, K. Dockter
Vapor pressure (25°C)	6.1×10^{-3} Pa	D207577, 4/9/97, K. Dockter
Dissociation constant (pK_a)	not required; does not dissociate	D207577, 4/9/97, K. Dockter
Octanol/water partition coefficient ($\log K_{ow}$; 20°C)	4.83	D207577, 4/9/97, K. Dockter
UV/vis absorption spectrum	not available	

860.1200 Directions for Use

Product List

Currently, there are 8 trifluralin end-use products (EPs) with food/feed uses registered to the members of the TDDC (Table 3). Seven of the trifluralin EPs are EC formulations, and one is a G formulation.

There is also a SLN Label with food/feed uses that is associated with the 4 lb/gal EC formulation [EPA Reg. No. 62719-250] for use on peppers.

Table 3. Trifluralin Feed / Food Registrations.¹			
Registrant EPA Reg. No.	Label Acceptance Date	Formulation Class	Product Name
Dow AgroSciences LLC²			
62719-97	11/20/01	4 lb/gal EC	Treflan E.C. Weed and Grass Preventer
62719-131	12/4/01	10% G	Treflan TR-10
62719-222 ³	2/16/99	3.4 lb/gal EC	Broadstrike + Treflan
62719-250 ⁴	11/30/01	4 lb/gal EC	Treflan HFP
Industria Prodotti Chimici S.P.A.			
33660-31	1/15/99	5 lb/gal EC	Flutrix Five EC
33660-32	1/15/99	4 lb/gal EC	Flutrix 4 EC ATT
33660-33	1/25/99	4 lb/gal EC	Flutrix 4 EC
Agan Chemical Manufacturers Ltd.			
66222-46	10/24/02	4 lb/gal EC	Triflurex HFP

¹ The Trifluralin Data Development Consortium (TDDC) consists of Dow AgroSciences LLC, Agan Chemical Manufacturers Ltd., and Industria Prodotti Chimici S.P.A.

² Two EPs registered to Dow AgroSciences (EPA Reg Nos. 62719-98 and 62719-175) are registered for use on non-bearing fruit and nut trees and non-bearing vineyards.

³ This formulation is a MAI that also contains flumetsulam at 0.25 lb/gal.

⁴ Including SLN No. AZ98000100 with use on peppers.

Use Pattern Table

Based on the EP labels registered to the members of the TDDC, a comprehensive summary of the registered food/feed use patterns of trifluralin is attached in Appendix 1. The conclusions listed in Table 4 regarding the reregistration eligibility of trifluralin food/feed uses are based on the use patterns registered by these basic producers.

A review of the above EP labels and the supporting residue data indicate that the following label changes should be made:

- Use directions for alfalfa should be clarified to list a maximum seasonal use rate of 2 lb ai/A for the EC formulation and 4 lb ai/A for the G formulation.
- Use directions for cotton should be clarified to specify a maximum seasonal use rate of 2 lb ai/A for all use patterns, including use for control of Johnson grass.
- The feeding/grazing restriction for rapeseed forage should be deleted as this type of prohibition is not considered feasible by the Agency.
- The feeding/grazing restriction for barley should be deleted as this type of prohibition is not considered feasible by the Agency.
- The feeding/grazing restriction for flax straw should be deleted as this type of prohibition is not considered feasible by the Agency.

Summary of Residue Chemistry Data

Table 4. Summary of Residue Chemistry Data for Trifluralin.				
OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹
860.1200	Directions for Use	NA = Not Applicable	No	
860.1300	Nature of the Residues - Plants	NA	No	00024731 00026054 00093553 00105720 00105759 00124905 00125299 41179001 41179002 41396801 41396802
860.1300	Nature of the Residues - Livestock	NA	Yes	00093636 00105690 00105772 41233101 41233102 41286101
860.1340	Residue Analytical Methods	NA	Yes ²	00022793 00047591 00047639 00059532 00067371 00067435 00080320 00105646 00105689 00105695 00105720 00105759 00125303 43622001 ³ 43627801 ³ 45125701 ⁴ 45125702 ⁴
860.1360	Multiresidue Method	NA	No	
860.1380	Storage Stability	NA	Yes ⁵	00047639 00105716 00105720 41335901 43626901-43626944 ⁶ 43850301 ⁷
860.1400	Magnitude of the Residue - Water, Fish, and Irrigated Crops	NA	No	
860.1460	Magnitude of the Residue - Food Handling	NA	No	
860.1480	Magnitude of the Residue - Meat, Milk, Poultry, and Eggs	NA	Yes ⁸	00023105 00080320 00080322 00093634 00093636 00105772

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OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹
860.1500	Crop Field Trials			
	Root and Tuber Vegetables (Crop Group 1)			
	- Carrot, root	1.0	No	00033087 00093554 44288802 ⁹
	- Potato	0.05 ¹⁰ vegetable, root crop (exc. carrot)	No ¹¹	00022257 00093574 00105733 00105734 00133939 42430802
	- Radish, root			
	- Sugar beet, root			
	Leaves of Root and Tuber Vegetables (Crop Group 2)			
	- Sugar beet, tops	0.05 ¹⁰ vegetable, root crop	No	00057546 00105648 00105666 00105757
	- Turnip, tops			
	Bulb Vegetables, except Brassica (Crop Group 3)			
	- Garlic	0.05 ¹⁰ vegetable, root crop	No ¹²	00105678 00120263 42448202
	- Onion, dry bulb			
	- Onion, green			
	Leaf Vegetables, except Brassica (Crop Group 4)			
	- Celery	0.05 ¹³ vegetable, leafy	No	00093549 00105670
	- Endive		No	
	- Upland cress	0.05	No ¹⁴	
	Leaf Vegetables, Brassica Leafy Vegetables (Crop Group 5)			
	- Broccoli	0.05 ¹⁵ vegetable, leafy	No	00105650 00105749
	- Brussel sprouts			00105749
	- Cabbage			00105650 00105749
	- Cauliflower			00105749
	- Collards			00105724
	- Kale			00105724
	- Mustard, greens			00105724

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OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹
806.1500	Legume Vegetables (Crop Group 6)			
	- Beans, dry	0.05 ¹⁶ vegetable, seed and pod	No ¹⁷	00022376 00105669 00105726
	- Beans, guar		No ¹⁷	00105670
	- Bean, Lima		No ¹⁷	00033086 00105669 00105726
	- Bean, Snap		No	00022376 00033086 00057547 00105669
	- Bean, Mung	2.0 ¹⁸ bean, mung, sprouts	No	00105670
	- Pea, field	0.05 ¹⁶ vegetable, seed and pod	No ¹⁷	00105669
	- Pea, succulent and dry			00105669 00105755
	- Soybean		No ¹⁹	00022793 00030932 00067433 00094410 00096361 00104423 00105655 00105669 00105717 00105720 00105725 00105746 00124904 00128308 42448203
	Foliage of Legume Vegetables (Crop Group 7)			
	- Bean, forage and straw/hay	0.05 ²⁰ legume, forage	No ²¹	00022376 00105669
	- Pea, vines and hay			00105669
	- Soybean, forage and hay			00022376 00030932 00067433 00096361 00105720
	Fruiting Vegetables, except Cucurbits (Crop Group 8)			
	- Pepper	0.05 vegetable, fruiting	No	00105750
	- Tomato			00105710 00105726 00105750
	Cucurbit Vegetables (Crop Group 9)			
	- Cantaloupe	0.05 vegetable, cucurbit	No ²²	00093555 00105726
	- Cucumber			00093555
	- Squash, summer			42354502
	- Watermelon			00105670
	Citrus Fruit (Crop Group 10)	0.05 Fruit, citrus	No ²³	00105677 42642601

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OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹	
860.1500	Stone Fruits (Crop Group 12)				
	- Apricot	0.05 Fruit, stone	No ²⁴	00105667 00105675	
	- Cherry			42430803	
	- Peach			00105667 00105675	
	- Plum			00105675 00105735	
	Tree Nuts (Crop Group 14)		0.05	No ²⁵	00105675 00105726
	Cereal Grains (Crop Group 15)				
	- Barley, grain	0.05 ²⁶ grain crops	No ²⁷	00070736 00105704	
	- Corn, field, grain	0.05	No	00032811 00105697 00105726 42448201 42403201 42779001	
	- Sorghum, grain	0.05 grain crops	No ²⁸	00105704 00105726 42325001	
	- Wheat, grain	0.05	No ²⁹	00070736 00105681 00105726 42430806	
	Forage, Fodder, and Straw of Cereal Grains (Crop Group 16)				
	- Barley, hay and straw	0.05 straw	No ³⁰	00070736 00105704	
	- Corn, field, forage and stover	0.05	No	00032811 00105726 42472301	
	- Sorghum, forage and stover	0.05	No ³¹	00105704	
	- Wheat, forage, hay and straw	0.05 straw	Yes ³⁰	00070736 00105681 44288804 ⁹	
	Non-grass Animal Feeds Group (Crop Group 18)				
	- Alfalfa, forage and hay	0.2 hay	No ³²	00093637 00105691 00105726 00143667 00155395 42460001- 42460010 44117801 ⁴	
	Herbs and Spices Group (Crop Group 19)				
	- Mustard, seed	None	No ³³	00067371, 42430801	
	Miscellaneous Commodities				
	- Aspirated Grain Fractions	None	No ³⁴	42403201 42430806 42448203 42779001 42917801	
	- Asparagus	0.05	No ³⁵	00105696 00105702 44288801 ⁹	

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OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹
860.1500	- Cotton, seed	0.05	No ³⁶	00093190 00105669 00105713 00105726 00105729 00105731 00105751 00105759 00105780 00105781 00124904 42354501 44332301 ³⁷
	- Flax, seed	0.05	No ³⁸	00084581
	- Grape	0.05	No	00105678 44288803 ⁹
	- Hop	0.05	No ³⁹	00105678
	- Okra	0.05 ¹⁶ vegetables, seed and pod	No	00105750
	- Peanut	0.05	No ⁴⁰	00026049 00059531 00067222 00105646 42472302 42430804
	- Peppermint, tops	0.05	No	00105683 43850301 ⁷
	- Rapeseed, seed	0.05	Yes ⁴¹	00047639
	- Safflower, seed	0.05	No ³⁸	00067371 00105726 00105750
	- Spearmint, tops	0.05	No	00105683 43850301 ⁷
	- Sugarcane	0.05	No ⁴²	00105668 00105674 00105727 00105730 41306701
	- Sunflower, seed	0.05	No ⁴³	00057545 00067371 00067430 00105673
860.1520	Processed Food/Feed			
	- Barley	None	No ⁴⁴	
	- Corn, field	None	No	42403201 42917801
	- Cottonseed	None	No	42354501
	- Flax	None	No ⁴⁵	
	- Grape	None	Yes ⁴⁶	00105678
	- Citrus fruit	None	No	42642601
	- Mint, oil	None	Yes ⁴⁷	00105683, 43850301 ⁷
	- Peanut	None	No	42430804 42779001
	- Plum	None	Yes ⁴⁸	00105675, 00105735
	- Potato	None	No	42514501
	- Rapeseed	None	No ⁴⁹	
	- Safflower	None	No ⁴⁹	
- Sorghum	None	No	42325001	
860.1520	- Soybean	None	No	42448203 42779001
	- Sugar beet	None	No	42448204

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OPPTS Guideline No.	Guideline Description / Commodity	40 CFR §180.207 Tolerances (ppm)	Must Additional Data Be Submitted?	MRID Nos. ¹
	- Sugarcane	None	No	41306701
	- Sunflower	None	No	42430805
	- Tomato	None	No	00105710 00105726 00105750
	- Wheat	None	No	42430806 42779001
860.1650	Submittal of Analytical Reference Standards	--	No	
860.1850	Confined Accumulation in Rotational Crops	--	No	41661102 ⁵⁰
860.1900	Field Accumulation in Rotational Crops	--	No	

1. Unless otherwise noted, the italicized references were cited in the Residue Chemistry Chapter for the Trifluralin RED dated 10/20/94; **bolded** references were reviewed in the Trifluralin Residue Chemistry Reregistration Standard Update dated 10/29/91; and unbolded references were reviewed in the Residue Chemistry Science Chapter of the Reregistration Standard dated 7/12/85.
2. Analytical methodology for determining trifluralin residues in meat, meat-byproducts, fat and milk should be submitted in conjunction with the requested cattle feeding study.
3. DP Barcode D216162, 8/19/95, B. Cropp-Kohlligian. Submission of the method validation data (MRIDs 43622001 and 43627801) for corn matrices was noted, but not reviewed.
4. DP Barcode D273840, currently under review.
5. The barley and wheat forage, hay and straw residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). New field trial data are required depicting trifluralin residues in/on wheat forage, hay, and straw following an application of the EC and G formulations at the maximum labeled rate. These data will be translated to support tolerances on barley hay and straw. Due to storage stability concerns, the existing residue data from the grape field trials conducted at exaggerated rates are no longer adequate (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). The available mint processing data is inadequate due to storage stability concerns. Therefore, a new mint processing study is required using either peppermint or spearmint.
6. DP Barcode D215083, 7/27/97, B. Cropp-Kohlligian.
7. MRID 43850301 contains sample storage intervals and conditions for peppermint and spearmint tops and oil. Storage intervals and conditions for peppermint and spearmint tops are supported by available storage stability data. However, storage intervals and conditions for peppermint and spearmint oil are not supported by available storage stability data. Therefore a new processing study on mint must be conducted.
8. The Agency previously waived the requirement for cattle and poultry feeding studies based on data from the ruminant and poultry metabolism studies and the low levels of trifluralin expected in livestock diets. However, with the reassessed tolerances for alfalfa hay (2 ppm) and forage (3 ppm), there has been a substantial increase in the maximum dietary burden for cattle (~6 ppm). Therefore, a cattle feeding study is now required.

9. DP Barcode D240693, currently under review.
10. The obsolete "root vegetables (exc. carrots)" group tolerance should be revoked concomitant with establishing separate crop group tolerances for (i) root and tuber vegetables (exc. carrots), (ii) leaves of root and tuber vegetables, and (iii) bulb vegetables. Based on available data for the representative commodities from each group, tolerances of 0.05 ppm would be appropriate for each group.
11. Although the existing potato and sugar beet field trials are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available radish field trial data and sugar beet processing study (5x) are adequate and will be used as bridging data. Therefore, no additional root and tuber vegetable field trial data are required.
12. Although the existing garlic and dry bulb onion residue data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the green onion residue data are adequate and will be used as bridging data. Therefore, no additional bulb vegetable field trial data are required.
13. The crop group tolerance for leafy vegetables (except Brassica) group is inappropriate as residue data are not available on all of the representative commodities (i.e., lettuce (head and leaf) and spinach). In addition, celery and endive are the only crops from Crop Group 4, which have registered uses for trifluralin (labels of TTDC members). Based on the available celery data, which will be translated to endive, separate tolerances of 0.05 ppm would be appropriate for celery and endive.
14. There are no registered uses of trifluralin on upland cress and no residue data on upland cress have been submitted. The established tolerance for upland cress should be revoked.
15. The obsolete "leafy vegetables" group tolerance should be revoked concomitant with establishing a crop group tolerance for Brassica (cole) leafy vegetables. Based on the available data for representative members of this crop group, a tolerance of 0.05 ppm would be appropriate.
16. The obsolete "seed and pod vegetables" group tolerance should be revoked concomitant with establishing a crop group tolerance for "Vegetable, legume (succulent or dried) Crop Group 6" and a separate tolerance for okra. Based on the available data for okra and selected members of Crop Group 6, a tolerance of 0.05 ppm would be appropriate for each.
17. Although the existing field trial data on beans (lima and dry) and peas (field, dry and succulent) are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available soybean processing study will be used as bridging data to support the legume vegetables crop group. Residues in/on soybeans were nondetectable (<0.01 ppm) following an application at 3.8x the maximum use rate.
18. Although the Agency recognizes bean sprouts as a raw agricultural commodity (OPPTS 860.1000, Table 1), there are no registered uses of trifluralin on mung bean sprouts *per se*. Therefore the 2 ppm tolerance, set for a proposed use of trifluralin (4 lb/gal EC) as a growth regulator, should be revoked.
19. Although the existing soybean field trial data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available soybean processing study (1.9x) is adequate and will be used as bridging data. Therefore, no additional soybean field trial data are required.
20. The obsolete "forage legumes" group tolerance should be revoked concomitant with establishing a crop group tolerance for foliage of legume vegetables (Crop Group 7). Based on the available data for soybean forage and hay, a tolerance of 0.05 ppm would be appropriate.

21. Although the available bean and pea vine, hay, and straw residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available soybean forage and hay data will be used as bridging data and will support the crop group tolerance on the foliage of legume vegetables.
22. Although the existing cantaloupe, cucumber, and watermelon residue data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the summer squash residue data are adequate and will be used as bridging data. Therefore, no additional cucurbit field trial data are required.
23. The existing citrus fruit field trial data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, the available citrus processing study (5x) is adequate and will be used as bridging data. Therefore, no additional citrus fruit field trial data are required.
24. Although the existing apricot, peach, and plum residue data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the cherry residue data are adequate and will be used as bridging data. Therefore, no additional stone fruit field trial data are required.
25. Due to storage stability concerns the available residue data on almonds, pecans, and walnut are now considered to be inadequate (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, no additional tree nut residue data are required. Based on the existing tree nut field trial data and the weight of evidence for trifluralin residues in/on tree crops, HED continues to expect that trifluralin residue are likely to be nondetectable (<0.01 ppm) in/on nut meats and almond hulls resulting from currently registered uses of trifluralin on tree nuts.
26. A crop group tolerance of 0.05 ppm in/on "grain crops " is inappropriate as there are no residue data or registered uses for rice and sweet corn, representative commodities of this group. Furthermore, the use directions are not uniform for the other representative commodities of this group. Therefore, the established crop group tolerance for "grain crops (except corn and rice grain)" should be revoked concomitant with the establishment of individual tolerances, each at 0.05 ppm, for barley grain and sorghum grain. Separate adequate tolerances of 0.05 ppm already exist for field corn grain and wheat grain.
27. The existing barley grain residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, the available residue data for wheat grain will be translated to support the use on barley.
28. The existing sorghum grain residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, the available sorghum grain processing study (3.8x) is adequate and will be used as bridging data, as residues were nondetectable (<0.01 pm) in/on grain. No additional sorghum field trial data are required.
29. The existing wheat grain residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, the available wheat grain processing study (2.5x) is adequate and will be used as bridging data as residues were nondetectable (<0.01 pm) in/on grain. No additional residue data are required on wheat grain.
30. The barley and wheat forage, hay and straw residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). Only one adequate field trial is available for wheat forage, hay and straw (MRID 44288804), and this trial was conducted at 0.5x the maximum rate. New field trial data are required depicting trifluralin residues in/on wheat forage, hay, and straw following an application of the EC and G formulations at the maximum labeled rate. These data will be translated to support tolerances on barley hay and straw.

31. The existing sorghum forage and fodder residue data are inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, the available residue data for field corn forage and stover will be translated to sorghum forage and stover.
32. The available alfalfa forage and hay field trial data are adequate and indicate that the tolerance for alfalfa hay should be increased to 2 ppm and a tolerance for alfalfa forage should be established at 3 ppm.

In addition, the data on alfalfa seed are adequate and no additional data are required. Currently the registered uses of alfalfa grown for seed are considered non-food uses because the labels prohibit the use of any portion of the treated field, including seed, seed screenings, hay, forage, or stubble, for human or animal consumption.
33. Current label directions for Brassica leafy vegetables could cover the use on mustard grown for seed, and adequate trifluralin residue data are available on mustard seeds. The available data indicate that a tolerance of 0.05 ppm (method LOQ) would be appropriate for mustard, seed.
34. Adequate data are available indicating that residues of trifluralin do not concentrate in aspirated grain fractions derived from corn grain, soybean seeds, and wheat grain. In addition, the Agency has determined that trifluralin residues are not likely to concentrate on the surface of sorghum grain as trifluralin is applied early in the growing season (DP Barcode D179068, 9/28/92, B. Cropp-Kohlligian); therefore, residue data on aspirated grain fractions derived from sorghum grain are not required.
35. Although sample storage information is not available for the earlier asparagus field trials, the recent adequate asparagus field trial (DP Barcode D240693, currently under review) will be used as bridging data. Therefore, no additional asparagus field trial data are required.
36. Data depicting residues of trifluralin in/on cotton gin byproducts are adequate provided labels are amended to specify a maximum seasonal application rate of 2 lb ai/A.
37. DP Barcode D240093, currently under review.
38. Due to storage stability concerns the available residue data on flax seed and safflower seed are now considered to be inadequate (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). However, no additional residue data are required as residue data (field trials and sunflower processing study) on rapeseed and sunflower will be translated to support the uses on flax and safflower.
39. Residues of trifluralin were non-detectable (<0.01 ppm) in/on fresh hops following applications at exaggerated rates; however, the existing residue data are considered inadequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). To support the use on hops, the Agency will translate the available peppermint and spearmint tops residue data to hops. Therefore, no additional hops field trial data are required.
40. Although the existing peanut nutmeat field trial data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available peanut processing study (5x) is adequate and will be used as bridging data. Therefore, no additional peanut field trial data are required. The available field trial data on peanut hay are adequate and indicate that a tolerance of 0.05 ppm should be established in/on peanut hay.
41. The Agency considers rape forage as a RAC which is not under grower/farmer control (OPPTS 860.1000, Table 1). Therefore, residue data are required for rape forage and a tolerance needs to be established.
42. Although the existing sugarcane residue data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), the available sugarcane processing study (2.5x), in which residues were nondetectable, is adequate and will be used as bridging data. Therefore, no

additional sugarcane field trial data are required.

43. Although much of the sunflower field trial data are considered questionable due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian), a limited number of adequate field trials are available. In addition, an adequate sunflower processing study (3x), in which residues were nondetectable (<0.01 ppm) in/on seeds, will be used as bridging data.
44. Data from the wheat processing study will be translated to barley processed commodities.
45. Data from the cottonseed and sunflower processing studies will be translated to flax seed, meal.
46. Due to storage stability concerns, the existing residue data from the grape field trials conducted at exaggerated rates are no longer adequate (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). Therefore, a new processing study is required using grapes treated at an exaggerated rate.
47. A food additive tolerance of 2 ppm for trifluralin residues in peppermint and spearmint oil was revoked, and the Agency (E. Zager, 10/20/95) subsequently recommended establishing a new tolerance for mint oil at 2 ppm (Section 701 MRL). However, the available mint processing is inadequate due to storage stability concerns. Therefore, a new mint processing study is required using either peppermint or spearmint.
48. Due to storage stability concerns, the existing residue data from the plum field trials are no longer adequate (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). Therefore, a new processing study is required using plums treated at an exaggerated rate.
49. Processing studies on rapeseed and safflower are not available; however, data from the available sunflower processing study will be translated to rapeseed and safflower processed commodities.
50. DP Barcode D206342, 7/21/95, B. Cropp-Kohlligian.

860.1300 Nature of the Residue - Plants

The qualitative nature of trifluralin residues in plants is adequately understood based on field corn and mustard green metabolism studies. These studies are supplemented with carrot, cotton, peanut, soybean, and sweet potato metabolism data. The residue of concern in plants is trifluralin *per se* and the current tolerance expression for plants is considered adequate.

Trifluralin was the predominant residue in field corn and mustard greens. Smaller amounts of conjugates C1 (N-[2-Ethyl-1-propyl-5-(trifluoromethyl)-1H-benzimidazol-7-yl]-β-D-glucopyranosylamine) and C2 (N-[2-Ethyl-1-propyl-5-(trifluoromethyl)-1H-benzimidazol-7-yl]-α-D-glucopyranosylamine) as well as the metabolite TR-4 (α,α,α-trifluoro-5-nitro-N⁴,N⁴,-dipropyltoluene-3,4-diamine) were identified in corn forage. It was concluded that conjugates in corn plants were converted from nonpolar to polar compounds, and subsequently incorporated into insoluble forms including cell wall components.

860.1300 Nature of the Residue - Livestock

Trifluralin metabolism studies in ruminants and in poultry have been submitted to the Agency and are summarized below. A preliminary dietary risk assessment is based, in part, on the results of the ruminant metabolism study, even though the study is considered to be of low quality by current standards. To address this uncertainty in the dietary risk assessment and to establish the appropriate tolerance expression and tolerance levels in ruminant commodities, the HED Metabolism Assessment Review Committee (2/4/04) concluded that a new metabolism study in ruminants must be submitted as well as a ruminant feeding study at 1x, 3x, and 10x [based on the reassessed tolerance of 3.0 ppm for alfalfa forage the (revised) maximum dietary exposure for cattle is ~6.0 ppm]. In addition, an analytical method for determining trifluralin residues in ruminant fat, meat, meat byproducts, and milk is required.

Ruminant Metabolism

In the available ruminant metabolism study, two steers were dosed with uniformly ring-labeled [¹⁴C]trifluralin at 0.88 ppm (0.15x the revised maximum exposure) and 8.8 ppm (1.5x) in the diet for 5 and 3 days, respectively. In addition, two dairy cows were dosed with uniformly ring-labeled [¹⁴C]trifluralin at 1.7 ppm (0.3x) and 17 ppm (2.8x) in the diet for 5 and 3 consecutive days, respectively.

For the steer dosed with [¹⁴C]trifluralin at levels equivalent to 0.15x the (revised) maximum exposure for 5 days, total radioactive residues (TRR) were <0.001 ppm in muscle, 0.004 ppm in fat and kidney, and 0.014 ppm in liver. For the steer dosed with [¹⁴C]trifluralin at levels equivalent to 1.5x the (revised) maximum exposure for 3 days, TRR were 0.003 ppm in muscle, 0.015 ppm in fat, 0.048 ppm in kidney, and 0.145 ppm in liver. Average TRR values in milk were 0.0016 ppm from the cow dosed at 0.3x and 0.011 ppm in milk from the cow dosed at 2.8x.

Tissues from the high-dose steer (8.75 ppm) and milk from the high-dose cow (17 ppm) were used for characterization of the TRR in tissues and milk. Solvent extraction and acid hydrolysis extracted 82% of the TRR from liver, and solvent extractions released 69% of the TRR from kidney, 88% of the TRR from fat, and 62% of the TRR in milk. Extracted ¹⁴C-residues were fractionated and characterized by column chromatography, but residues in milk and tissues were not conclusively identified. Based on thin layer chromatography (TLC) data and comparison to metabolite fractions identified in urine, the following compounds were identified in milk and tissues:

liver	TR-14, TR-5, TR-6, TR-7, and desethyl TR-14
kidney	TR-42 or TR-44, and desethyl TR-15
fat	Trifluralin, TR-4, TR-6, and TR-14
milk	Trifluralin, TR-2, TR-6, TR-7 and TR-14

It should be noted that the HED Metabolism committee concluded (2/4/04) that all trifluralin metabolites, including the above, must be considered toxicologically similar to trifluralin *per se*.

Poultry Metabolism

The maximum dietary exposure of trifluralin to poultry is 0.05 ppm based on a diet consisting of 80% field corn grain and 20% soybean. In the poultry metabolism study, laying hens were dosed with uniformly ring labeled [¹⁴C]trifluralin at 0.05 ppm (1x) and 0.5 ppm (10x) in the diet for five consecutive days, or at 50 ppm (1,000x) for ten consecutive days. For the 1x dose group, TRR were nondetectable in muscle (<0.003 ppm), skin/fat (<0.003 ppm), and eggs (<0.001 ppm) and 0.004 ppm in liver. For the 10x dose group, TRR were nondetectable (<0.003 ppm) in muscle, 0.002 ppm in skin/fat, 0.014 ppm in liver, and ≤0.002 ppm in eggs. For the 1,000x dose group, TRR were 0.15 ppm in muscle, 0.47 ppm in skin/fat, 2.49 ppm in liver, and 0.032-0.53 ppm in eggs. ¹⁴C-Residues in eggs from the 1,000x dose group plateaued by 8 days. TRR in eggs and tissues from the 1,000x dose group were extracted and fractionated, but attempts at identifying metabolites were unsuccessful. However, given the low dietary exposure of trifluralin residues to poultry, the Agency has concluded that further characterization and identification of ¹⁴C-residues in eggs and tissues is not required.

860.1340 Residue Analytical Methods

Plant Commodities

The reregistration requirements for residue analytical methods are fulfilled for plant commodities. Adequate methods are available for data collection and enforcement of tolerances for residues of trifluralin *per se* in/on plant commodities.

The Pesticide Analytical Manual (PAM, Vol. II, Section 180.207) lists four GC methods (designated as Methods I, II, III, and A) with electron capture detection (ECD) and a detection limit of 0.005-0.01 ppm, as available for determination of trifluralin *per*

se in/on plant commodities. Method I in PAM, Vol. II is a multiresidue method listed in PAM, Vol. I, Sections 211.1 (fatty) and 212.1 (nonfatty) for organochlorine compounds.

Adequate methods for analysis of trifluralin in/on plant commodities are available. Procedure numbers 5801000 and 5801210 and their modifications, such as procedure number 5801616 are GC methods using ECD. Minor procedures, designed for particular crops and/or used only for a small part of data collection included;

1) procedure number 5801160, used for analysis of peanut meats and safflower oil and seed; 2) procedure number 5800600 used for analysis of tomatoes 3); procedure number 5801577 used for analysis of mint oil; and 4) a nondesignated procedure (Monsanto Company) for the analysis of trifluralin in oil seed crops (which involved extraction with iso-octane and cleanup with an alumina column). Other data collection methods are procedure number MMS-R-274-1 (Shell Chemical Company) used for analysis of soybean and their processed fractions, and a nondesignated procedure (International Research Project Number 4) used for data collection in rape seed and straw. Procedure number 5801110, which incorporates a TLC cleanup step, is the preferred regulatory method when interfering pesticides are present in crop samples.

Procedure numbers 5801210, 5801110, and 5801577 (Eli Lilly and Company) are listed in PAM, Vol. II as Methods II, III, and A, respectively. Procedure number 5801210 (designated as Method II) was subjected to an Agency validation trial. The Eli Lilly Method AM-AA-CA-RO23-AA-755 was used for the generation of trifluralin residue data in various plant commodities. This method is a modification to procedure number 5801616 which in turn is a modification of procedure number 5801210. The modifications include different dilution solvents and GC columns. In addition, GC/ECD methods AM-AA-CA-R146-AA-755, GRM92.11, GRM92.12, and TFN0291 are modifications of method AM-AA-CA-RO23-AA-755 and are adequate for collecting data on residues of trifluralin in/on various plant commodities.

Livestock commodities

Although the Agency previously (2/2/94) waived the requirement for an analytical method for animal commodities, an analytical method for determining trifluralin residues in fat, meat, meat byproducts, and milk is now required in conjunction with the required metabolism and feeding studies.

860.1360 Multiresidue Methods

The FDA PESTDATA database (PAM Vol. I, Appendix II, 1/94) indicates that trifluralin is completely recovered (>80%) using multiresidue method PAM Vol. I Sections 302 (Luke method), 303 (Mills, Onley, Gaither method) and 304 (Mills fatty food method).

860.1380 Storage Stability

Plant commodities

Acceptable storage stability studies have been conducted on representative oil seeds, non-oily grains, leafy vegetables, root and bulb crops, fruits and fruiting vegetables, legume vegetables (succulent or dried), low moisture content forage/hay, and miscellaneous commodities including mustard seed, sugarcane, and green hops. Additional studies have also been conducted to investigate the frozen stability of trifluralin in selected processed food/feed commodities. These data adequately demonstrate that residues of trifluralin are stable in/on plant matrices for intervals up to 554 days at frozen temperatures. However, storage stability data also indicate a potential for trifluralin residue decline in commodities stored at elevated temperatures (4°C to room temperature).

860.1400 Water, Fish, and Irrigated Crops

Trifluralin is not registered for direct use on water or aquatic food and feed crops; therefore, no residue chemistry data are required under this guideline topic.

860.1460 Food Handling

Trifluralin is not registered for use in food-handling establishments; therefore, no residue chemistry data are required under this guideline topic.

860.1480 Meat, Milk, Poultry, and Eggs

Ruminants

In the Residue Chemistry Chapter of the Trifluralin RED (10/94), the data requirements for magnitude of trifluralin residues in livestock were waived (R. Perfetti, 2/4/93) based on the low levels of radioactive residues shown in the animal metabolism studies and the low dietary trifluralin exposure estimated for cattle. The Agency concluded that tolerances for trifluralin in fat, meat, meat byproducts, and milk were not necessary as there was no expectation for finite residues occurring in animal commodities [40 CFR 180.6(a)(3)].

However, residue data from alfalfa field trials indicate that the estimated maximum dietary intake of trifluralin by cattle may be significant due to residues in/on alfalfa forage and hay, which are major livestock feed items. In the recent alfalfa field trials, maximum trifluralin residues at the labeled 21-day PHI were 2.2 ppm in/on alfalfa forage and 1.6 ppm in/on alfalfa hay, and the highest average field trial (HAFT) residues were 2.0 ppm in/on alfalfa forage and 1.3 ppm in/on alfalfa hay.

The maximum dietary exposure for beef and dairy cattle is calculated below in Table 5. using the reassessed tolerance for alfalfa forage (3.0 ppm). Based on diets consisting of alfalfa forage and corn grain, the maximum exposure for beef and dairy cattle are calculated to be 6.0 and 5.2 ppm, respectively.

Table 5. Calculation of maximum dietary exposure of beef and dairy cattle				
Feed Commodity ¹	% Dry Matter ²	% Diet ²	Reassessed Tolerances (ppm)	Dietary Contribution (ppm) ³
Beef Cattle				
alfalfa forage	35	70	3.0	6.0
corn grain	88	20	0.05	0.02
soybean	89	10	0.05	0.01
TOTAL BURDEN				6.02
Dairy Cattle				
alfalfa forage	35	60	3.0	5.14
corn grain	88	30	0.05	0.02
soybean	89	10	0.05	0.01
TOTAL BURDEN				5.16

¹ Although tolerances are currently higher for carrot roots (1.0 ppm) than for corn grain (0.05), carrots were not included in the cattle diet because carrot culls will be unlikely to contribute 25% of the diet.

² Table 1 (August 1996).

³ Contribution = [tolerance / % DM (if cattle)] X % diet).

In the ruminant metabolism study, a steer and a cow were dosed orally with [¹⁴C]trifluralin at 8.75 ppm and 17 ppm, respectively, for 3 days. Based on the dietary exposure estimates above, these doses are equivalent to 1.5x for beef cattle and 3.3x for dairy cattle. Characterization and identification of ¹⁴C-residues in tissues and milk was limited; however, minor amounts of trifluralin were detected in fat and milk. Again, given the low number of animals used and the short duration of the dosing period (3 days) the Agency requires new metabolism and feeding studies in ruminants.

Hogs: The maximum dietary trifluralin exposure for hogs is estimated to be 0.15 ppm based on a diet including 10% carrot culls, 25% soybean seed or meal, and 65% corn grain. As the Agency continues to expect that finite residues of trifluralin will not occur in hog commodities, tolerances for hog commodities are not required.

Eggs and fat, meat, and meat byproducts of poultry

Based on a dietary exposure of 0.05 ppm for poultry, and data from the poultry metabolism study, the Agency has concluded that residues of trifluralin are unlikely to be detectable in eggs and poultry commodities [40 CFR §180.6(a)(3)]. Therefore a poultry feeding study and tolerances for poultry commodities are not required.

860.1500 Crop Field Trials

The Residue Chemistry Chapter for the Trifluralin RED (10/94) noted that, with a few exceptions, crop field trial data were available to support the registered uses of trifluralin. However, a substantial portion of the trifluralin crop field trials are older

studies conducted 20 to 30 years ago. HED noted that field trial samples stored at temperatures above freezing would be of particular concern because storage stability data indicated the potential for trifluralin residue instability in those cases. To address concerns pertaining to the storage stability of trifluralin residues, the Trifluralin Reregistration Standard, Science Chapter (7/85) and the Trifluralin Product and Residue Reregistration Update (10/91) required sample storage information to validate existing crop field trials.

With the exception of the older asparagus field trials, the sample storage information for all crop field trials has been received and evaluated (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian). Field trials for the following crops/commodities are supported by *adequate* storage stability data: alfalfa (forage, hay, and seed); beans (snap); broccoli; cabbage; cauliflower; carrots; celery; cherries; corn (grain, forage, and stover); cotton (undelinted seed and gin byproducts); mustard seeds; okra; onions (green); peanuts (nutmeats and hay); peppermint tops; peppers; radishes (roots and tops); rape (seed); soybeans (seed, forage, hays); spearmint (tops); squash (summer), sugar beets (roots and tops); tomatoes; and turnip greens.

Based on sample storage information and available storage stability data, HED considers field trial data for the following crops/commodities to be *inadequate*, or questionable: almonds; apricots; barley (grain, forage, and straw); beans (dry and lima); bean forage and hay; Brussel sprouts; cantaloupe; citrus fruits; collards; cucumbers; flax seed; garlic; grapes; hops; kale; mustard greens; onions (dry bulb); peaches; peas (field, dry, and succulent); pea vines; pecans; plums; potatoes; safflower seed; sorghum (grain, forage, and fodder); soybean seeds; sugar beet roots; sugarcane; sunflower seeds; turnip roots; walnuts; watermelon; and wheat (grain, forage, and straw).

Although a substantial portion of the field trial residue database for trifluralin is considered questionable, the Agency has determined that sufficient residue data are available for reassessment of trifluralin tolerances for most crops based on the following: (1) the early-season use pattern of trifluralin in most crops results in residues below the enforcement method LOQ (0.05 pm); (2) bridging studies from more recent field trials have residue levels that are similar to residue levels in the earlier field trials; (3) adequate residue data are available for some crops that can be readily translated to similar uses on related crops; and (4) numerous processing studies conducted at exaggerated rates indicate that trifluralin residues in various RACs are likely to be nondetectable (<0.01 ppm) following treatment at 1x the maximum labeled rate. discussed below.

For root and tuber vegetables, adequate residue data are available to support the separate tolerance for carrots. Adequate residue data are also available from recent radish field trials, which will be used as a bridging study. In addition, supporting residue data are available from a sugar beet processing study conducted at 5x, in which residues in/on the RAC were nondetectable (<0.01 ppm). Adequate field trial data are also available on sugar beet tops and turnip tops to support a tolerance on leaves of root and tuber vegetables. Therefore, no additional root and tuber vegetable field trial

data are required.

Although the existing garlic and dry bulb onion residue data are considered questionable, the recent green onion residue data are adequate and will be used as bridging data. Therefore, no additional bulb vegetable field trial data are required.

For leafy vegetables (except Brassica), adequate residue data are available to support the use on celery and these data will be translated to support the use on endive. There are no other registered uses for trifluralin on crops in group 4.

For Brassica leafy vegetables, adequate residue data are available on the representative commodities broccoli, cabbage, and cauliflower. Therefore, no additional Brassica vegetable field trial data are required.

Although the existing field trial data on beans (lima and dry), peas (field, dry and succulent), and soybean seeds are questionable, the available soybean processing study will be used as bridging data to support the legume vegetables crop group. Residues in/on soybeans were nondetectable (<0.01 ppm) following an application at 3.8x the maximum use rate on beans (and peas) and 1.9x the maximum use rate on soybeans.

For foliage of legume vegetables, the available bean and pea vine, hay, and straw residue data are questionable. However, the available soybean forage and hay data are adequate and will be used as bridging data to support the crop group tolerance.

For the fruiting vegetables, adequate residue data are available on tomatoes and peppers to support the crop group.

For cucurbit vegetables, the existing cantaloupe, cucumber and watermelon residue data are considered questionable. However, the recent summer squash residue data are adequate and will be used as bridging data. Therefore, no additional cucurbit field trial data are required.

Although the existing citrus fruit field trial data are questionable, the available citrus processing study (5x) is adequate and will be used as bridging data. Following a directed broadcast application of trifluralin at 5x to the ground around orange trees, trifluralin residues in/on oranges were nondetectable (<0.01 ppm). No additional citrus fruit field trial data are required.

For stone fruits, the existing apricot, peach and plum residue data are considered questionable. However, the recent cherry residue data are adequate and will be used as bridging data. Therefore, no additional stone fruit field trial data are required.

For the tree nuts, all of the available residue data on almonds, pecans, and walnuts are now considered to be questionable. However, based on tree nut field trial data and the weight of evidence for trifluralin residues in tree crops, HED continues to

expect that trifluralin residues will be nondetectable (<0.01 ppm) in tree nuts and almond hulls. Therefore, no additional tree nut field trial data are required.

For cereal grains, adequate residue data are available for field corn grain, but the field trial data for grain from barley, sorghum, and wheat are now considered questionable. However, adequate sorghum grain (at 3.8x) and wheat grain (at 2.5x) processing studies are available and will be used as bridging data. Trifluralin residues were nondetectable (<0.01 pm) in/on sorghum and wheat grain from these exaggerated rate studies. Data from the wheat grain processing study will also be translated to support a tolerance on barley grain.

For the forage, fodder and straw of cereal grains, adequate residue data are available for field corn forage and stover, but the field trial data for barley, sorghum, and wheat are now considered questionable. The residue data from field corn forage and stover will be translated to support tolerances on sorghum forage and stover. However, new field trials must be conducted on wheat (forage, hay and straw) using trifluralin (EC and G) at the maximum labeled rates. The results from the requested wheat field trails will be translated to support tolerances on barley hay and straw.

Although the earlier field trial data on asparagus are not supported with sample storage information, the recent asparagus field trial data will be used as bridging data. Therefore, no additional field trials on asparagus are required.

Although the existing field trial data on peanut nutmeats are questionable, the available peanut processing study will be used as bridging data, as residues in/on peanuts were 0.016 ppm following an application at 5x maximum use rate for peanuts.

Similarly, the available sugarcane and sunflower field trial data are either questionable or limited. Therefore, the sugarcane and sunflower processing studies will be used as bridging data. Residues in/on sugarcane were nondetectable (<0.01 ppm) following an application at 5x the maximum label rate, and residues in/on sunflower seed were also nondetectable (<0.01 ppm) following an application at 3x the maximum label rate.

The existing residue data on flax seed, safflower seed, and hops are also now considered questionable. However, the available residue data for rapeseed and sunflower will be translated to support the uses and tolerances on flax seed and safflower; and the available residue data peppermint and spearmint tops will be translated to support the use on hop vines.

No residue data are available depicting residues in/on rapeseed forage, and the Agency does not allow label restrictions prohibiting the feeding of rapeseed forage. Therefore, new field trials are required depicting trifluralin residues in/on rapeseed forage following application of trifluralin (EC and G) at the maximum labeled rates.

Adequate residue data are also available for *aspirated grain fractions* derived from

corn grain, soybean seeds, and wheat grain. These data indicate that trifluralin residues do not concentrate in aspirated grain fractions. In addition, the Agency has also determined that trifluralin residues are not likely to concentrate on the surface of sorghum grain as trifluralin is applied early in the growing season (DP Barcode D179068, 9/28/92, B. Cropp-Kohlligian). Therefore, no additional residue data on aspirated grain fractions are required.

860.1520 Processed Food and Feed

Adequate processing studies have been conducted to determine the concentration, or reduction, of trifluralin residues in the processed commodities of the following RACs: field corn grain, cottonseed, oranges, peanuts, potatoes, sorghum, soybeans, sugar beets, sugarcane, sunflower seed, and wheat. With the exception of potatoes, the data from these studies indicate that trifluralin residues do not concentrate in the regulated processed commodities derived from these crops.

Potato processing studies indicate that residues of trifluralin do not concentrate in flakes and chips, but can concentrate (on average) by 3x in wet peel (≤ 0.05 ppm). The available root and tuber vegetable residue data indicate that residues in/on potatoes treated at 1x will be nondetectable (< 0.01 ppm); therefore, a separate tolerance for potato waste is not required as any residues in/on waste are likely to be below the current 0.05 ppm tolerance covering potatoes.

Processing studies are not available on barley grain, flax seed, safflower seed, and rapeseed. However, data from the wheat grain processing study will be translated to barley; data from the cottonseed processing study will be translated for flax seed; and data from the sunflower seed processing study will be translated to rape seed and safflower seed. Based on the translated data, tolerances are not required for commodities derived from barley grain, flax seed, rapeseed, and safflower.

A processing study is not available for tomatoes. However, adequate tomato field trial data are available and demonstrate nondetectable residues of trifluralin in/on tomatoes following treatment at exaggerated application rates up to 4x. Therefore, a tomato processing study is not required.

A processing study on peppermint and spearmint has been submitted; however, the residue data on mint oil are not supported by adequate storage stability data. Therefore, a new mint processing study must be conducted.

In addition, processing studies are now required on grapes and plums. Previously, the Agency waived the requirement for these studies as residue data for grapes and plums were available from field trials conducted at exaggerated rates, which indicated that detectable trifluralin residues were unlikely to occur in grape and plum processed fractions. However, these earlier field trials are no longer considered adequate due to storage stability concerns (DP Barcode D215083, 7/27/95, B. Cropp-Kohlligian).

860.1650 Submittal of Analytical Reference Standards

Analytical reference standards for Trifluralin are available at the EPA National Pesticide Standards Repository.

860.1850 and 860.1900 Confined and Field Accumulation in Rotational Crops

A Confined Rotational Crop Study for trifluralin has been reviewed by the Agency, and, at the time of review was considered an adequate study. In this study, total radioactive residues (TRR) accumulated at a level equal to or greater than 0.01 ppm in chard, turnip roots and tops, and corn forage, silage, and fodder planted in sandy loam soil 30 days after treatment (DAT) with [¹⁴C]trifluralin applied at the rate of 0.76-0.83 lb/A. However, the residue of concern was trifluralin *per se*, and this study indicated that residues of trifluralin *per se* in/on any 30 DAT rotational crop commodity would unlikely exceed 0.01 ppm, even though the study was conducted at less than the maximum permissible treatment rate. Accumulation of ¹⁴C-residues peaked in crops at 30-day rotation and declined in subsequent rotations. Based on the results of this study, the Agency did not require a plant-back interval and rotational crop tolerances for trifluralin residues were not required.

However, the HED Metabolism Assessment Review Committee concluded (meeting date 2/4/04) that the confined rotational crop study is not adequate by current standards and a plant-back interval of 100 days will be required. If the 100 day interval presents an issue to users, a new confined rotational study can be conducted at a 1x rate with a more comprehensive characterization/identification of metabolites.

TOLERANCE REASSESSMENT SUMMARY

Tolerances for residues of trifluralin in or on raw agricultural commodities are expressed as parent compound. Permanent tolerances for trifluralin residues have been established on numerous plant commodities ranging from 0.05 ppm in/on various commodities to 2.0 ppm in/on mung bean sprouts [40 CFR §180.207(a)]. A summary of the tolerance reassessment and the recommended modifications in commodity definitions for trifluralin is presented in Table 6.

The available residue data support the *existing* tolerances on the following crops/commodities: asparagus; carrot, roots; field corn, grain, forage, and stover; cotton, undelinted seed; flax, seed; citrus fruit group; stone fruit group; grapes; tree nut group; hop, vine; peanut; peppermint, tops; rapeseed, seed; safflower, seed; sorghum, forage and stover; spearmint, tops; sugarcane, cane; sunflower seed; cucurbit vegetables group; fruiting vegetables group; and wheat, grain.

Tolerance Modifications:

Available data for alfalfa hay reflecting treatment at the maximum registered application rate indicate that the established tolerance for residues of trifluralin in/on

alfalfa hay should be increased to 2.0 ppm.

Several of the trifluralin tolerances established for general crop groups are obsolete and should be revoked concomitant with establishing tolerances on the appropriate crops and/or crop groups. The tolerance for "vegetable, root (exc. carrots)" should be revoked concomitant with establishing separate tolerances at 0.05 ppm on root and tuber vegetables (exc, carrots; crop group 1) and bulb vegetables (crop group 3). The tolerance for "vegetable, leafy" should be revoked concomitant with establishing separate tolerances at 0.05 ppm on celery, endive, leaves of root and tuber vegetables (crop group 2), and Brassica leafy vegetables (crop group 4). The tolerance for "vegetables, seed and pod" should be revoked concomitant with establishing separate tolerances at 0.05 ppm for okra and the legume vegetables (crop group 6). The tolerance for "legumes, forage" should be revoked concomitant with establishing a tolerance at 0.05 ppm for foliage of legume vegetables (crop group 7), and a separate tolerance for alfalfa forage at 3 ppm.

In addition, the established tolerance for "grain, crops, except corn, sweet and rice grain" is inappropriate. This tolerance should be revoked concomitant with establishing individual tolerances at 0.05 ppm for barley grain and sorghum grain. Separate (adequate) tolerances of 0.05 ppm already exist for corn and wheat grain, and sorghum grain residue data are available to support a 0.05 ppm tolerance. Residue data on wheat grain will be translated to support a 0.05 ppm tolerance on barley grain. The established tolerance for mung bean sprouts should be revoked as no registered uses exist for mung bean sprouts *per se*, and the established tolerance for upland cress should be revoked as there are no registered uses on this crop.

New Tolerances

Sufficient data are available to recommend establishing *new* tolerances for residues of trifluralin at 0.05 ppm in/on almond hulls, cotton gin byproducts, and mustard seeds. New tolerances will also need to be established for ruminant commodities at a level to be determined by the required feeding study.

Data Requirements

Additional field trial data or processing studies are required to support existing tolerances in/on the following commodities: barley, hay and straw; peppermint, oil; rapeseed, forage; spearmint, oil, and wheat forage, hay, and straw.

Based on the available poultry metabolism data, the Agency has concluded that there is no expectation of finite residues of trifluralin in poultry commodities. Therefore, tolerances are not required for eggs and fat, meat, and meat byproducts of poultry at this time. However, based on the reassessed tolerance for alfalfa forage (3 ppm) and hay (2 ppm), the estimate of *possible* dietary exposure of trifluralin to ruminants has

increased significantly. Therefore, in order to assess residue levels for tolerances, new metabolism and feeding studies in ruminants are now being required. Once these data are available, the need for tolerances for trifluralin in milk and in fat, meat, and meat byproducts of cattle, goats, horses, and sheep will be reassessed. The Agency continues to expect that finite residues of trifluralin will not occur in hog and poultry commodities since alfalfa is not a feed item for these non-ruminants.

Table 6. Tolerance Reassessment Summary for Trifluralin.			
Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct Commodity Definition
Tolerances listed under 40 CFR 180.207 (a):			
Alfalfa, hay	0.2	2.0	The available residue data support increasing the tolerance for hay to 2.0 ppm
Asparagus	0.05	0.05	
Barley, hay	0.05	TBD ¹	Additional wheat hay and straw data are required and will be translated to barley hay and straw
Barley, straw	0.05	TBD	
Bean, mung, sprouts	2.0	Revoke	No registered uses exist for mung bean sprouts <i>per se</i> .
Carrot, roots	1.0	1.0	
Corn, field, grain	0.05	0.05	
Corn, field, forage	0.05	0.05	
Corn, field, stover	0.05	0.05	
Cotton, undelinted seed	0.05	0.05	
Cress, upland	0.05	Revoke	No registered uses exist.
Flax, seed	0.05	0.05	Supported by residue data from rapeseed and sunflower
Fruit, citrus, group	0.05	0.05	<i>Fruit, citrus, group 10</i>
Fruit, stone, group	0.05	0.05	<i>Fruit, stone, group 12</i>
Grain, crops, except corn, sweet and rice grain	0.05	Revoke	The tolerance should be revoked concomitant with establishing separate tolerances for barley and sorghum grain.
Grape	0.05	0.05	
Hop	0.05	0.05	Supported by residue data from peppermint and spearmint, tops <i>Hop, dried cones</i>

Table 6. Tolerance Reassessment Summary for Trifluralin.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct Commodity Definition
Legume, forage	0.05	Revoke	The tolerance should be revoked concomitant with establishing (i) a tolerance for <i>Vegetable, foliage of legume, group 7</i> ; and (ii) a separate tolerance for alfalfa forage.
Nut, tree, group	0.05	0.05	<i>Nuts, tree, group 14</i>
Peanut	0.05	0.05	
Peppermint, tops	0.05	0.05	
Rapeseed, seed	0.05	0.05	
Safflower, seed	0.05	0.05	Supported by residue data from rapeseed and sunflower
Sorghum, forage	0.05	0.05	Supported by data on corn forage and stover
Sorghum, stover	0.05	0.05	<i>Sorghum, grain, forage and Sorghum, grain, stover</i>
Spearmint, tops	0.05	0.05	
Sugarcane, cane	0.05	0.05	
Sunflower, seed	0.05	0.05	
Vegetable, cucurbit, group	0.05	0.05	<i>Vegetable, cucurbit, group 9</i>
Vegetable, fruiting, group	0.05	0.05	<i>Vegetable, fruiting, group 8</i>
Vegetable, leafy	0.05	Revoke	The tolerance should be revoked concomitant with establishing (i) separate tolerances for celery and endive; (ii) a tolerance for <i>Vegetable, leaves of root and tuber, group 2</i> ; and (iii) a tolerance for <i>Vegetable, brassica, leafy, group 4</i> .
Vegetable, root (exc. carrots)	0.05	Revoke	The tolerance should be revoked concomitant with establishing (i) a tolerance for <i>Vegetable, root and tuber (except carrots), group 1</i> ; and (ii) a tolerance for <i>Vegetable, bulb, group 3</i> .
Vegetable, seed and pod	0.05	Revoke	The tolerance should be revoked concomitant with establishing (i) a tolerance for <i>Vegetable, legume, group 6</i> ; and (ii) a separate tolerance for okra.
Wheat, grain	0.05	0.05	
Wheat, straw	0.05	TBD	Additional data are required

Table 6. Tolerance Reassessment Summary for Trifluralin.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct Commodity Definition
Tolerances That Need To Be Proposed under 40 CFR 180.207:			
Alfalfa, forage	None	3.0	
Almonds, hulls	None	0.05	
Barley, grain	None	0.05	
Cattle, fat	None	TBD	Additional data are required
Cattle, kidney	None	TBD	Additional data are required
Cattle, liver	None	TBD	Additional data are required
Cattle, meat	None	TBD	Additional data are required
Cattle, meat byproducts	None	TBD	Additional data are required
Celery	None	0.05	
Cotton, gin byproducts	None	0.05	
Endive	None	0.05	
Goat, fat	None	TBD	Additional data are required
Goat, liver	None	TBD	Additional data are required
Goat, meat	None	TBD	Additional data are required
Goat, meat byproducts	None	TBD	Additional data are required
Horse, fat	None	TBD	Additional data are required
Horse, liver	None	TBD	Additional data are required
Horse, meat	None	TBD	Additional data are required
Horse, meat byproducts	None	TBD	Additional data are required
Milk	None	TBD	Additional data are required
Mustard, seed	None	0.05	
Okra	None	0.05	
Peanuts, hay	None	0.05	
Peppermint, oil	None	TBD	Additional data are required
Rapeseed, forage	None	TBD	Additional data are required
Sheep, fat	None	TBD	Additional data are required
Sheep, liver	None	TBD	Additional data are required
Sheep, meat	None	TBD	Additional data are required
Sheep, meat byproducts	None	TBD	Additional data are required
Sorghum, grain	None	0.05	
Spearmint oil	None	TBD	Additional data are required
Vegetable, brassica, leafy, group 4	None	0.05	
Vegetable, bulb, group 3	None	0.05	
Vegetable, foliage of legume, group 7	None	0.05	
Vegetable, leaves of root and tuber, group 2	None	0.05	
Vegetable, legume, group 6	None	0.05	
Vegetable, root and tuber (except carrots), group 1	None	0.05	

Table 6. Tolerance Reassessment Summary for Trifluralin.			
Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ <i>Correct Commodity Definition</i>
Wheat, forage	None	TBD	Additional data are required
Wheat, hay	None	TBD	

¹ TBD = To be determined. Reassessment of tolerance(s) cannot be made at this time because additional data are required.

Codex / International Harmonization

No maximum residue limits (MRLs) for trifluralin have been established or proposed by Codex for any agricultural commodity. Therefore, no compatibility questions exist with respect to U.S. tolerances.

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Agency Memoranda Citations

Table 7. Agency Memoranda Citations.						
Date	DP Barcode	CB No.	From	To	MRID Nos.	Subject
9/28/92	D179068	9991	B. Cropp-Kohligian	L. Rossi and W. Waldrop	42325001	Reregistration of Trifluralin. Sorghum Grain Processing Study.
2/04/93	None	None	R. Perfetti	L. Rossi and E. Saito	None	Animal Feeding Studies: Requirement Status Modification.
9/14/94	D207243	None	B. Cropp-Kohligian	L. Rossi and C. Childress	None	Trifluralin Reregistration. Clarification of magnitude of the residue sample storage information requirement.
7/21/95	D206342	14159	B. Cropp-Kohligian	L. Rossi and C. Childress	41661102	Trifluralin Reregistration. Confined Rotational Crop Study.
7/27/95	D215083	15507	B. Cropp-Kohligian	L. Rossi and C. Childress	43626901-43626944	Trifluralin Reregistration. Review of submitted test sample storage intervals/conditions and available storage stability data.
8/19/95	D216162	15689	B. Cropp-Kohligian	L. Rossi and C. Childress	43622001 and 43627801	Trifluralin Reregistration. Method Validation Data for the Determination of Trifluralin in/on Corn Grain, Forage, Fodder, and Silage.
10/20/95	None	None	E. Zager	L. Rossi	None	Trifluralin on Mint. Need for Food Additive Tolerances on Mint Oils
10/31/95	D218438	16049	B. Cropp-Kohligian	L. Rossi and C. Childress	43569601, 43569602	Trifluralin Reregistration. Alfalfa and Peanut Information/Data.
	D240093	None	Under review		44332301	Trifluralin Reregistration. Cotton Gin Byproduct Field Trails.
	D240693	None	Under review		44288801-44288804	Trifluralin Reregistration. Asparagus, Carrot, Grape, and Wheat Field Trial Bridging Data.
	D273840	None	Under review		44117801, 45125701, 45125702	Trifluralin Reregistration. Analytical Methodology for Alfalfa and Carrots, and Alfalfa Field Trials

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APPENDIX 1

Food/Feed Use Pattern Table for Trifluralin

Food/Feed Use Patterns Subject To Reregistration for Trifluralin (PC Code 036101) ¹.

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Alfalfa (established)					
Soil incorporated treatment Dormant or during the growing season (after a cutting) Ground or aerial equipment	10% G [62719-131]	2.0	Not specified (NS)	Not applicable (NA)	A 21-day PHI/PGI has been established.
Soil incorporated treatment Dormant, late dormant, or during the growing season (after a cutting) Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46]	1.0	1	NA	A 21-day PHI/PGI has been established. Application may be made alone or as a tank mix with other herbicides.
Broadcast Foliar (water incorporated) Dormant, late dormant, or during the growing season (after a cutting) Ground or aerial equipment	5 lb/gal EC [33660-31]	2.0	1	NA	A 21-day PHI/PGI has been established. A minimum of 0.5" of water (rainfall or overhead sprinkler) is required for activation. Application may be made alone or as a tank mix with other herbicides.
Asparagus (established)					
Soil incorporated treatment Dormant (before spear emergence) or postharvest (before fern development) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0 (single application) or 1.0 (split applications)	1 or 2	Not specified (NS)	
Soil incorporated treatment Before spear emergence Ground equipment	4 lb/gal EC [62719-97]	1.0	1	NA	

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Barley					
Soil incorporated treatment Fall, prior to spring planting Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [66222-46]	0.75	1	NA	Use limited to MN, ND, and SD.
Soil incorporated treatment Spring (preplant) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32]	0.5	1	NA	Use limited to MN, ND, and SD.
Soil incorporated treatment Spring (preplant) Ground or aerial equipment	[33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	Use limited to barley grown in MN, ND, and SD, used as cover crops or in the Acreage Conservation Reserve Program. Grazing is restricted.
Soil incorporated treatment Postplant, preemergence Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	
Soil incorporated treatment Summer fallow period (seeded the following spring) Ground or aerial equipment	10% G [62719-131]	1.0	1	NA	

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Brassica (Cole) leafy vegetables					
Soil incorporated treatment Preplant (direct seeded) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [33660-32]	0.75	1	NA	The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only.
Soil incorporated treatment Pre-transplant Ground or aerial equipment	[33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Use rate for broccoli, Brussels sprouts, cabbage and cauliflower transplants only. The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only.
Bulb vegetables (dry bulb and green onions)					
Soil incorporated treatment (directed spray) Postemergence at lay-by Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [66222-46]	0.63	1	NA	Use on dry bulb onions only. A 60-day PHI has been established.
Soil incorporated treatment (directed spray) Postemergence at lay-by Ground or aerial equipment	4 lb/gal EC [33660-32] [33660-33] 5 lb/gal EC [33660-31]	1.0	1	NA	Use on green onions only. A 60-day PHI has been established.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Carrots					
Soil incorporated treatment Preplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	
Soil incorporated treatment Preplant, at-plant, or postplant Ground equipment	4 lb/gal EC [62719-97]	1.0	1	NA	
Celery					
Soil incorporated treatment Preplant, at-plant, or postplant (direct seeded or transplant) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only.
Chicory (including endive)					
Soil incorporated treatment Preplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC	1.0	1	NA	

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations ³
Citrus fruits (including grapefruit, lemons, oranges, tangelos, and tangerines)					
Soil incorporated treatment Preplant (new plantings) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32]	1.0	1	NA	
Soil incorporated treatment (directed spray) Bearing and nonbearing established plantings Ground or aerial equipment	[33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0	1	NA	
Soil incorporated treatment Bearing and nonbearing established plantings Subsurface injection equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0	1	NA	Use limited to CA.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations ³
Corn, field					
Soil incorporated treatment (directed or over-the-top spray) Postemergence Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Application to sweet corn, popcorn, and corn grown for seed is prohibited. Application of the EC formulations (except EPA Reg No. 62719-250) may be made alone or as a tank mix with other herbicides. Do not apply after corn is 30" tall or within 6 weeks prior to harvesting forage, fodder, or silage.
Broadcast Foliar (water incorporated) Postemergence Ground or aerial equipment	4 lb/gal EC [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Application limited to coarse and medium soils. Application to sweet corn, popcorn, and corn grown for seed is prohibited. Application may be made alone or as a tank mix with other herbicides. Do not apply after corn is 30" tall or within 6 weeks prior to harvesting forage, fodder, or silage.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Cotton					
Soil incorporated treatment Preplant, postplant, or preemergence in spring Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Application of the EC formulations may be made alone or as a tank mix with other herbicides. Postplant application may be made from 4 true leaf stage up to layby. A 90-day PHI has been established.
Soil incorporated treatment Fall, prior to spring planting Ground or aerial equipment		1.25	1	NA	
Soil or water incorporated treatment Preplant, postplant, or preemergence Ground or aerial equipment		2.0	2	NS	Use rate for conservation tillage cotton only. Water incorporation should be made with a minimum of 0.75" of water. The maximum seasonal use rate is 2.0 lb ai/A. Postplant application may be made from 4 true leaf stage up to layby. A 90-day PHI has been established.
Soil incorporated treatment Spring (preplant) or fall Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0	2	NS	Use limited to all cotton producing states except AZ and CA for control of rhizome Johnsongrass. Two year treatment program which consists of a double rate application for two consecutive years.
Cucurbit vegetables					

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Soil incorporated treatment (directed spray) Postemergence Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Application may be made to plants in the 3 to 4 true leaf stage. The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only and does not specify a PHI. For all other formulations, a 30-day PHI is specified for all cucurbits except watermelon, which has a 60-day PHI.
Flax					
Soil incorporated treatment Fall (preplant) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Animal grazing on flax straw is prohibited after application of EPA Reg Nos. 33660-31, 33660-32, 33660-33, and 66222-46.
Grapes					
Soil incorporated treatment Preplant (new plantings) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0	1	NA	The maximum use rate for mist propagated grape rootings is 1.0 lb ai/A.
Soil incorporated treatment (directed spray) Bearing and nonbearing established plantings Ground or aerial equipment	[33660-33] [66222-46] 5 lb/gal EC [33660-31]	2.0	1	NA	A 60-day PHI has been established.
Soil incorporated treatment Bearing and nonbearing established plantings	4 lb/gal EC [62719-250] [33660-32]	2.0	1	NA	Use limited to CA.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Hops (established)					
Soil incorporated treatment Dormant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	
Legume vegetables (not including soybeans, listed separately)					
Soil incorporated treatment Spring (preplant) or fall prior to spring planting Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Use pattern for dry and succulent beans and southern peas. Fall application for southern peas not specified. Application of the EC formulations to dry and succulent beans may be made alone or as a tank mix with other herbicides.
Soil incorporated treatment Spring (preplant) or fall prior to spring planting Ground or aerial equipment	5 lb/gal EC [33660-31]	0.75	1	NA	Use pattern for guar, lima, mung, and snap beans and dry and English peas. Fall application may be made to dry and English peas only in ID, OR, and WA. The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be used only on green peas and applied using ground equipment only. Application of the EC formulations may be made alone or as a tank mix with other herbicides.
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC [62719-97]	1.0	1	NA	Use on southern peas only.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Lupine					
Soil incorporated treatment Preplant Ground or aerial equipment	4 lb/gal EC [66222-46]	1.0	1	NA	
Mint (established plantings of peppermint and spearmint)					
Soil incorporated treatment Dormant Ground or aerial equipment	4 lb/gal EC [66222-46]	0.75	1	NA	
Okra					
Soil incorporated treatment Preplant or postplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only.
Peanuts					
Soil incorporated treatment Preplant, at-plant, or postplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	Use limited to NM, OK, and TX. Application of the EC formulations may be made alone or as a tank mix with other herbicides.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Peppers (transplant only)					
Soil incorporated treatment Pre-transplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [AZ98000100] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only. Use of SLN No. AZ98000100 limited to AZ.
Potatoes					
Soil incorporated treatment Postplant, preemergence, immediately following drag-off, or after potato plants have fully emerged Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-97] [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Use prohibited in ME. Application of the EC formulations may be made alone or as a tank mix with other herbicides. The 4 lb/gal EC (EPA Reg. No. 62719-97) formulation may be applied using ground equipment only.
Soil incorporated treatment Split applications preplant and postplant after potato plants have fully emerged Ground or aerial equipment	4 lb/gal EC [62719-250] [66222-46]	0.375	2	NS	Use in ID, OR, and WA only.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Radishes					
Soil incorporated treatment Preplant Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	
Rapeseed (including canola and crambe)					
Soil incorporated treatment Spring (preplant) or fall Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Use prohibited in AK. The grazing or harvesting of treated crop for livestock forage is prohibited. The maximum rate is 0.8 lb ai/A for EPA Reg. Nos. 33660-32 and 33660-33 in MT.
Soil incorporated treatment Spring (preplant) or fall Ground or aerial equipment	4 lb/gal EC [33660-32] [33660-33]	0.8	1	NA	Application rate is for use in MT only. The grazing or harvesting of treated crop for livestock forage is prohibited.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Safflower					
Soil incorporated treatment Spring (preplant) or Fall Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.25	1	NA	In MT, the maximum rate is 1.0 lb ai/A for EPA Reg. Nos. 33660-31, 33660-32 and 33660-33.
Soil incorporated treatment Spring (preplant) or Fall Ground or aerial equipment	4 lb/gal EC [33660-32] [33660-33] 5 lb/gal EC [33660-31]	1.0	1	NA	Application rate is for use in MT only.
Sorghum					
Soil incorporated treatment (directed or over-the-top spray) Postemergence Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Application should be made when plant is 8-24" tall, but no taller. Application of the EC formulations (EPA Reg. Nos. 33660-31, 33660-32, and 33660-33) may be made alone or as a tank mix with other herbicides.
Soybeans					
Soil incorporated treatment Preplant Ground equipment	3.4 lb/gal EC [62719-222]	1.0	1	NA	A 85-day PHI is specified Do not graze or feed treated forage, hay or straw to livestock.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Soybeans - continued					
Soil incorporated treatment Spring (preplant) or Fall Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	1.25	1	NA	Application of the EC formulations may be made alone or as a tank mix with other herbicides. Maximum rate for fall application limited to AL, AR, northern FL, GA, LA, MS, southeastern MO (Bootheel), NC, OK, SC, TN, and TX.
Soil incorporated treatment Fall Ground or aerial equipment		1.5	1	NA	Use limited to soybeans grown under reduced or conservation tillage conditions.
Soil incorporated treatment Preplant Ground or aerial equipment	4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	1.5	1	NA	Use limited to LA for control of pigweed and seedling Johnsongrass, and to TX Gulf Coast Counties, or to charcoal soils in AR, LA, and MS.
Soil incorporated treatment (directed spray) Preplant Ground or aerial equipment		1.5	1	NA	
Soil incorporated treatment (directed spray) Layby Ground or aerial equipment		1.0	1	NA	
Soil incorporated treatment Spring (preplant) Ground or aerial equipment		2.0	2	NS	Use limited to AR, LA, MS, and TX for control of red rice. Two year treatment program which consists of a 2.0 lb ai/A application the first year followed by a 1.25 lb ai/A application the second.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations ³
Soil incorporated treatment Spring (preplant) or fall Ground or aerial equipment		2.0 or 1.0 (split application)	1 or 2	NS	Use limited to eastern U.S. and TX for control of rhizome Johnsongrass. Two year treatment program which consists of either a 2.0 lb ai/A application (spring or fall) or split applications (both spring and fall) made at 1.0 lb ai/A, each for two consecutive years.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Stone fruits (including apricots, nectarines, peaches, plums, and prunes)					
Soil incorporated treatment Preplant (new plantings) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32]	1.0	1	NA	
Soil incorporated treatment (directed spray) Bearing and nonbearing established plantings Ground or aerial equipment	[33660-33] [62719-250] 5 lb/gal EC [33660-31]	2.0	1	NA	
Soil incorporated treatment Bearing and nonbearing established plantings Subsurface injection equipment	4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	2.0	1	NA	Use limited to CA.
Sugar beets					
Soil incorporated treatment (over-the-top spray) Postemergence Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	0.75	1	NA	Application of the EC formulations may be made alone or as a tank mix with other herbicides.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Sugarcane					
Soil incorporated treatment Fall (postplant) and spring (preemergence or postemergence) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	2.0	2	NS	
Broadcast surface or soil directed application Postplant (plant cane) or postharvest (ratoon cane); postemergence (second and third applications) Ground or aerial equipment		4.0	3	NS	Use limited to HI. The second and third applications should be directed to the soil surface during early crop development. Postplant applications should not be made within 180 days of harvest.
Soil incorporated treatment Spring (preemergence or postemergence until layby) Ground or aerial equipment		2.0	1	NA	Use limited to LA and TX.
Sunflower					
Soil incorporated treatment Spring (preplant) or fall Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	1.0	1	NA	Application of the EC formulations may be made alone or as a tank mix with other herbicides. Use of EPA Reg. Nos. 33660-32 and 33660-33 limited to MN, ND, and SD.

Trifluralin Food/Feed Use Pattern Table (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Tomatoes					
Soil incorporated treatment (directed spray) Postemergence (at blocking or thinning for direct seeded plants), pre-transplant, or post-transplant Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	1.0	1	NA	
Soil incorporated treatment Pre-transplant Ground equipment	4 lb/gal EC [62719-97]	1.0	1	NA	
Tree nuts (including almonds, pecans, and walnuts)					
Soil incorporated treatment Preplant (new plantings) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [33660-32] [33660-33]	1.0	1	NA	
Soil incorporated treatment (directed spray) Bearing and nonbearing established plantings Ground or aerial equipment	[62719-250] 5 lb/gal EC [33660-31]	2.0	1	NA	
Soil incorporated treatment Bearing and nonbearing established plantings Subsurface injection equipment	4 lb/gal EC [33660-32] [33660-33] [62719-250] 5 lb/gal EC [33660-31]	2.0	1	NA	Use limited to CA.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Wheat (including durum, spring and winter wheat)					
Soil incorporated treatment Fall Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [66222-46]	0.75	1	NA	For use on spring seeded or durum wheat. Use of the 4 lb/gal EC formulations limited to MN, ND, and SD.
Soil incorporated treatment Preplant, Spring Ground or aerial equipment	10% G [62719-131]	0.4	1	NA	Use restricted to ND west of Hwy 3 and SD.
Soil incorporated treatment Postplant, preemergence Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	For use on spring seeded or durum wheat.
Soil incorporated treatment Summer fallow period (seeded the following spring) Ground or aerial equipment	10% G [62719-131]	1.0	1	NA	
Soil incorporated treatment Preplant (up to 3 weeks prior to planting or to fallow soil up to 4 months before planting) Ground or aerial equipment	10% G [62719-131] 4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	1.0	1	NA	Use limited to ID, OR, and WA on winter wheat.

Trifluralin Food/Feed Use Pattern Table (*continued*).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.]	Max. Single Application Rate (lb ai/A) ²	Max. # Apps.	Min. Retreatmen t Interval (Days)	Use Limitations ³
Wheat - continued					
Soil incorporated treatment Postplant, preemergence Ground or aerial equipment	4 lb/gal EC [62719-250] [33660-32] [33660-33] [66222-46] 5 lb/gal EC [33660-31]	0.75	1	NA	Use on winter wheat. Use of EPA Reg. Nos 33660-31 and 33660-32 limited to ID, OR, and WA.

¹ Use pattern table is based on the labels for the trifluralin end-use products (EPs) registered to the members of the Trifluralin Data Development Consortium (TDDC), which consists of Dow AgroSciences LLC, Agan Chemical Manufacturers Ltd. (Israel), and Industria Prodotti Chimici S.P.A. (I.Pi.Ci., Italy). A search of the Agency's Reference Files System (3/13/03) indicated that there are 7 trifluralin EPs with food/feed uses registered to members of the TDDC, six EC formulations and a G formulation.

² Maximum use rates for most crops are based on soil textural class (course, medium, or fine) and the % organic matter (OM).

³ Use of the 10% G (EPA Reg. No. 62719-131), the 3.4 lb/gal EC (EPA Reg. No. 621790-222), the 4 lb/gal ECs (EPA Reg. Nos. 62719-250, 33660-32, 33660-33, and 66222-46), and the 5 lb/gal EC (EPA Reg. No. 33660-31) in Pecos County and Reeves County, TX is prohibited. A 12-hour restricted entry interval (REI) has been established.

The following rotational crop restrictions have been established for the 10% G (EPA Reg. No. 62719-131) and the 4 lb/gal EC (EPA Reg. No. 62719-250) formulations: (i) for sugar beets, red beets, and spinach grown in AZ, CA, CO, ID, NV, NM, OR, UT, WA, and WY a 12-month plant-back interval (PBI) after spring application or 14-month PBI after fall application; if land has not been irrigated, an 18-month PBI after spring application or 20-month PBI; in other areas, sugar beets, red beets, and spinach may be planted 12 months after spring application or 14 months after fall application; (ii) for corn, oats, proso millet, sorghum (milo), and annual/perennial crops or grass mixtures grown in AZ, CA, CO, ID, NV, NM, OR, UT, WA, and WY a 12-month PBI after spring application or 14-month PBI after fall application; if land has not been irrigated, an 18-month PBI after spring application or 20-month PBI after fall application; for oats, proso millet, sorghum (milo), and annual/perennial crops or grass mixtures grown in MN, ND, and SD an 18-month PBI after spring application or 21-month PBI after fall application; for oats, proso millet, sorghum (milo), and annual/perennial grass crops or grass mixtures grown in KS, NE, OK, and TX in areas that receive <20 inches of rainfall or irrigation an 18-month PBI and in areas that receive >20 inches of rainfall or irrigation a 12-month PBI after spring application or 14-month PBI after fall application; (iii) for vegetable crops other than those listed on the label for use with preplant soil incorporated treatment a 5-PBI.

The following rotational crop restrictions have been established for the 4 and 5 lb/gal EC (EPA Reg. Nos. 33660-31, 33660-32, and 33660-33) formulations: (i) in MT, a 12-month PBI for late summer or fall applications for all crops except rapeseed, safflower, sunflower, or spring seeded barley; (ii) for corn, oats, sorghum (milo), sugar beets, red beets, and spinach grown in AZ, CA, CO, ID, NV, NM, OR, UT, WA, and WY a 12-month PBI after spring application or 14-month PBI after fall application; if land has not been irrigated, an 18-month PBI after spring application or 21-month PBI after fall application; (iii) for oats, sorghum (milo), millet, and annual and perennial grasses grown in MN, ND, and SD an 18-month PBI after spring application or 21-month PBI after fall application; (iv) for oats and sorghum (milo), millet, and annual and perennial grasses grown in KS, NE, OK, and TX in areas that receive <20 inches of rainfall or irrigation an 18-month PBI; (v) a 5-PBI for vegetable crops other than those listed on the label.

The following rotational crop restrictions have been established for the 4 lb/gal EC (EPA Reg. No. 66222-46) formulation: (i) for corn, oats (proso millet), sorghum (milo), sugar beets, red beets, and spinach grown in AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA, and WY a 12-month PBI after spring application or 14-month PBI after fall application; if land has not been irrigated, an 18-month PBI after spring application or 20-month PBI after fall application; (ii) for oats, sorghum (milo), millet, and annual and perennial grasses grown in MN, ND, and SD an 18-month PBI after spring application or 21-month PBI after fall application; (iii) for oats and sorghum (milo), millet, and annual and perennial grasses grown in KS, NE, OK, and TX in areas that receive <20 inches of rainfall or irrigation an 18-month PBI; and (iv) a 5-PBI for vegetable crops other than those listed on the label.

No rotation crop restrictions have been established for the 4 lb/gal EC (EPA Reg. Nos. 62719-97) formulation.