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

SEP 23 1993

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Trifluralin on Corn Forage, Fodder, and Silage; Alfalfa Forage, Seeds, and Hay; and Peanut Vines and Hay.
DP Barcode: D183215; CRBS No. 10673; MRID No.: 424660-01 thru 424660-10, 42472301, 42472302;

FROM: David J. Miller, SA HSO, US Public Health Service
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THRU: Edward Zager, Chief
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Attached is a review of a registrant's response to residue chemistry data requirements for the agricultural commodities corn forage, fodder, and silage; alfalfa forage, hay, and seeds; and peanut vines and hay. This information was reviewed by Acurex Corporation under the supervision of CBRS/HED. The data assessment has undergone secondary review in the branch and has been revised to reflect branch policies.

CBRS conclusions and recommendations are presented in the attached Acurex report.

cc: RF, SF, Rereg. F., Circ., Acurex, DJM.
RDI: LCheng:9/2/93; MMetzger 9/16/93; EZager:9/22/93.
EF: 9/22/93

TRIFLURALIN
(Chemical Code 036101)
(CBRS No. 10673; DP Barcode D183215)

TASK 3

Registrant's Response to Residue Chemistry Data Requirements

February 17, 1993

Contract No. 68-DO-0142

Submitted to:

U.S. Environmental Protection Agency
Arlington, VA 22202

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TRIFLURALIN

(Chemical Code 036101)

(CBRS No. 10673; DP Barcode D183215)

REGISTRANT'S RESPONSE TO RESIDUE CHEMISTRY REQUIREMENTS

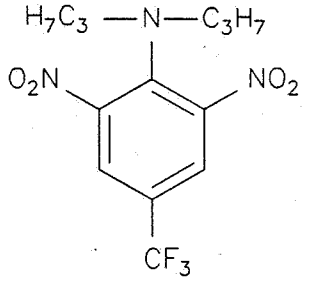
Task 3

BACKGROUND

The Trifluralin Guidance Document dated 4/87 required data depicting residues of trifluralin in or on corn forage, fodder, and silage, alfalfa forage, hay, and seeds, and peanut vines and hay. These data requirements were reiterated in the 10/91 Trifluralin Reregistration Standard Update. In response, DowElanco and the Trifluralin Data Development Consortium submitted data (1991-92; MRIDs 42466001 through -10, 42472301, and 42472302) depicting residues of trifluralin in or on the above commodities. These submissions are reviewed here to determine their adequacy in fulfilling residue chemistry data requirements. The Conclusions and Recommendations stated in this review pertain only to the magnitude of trifluralin residues in or on corn forage, fodder, and silage, alfalfa forage, hay, and seeds, and peanut vines and hay.

The nature of the residue in plants and animals is adequately understood. The residue of concern in both plants and animals is trifluralin per se. Adequate analytical methods are available for enforcing trifluralin tolerances in plants. These methods are listed in PAM, Vol. II as Methods II and III.

Tolerances for residues of trifluralin (α,α,α-trifluoro-2,6-dinitro-*N,N*-dipropyl-*p*-toluidine) in or on raw agricultural commodities are currently expressed in terms of trifluralin per se (40 CFR §180.207 and §185.5900). There are no Codex MRLs for residues of trifluralin; therefore, there is no question with respect to Codex/U.S. tolerance compatibility.



Trifluralin

CONCLUSIONS/RECOMMENDATIONS

1a. The residue study on corn forage, fodder, and silage is adequate pending submission of acceptable data validating the analytical method (method GRM92.11) at or below the established tolerance (0.05 ppm). Detected residues of trifluralin were 1.4-70 ppm in or on corn forage harvested the same day corn plants were treated with trifluralin at 1x the maximum registered rate. By 42 days posttreatment, residues in or on forage declined to <0.01 ppm. Residues of trifluralin were <0.01 ppm in or on corn silage and fodder harvested at 67-104 and 105-134 days posttreatment, respectively.

1b. The current label, by stating that trifluralin is to be applied at any time after the plant reaches an 8" height, is too open-ended. The registrant should propose a more restrictive label which assures at least a 6 week interval prior to harvesting forage, fodder, and silage.

1c. Once issues involving the analytical method for corn forage and fodder are resolved, data for corn forage and fodder will be translated to sorghum forage and fodder.

2a. The registrant has requested a large increase in the application rate and correspondingly the tolerance levels for alfalfa forage (from 0.05 to 1.0 ppm) and alfalfa hay (from 0.5 to 3.0 ppm). This use is sufficiently different from the registered use that a complete residue field trial data set is required reflecting the new use. To date, tests have been conducted in only four states (CA, NY, SD, and AZ).

2b. The submitted studies on alfalfa forage and hay are not adequate. Geographic representation is not sufficient, and storage temperatures were not reported. Additional tests should be conducted using trifluralin EC and granular formulations at the maximum intended labeled rates in separate tests in (i) ID, OR, or WA; (ii) MI; (iii) IL or OH; (iv) KS; (v) CO; and (vi) UT. A test using the granular formulation applied at 2 x 2 lb ai/A should be conducted in (i) ID, OR, or WA; (ii) the Northern Tier states (MN, MT, ND, SD, and WI) (iii) MI; (iv) IL or OH; (v) KS; (vi) CO; and (vii) UT. In addition, storage conditions for alfalfa samples from all tests must be reported.

2c. The submitted data indicate that trifluralin residues in or on alfalfa forage and hay are likely to exceed the established tolerances for legume forage (0.05 ppm) and alfalfa hay (0.2 ppm) following application of trifluralin at the proposed 2 lb ai/A per application rate. Once the requested alfalfa data have been submitted, the registrant must propose a tolerance for alfalfa forage and a revised tolerance for alfalfa hay. Recommendations for tolerances and any PHI for alfalfa forage and hay will be made after all the requested alfalfa residue data have been reviewed.

2d. The submitted data on alfalfa seed are adequate. Residues of trifluralin do not concentrate in seed obtained from alfalfa hay bearing measurable residues. No additional data are required on alfalfa seed.

2e. The registrant has submitted no data reflecting the current use on alfalfa as required in the Registration Standard and the Update. Since the data submitted for the revised use are also inadequate, the Agency currently has no adequate data reflecting any use pattern on alfalfa.

3. The residue study on peanut vines and hay is adequate. Residues of trifluralin were <0.01-0.016 ppm in or on peanut vines harvested 30-148 days following a preplant application of trifluralin at the maximum registered rate. Residues of trifluralin were <0.01-0.014 ppm in or on hay harvested at maturity (113-152 days posttreatment). No additional data are required for peanuts. The registrant should propose a tolerance for peanut vines and hay. The available data indicate that a tolerance of 0.05 ppm is appropriate for peanut vines and hay. In addition, the registrant should amend trifluralin labels to restrict the grazing or feeding of treated peanut vines to livestock within 30 days of treatment.

4a. The GC/electron capture detector (ECD) methods described in the current submissions, which are equivalent to method AM-AA-CA-R023-AA-755, are adequate for collecting data on residues of trifluralin in or on alfalfa forage, hay and seeds and peanut forage and hay.

4b. DowElanco method GRM92.11 is adequate for collecting data on residues of trifluralin in or on corn forage and fodder, pending submission of data from corn grain, forage, and fodder validating the method at or below the established tolerance (0.05 ppm).

5. The submitted storage stability data are adequate and indicate that trifluralin is stable at -20 °C for at least 221 days in corn forage, 197 days in corn silage, 350 days in alfalfa forage and hay, 175 days in alfalfa seed, 402 days in peanut forage, and 163 days in peanut hay. The available data indicate that trifluralin is stable in samples of corn forage, silage, and fodder, and peanut vines and hay stored for the intervals and conditions reflected in the current submissions. However, the adequacy of storage stability data in relation to the alfalfa residue data cannot be determined because storage temperatures for alfalfa residue samples were not reported. The registrant must report storage temperatures for alfalfa forage and hay samples in the current studies.

6. The proposal to increase the application rate to alfalfa by 2x and the concomitant proposal to increase the alfalfa forage and hay tolerances by 20x and 6x, respectively, triggers the requirement for studies regarding the nature of the residue in livestock,

magnitude of the residue in livestock, livestock commodity storage stability, and residue method(s) for analysis of livestock commodities.

Note to SRRD: The "(N)" designation should be deleted from all 40 CFR §180.207 entries. The current listing for "legumes, forage" is inappropriate and should be revised to reflect currently accepted crop groupings. Once tolerances are established for commodities previously included under "legumes, forage," this listing should be deleted from 40 CFR §180.207.

DETAILED CONSIDERATIONS

Residue Analytical Methods

In conjunction with the submitted residue studies, DowElanco and the Trifluralin Data Development Consortium (1991-92; MRIDs 42466009, 42472301, and 42472302) submitted descriptions of several related GC/ECD methods used to determine residues of trifluralin in or on corn forage, fodder, and silage, alfalfa forage, seeds, and hay, and peanut vines and hay.

In the alfalfa and peanut studies, residues of trifluralin were determined using methods AM-AA-CA-R146-AA-755 and AM-AA-CA-R023-AA-755, respectively. Method AM-AA-CA-R146-AA-755 is essentially the same as method AM-AA-CA-R023-AA-755, which was previously described in the Trifluralin Residue Chemistry Chapter dated 7/85 and is a modification of Method II in PAM, Vol II. In brief, residues in alfalfa and peanut samples (excluding oil and soapstock matrices) are extracted with methanol, partitioned into methylene chloride, and cleaned-up by Florisil column chromatography. Residues are determined by GC/ECD. The detection limit for the method is 0.01 ppm for alfalfa forage, seeds, and hay and peanut vines and hay. In the current alfalfa and peanut residue studies, control samples of alfalfa forage, hay and seeds, and peanut vines and hay were fortified with trifluralin at 0.01-1.0 ppm and were analyzed to validate the method. Method recoveries of trifluralin from alfalfa and peanut commodities are summarized in Table 1. Sample calculations and chromatograms were provided with each study.

In the corn residue study, residues of trifluralin in or on corn forage, silage, and fodder were determined using DowElanco Method GRM92.11, which is also described in a corn grain processing study (B. Kropp-Kohlligian, CBRS No. 10338, 2/8/93). Method GRM92.11 is a modification of method AM-AA-CA-R023-AA-755. In method GRM92.11, trifluralin residues are extracted with methanol, cleaned up using a reverse-phase (C18) solid phase extraction (SPE) cartridge, and further purified using a silica SPE cartridge. Residues are then determined by GC/ECD. The reported detection limit for the method is 0.01 ppm for

each corn commodity; however, data validating the 0.01 ppm detection limit have not been submitted on any corn commodity. Method recoveries of trifluralin from corn forage, fodder, and silage fortified at 0.05-0.2 ppm are summarized in Table 1. However, the lowest level of trifluralin (0.05 ppm) for which validation data are available comes from a single fortified sample of corn silage. Sample calculations and chromatograms were provided.

These data indicate that methods AM-AA-CA-R023-AA-755 and AM-AA-CA-R146-AA-755 are adequate for collecting data on residues of trifluralin in or on alfalfa forage, seeds, and hay and peanut vines and hay, respectively. Method GRM92.11 is adequate for collecting data on residues of trifluralin in or on corn forage and fodder, pending submission of data from corn grain, forage, and fodder validating the method at the or below the established tolerances of 0.05 ppm. The submission should include representative chromatograms from all treated commodities of interest as well as both chromatograms from spiked and control samples, integrator printouts of peak heights/areas, sample weights, extraction and injection volumes, standard curve equations, and sample concentration calculations. In addition, control and method blank chromatograms should be submitted to allow assessment of the method limits of detection and quantitation.

Table 1. Trifluralin method[a] recoveries from fortified corn forage, fodder, and silage, alfalfa forage, hay, and seeds, and peanut vines and hay samples.

Commodity		Fortification Level (ppm)	# of Samples	Percent Recovery
Corn	forage	0.2	12	75-90
	silage	0.05[b], 0.2	3	90-100
	fodder	0.083	3	96-103
Alfalfa	forage	0.01-1.0	24	70-103
	hay	0.01-1.0	24	92-109
	seeds	0.01-1.0	24	67-114
Peanut	vines	0.01-0.05	15	92-117
	hay	0.01-0.05	4	94-116

[a] Corn samples were analyzed using method GRM92.11, and alfalfa and peanut samples were analyzed using methods equivalent to AM-AA-CA-R023-AA-755.
[b] A single sample of silage was fortified at 0.05 ppm.

Storage Stability Data

In conjunction with the residue studies, DowElanco and the Trifluralin Data Development Consortium submitted data (1991-92; MRIDs 42466001 through -08, 42472301, and 42472302) depicting the stability of trifluralin in corn forage and silage, alfalfa forage, seeds, and hay, and peanut vines and hay stored at approximately -20 °C for various intervals. The recovery of trifluralin from fortified control samples (0.01 or 0.05 ppm) and the storage

intervals for actual residue samples are shown in Table 2. Data from 11 alfalfa hay samples analyzed on 6/27/91 are not included in the table because of the abnormally high recoveries (131-167%) associated with samples analyzed on that date. In addition, two fortified peanut hay samples analyzed after 77 and 86 days of storage had recoveries of 45% and 41%, respectively, and were considered aberrant.

The submitted storage stability data indicate that trifluralin is stable at -20 °C for at least 221 days in corn forage, 197 days in corn silage, 348 days in alfalfa forage and hay, 175 days in alfalfa seed, 402 days in peanut vines, and 163 days in peanut hay. These data adequately support the submitted residue data on corn fodder and silage, and peanut forage and hay. The submitted storage stability data do not support the residue data obtained from corn forage samples that were stored for up to 321 days prior to extraction and analysis. However, the 10/91 Reregistration Standard Update previously concluded that residues of trifluralin are stable at -20 °C for up to 554 days in wheat forage and straw, and these data can be used to support the maximum storage interval for corn forage in the current submission. In addition, the adequacy of the storage stability data in relation to the alfalfa residue data cannot be determined because storage temperatures for alfalfa residue samples were not reported. The registrant must report storage temperatures for alfalfa forage and hay samples in the current studies.

Table 2. Storage stability of trifluralin in fortified samples of corn forage and silage, alfalfa forage, seeds, and hay, and peanut vines and hay stored at approximately -20 °C, along with storage intervals of actual residue samples.

		Fortified Control Samples[a]			Residue Samples[b]
Commodity		Storage Interval (days)	# of Samples	% Recovery	Storage Interval (days)
Corn[c]	forage	192-221	11	81-110	252-321
	silage	12-197	6	69-100	129-185
	fodder[d]	-	-	-	149-172
Alfalfa	forage	4-348	98	59-116	9-238
	hay	0-356	64	71-120	15-210
	seed	175, 196	2	126, 68	135-155
Peanut[c]	vines	64-402	16	78-114	112-245
	hay	69, 163	2	95, 113	109-131

[a] Corn and alfalfa control samples were fortified with trifluralin at 0.1 ppm, and peanut control samples were fortified at 0.05 ppm.
[b] Residue samples were stored at ≤-6 °C.
[c] Corn and peanut data corrected for concurrent method recoveries if recoveries were <100%.
[d] Storage stability data were not provided.

Magnitude of the Residue in Plants

Trifluralin use directions for the use patterns discussed below were obtained from the following DowElanco trifluralin products: 4 lb/gal EC (EPA Reg. Nos. 62719-93 and -116), 5 lb/gal EC (62719-118), 10% G (EPA Reg. No. 62719-131), and a 80% dry formulation (EPA Reg. No. 62719-216).

Corn forage and fodder. Tolerances of 0.05 (N) ppm have been established for residues of trifluralin in or on corn forage and fodder, excluding popcorn (40 CFR §180.207). A REFs search dated 10/8/92 of DowElanco's trifluralin labels indicates that trifluralin (formulated as a 4 or 5 lb/gal EC, 10% G, and an undetermined 80% dry formulation) is currently registered for use on corn. Trifluralin can be applied to corn as an over-the-top or directed application at 0.38-1 lb ai/A, depending on soil type, when corn plants are at least 8 inches tall (2nd true leaf stage). Labels do not specify a maximum growth stage after which trifluralin should not be applied. Trifluralin is incorporated into the soil at or shortly after application.

DowElanco and the Trifluralin Data Development Consortium submitted data (1992; MRID 42472301) from three tests conducted in IA(1), IL(1), and OH(1) depicting trifluralin residues in or on corn forage, silage, and fodder harvested from corn plants treated with trifluralin (4 lb/gal EC) at 1 lb ai/A (1x) as an over-the-top postemergence application when plants were 8-15 inches tall (four- to six-leaf stage). Each test site consisted of a control and treated plot. Corn forage was sampled on day 0 and at 14, 28, and 42 days posttreatment, silage was sampled at 67-104 days posttreatment (R5-R6 stage), and fodder was sampled at 105-134 days posttreatment. For each commodity at each interval, a single control and three treated samples were harvested and immediately frozen. Prior to extraction and analysis, samples were stored at $\leq$-6 °C for the intervals indicated in Table 2. Trifluralin residues in or on corn forage, silage, and fodder were determined using method GRM92.11.

Residues of trifluralin in or on corn forage, silage, and fodder are summarized in Table 3. On the day of application, detected residues of trifluralin in or on corn forage were 1.4-70 ppm. By 42 days posttreatment, residues in or on forage declined to $<$0.01 ppm. Residues in or on silage and fodder harvested at 67-134 days posttreatment were also nondetectable ($<$0.01 ppm). Apparent residues of trifluralin were nondetectable ($<$0.01 ppm) in or on 12 control samples of forage, three control samples of silage, and three control samples of fodder.

Table 3. Trifluralin residues in or on corn forage, silage, and fodder harvested from corn treated with trifluralin at 1 lb ai/A (1x) as an over-the-top postemergence broadcast application to corn plants 8-15 inches in height.

Commodity	Posttreatment Interval (days)	Residues of Trifluralin (ppm)[a]		
		IA	IL	OH
Corn forage	0	3.4-3.8	<0.01-1.9	42-70
	14	<0.01[b]	0.01-0.04	0.24-1.7
	28	<0.01	<0.01	0.23-0.69
	42	<0.01	<0.01	<0.01
Corn silage	67-104	<0.01	<0.01	<0.01
Corn fodder	105-134	<0.01	<0.01	<0.01

[a] Corrected for method recoveries of <100%.
[b] The reported limit of detection for each commodity is 0.01 ppm; however, the method was validated at 0.2 ppm for forage and 0.083 ppm for fodder.

Geographic representation is adequate. The test states of IA(20%), IL(17%), and OH(5%) accounted for approximately 42% of the U.S. field corn production in 1990 (Agricultural Statistics, 1990, p. 33) and adequately represent the major U.S. corn growing region. In addition, the Agency (S. Willett, No CBRS No., 10/17/89) previously concluded that three residue trials conducted on field corn in IA, IL, and OH would be adequate.

The trifluralin residue study on corn forage, fodder, and silage is adequate pending submission of acceptable data validating the analytical method (method GRM92.11) at or below the established 0.05 ppm tolerance level. The data indicate that trifluralin residues are not likely to exceed the established tolerances of 0.05 ppm in or on corn fodder harvested at maturity and forage harvested 42 days (6 weeks) following an over-the-top postemergence application of trifluralin at 1x the maximum label rate. Residues are also not likely to exceed 0.05 ppm in or on silage harvested at least 67 days posttreatment.

The current label, by stating that trifluralin is to be applied at any time after the plant reaches an 8" height, is too open-ended. The registrant should propose a more restrictive label which assures at least a 6 week interval prior to harvesting forage and fodder and for silage.

As indicated in the 10/91 Trifluralin Reregistration Standard Update, these data on corn forage and fodder will be translated to fulfill the requirement for residue data on sorghum forage and fodder.

Alfalfa forage and hay. Tolerances of 0.05 (N) ppm and 0.2 (N) ppm have been established for residues of trifluralin per se in or on legume forage and alfalfa hay, respectively (40 CFR §180.207). Trifluralin (formulated as a 4 or 5 lb/gal EC and an undetermined 80% dry formulation) is currently registered for application to established alfalfa fields during dormancy, semi-dormancy, or during the growing season immediately following cutting. Trifluralin can be applied at 0.75-1 lb ai/A as a broadcast surface application using aerial or ground equipment and is incorporated into the soil mechanically or by rainfall or irrigation. Alfalfa may not be cut or grazed within 21 days of treatment, and no more than 2 lb ai/A may be applied during a single growing season; however, the label for the 10% G formulation does not list a PHI for grazing or feeding of treated forage or a maximum seasonal application rate.

The Trifluralin Guidance Document (4/87) required data depicting residues in or on alfalfa forage and hay (dried to a 10% water content) harvested at regular intervals following a single postemergence application to established alfalfa with G and EC formulations at 1 lb ai/A, in separate tests. Tests were required in the major U.S. alfalfa production regions, CA, MN, and PA or NY. The 10/91 Reregistration Standard Update reviewed older data on alfalfa hay that was not included in the 4/87 Guidance Document, but concluded that the data did not adequately fulfill the data requirements from the Guidance Document.

In a summary (1992; MRID 42466010) accompanying the submitted alfalfa studies (1992; MRIDs 42466001 through 42466008), DowElanco and the Trifluralin Data Development Consortium indicated that they intend to support a maximum single application rate of 2 lb ai/A for both EC and G trifluralin formulations and support the use of a second application at up to 2 lb ai/A for the G formulation. In the studies discussed below the registrant's intended use rates are considered the maximum application rate rather than the current label rates. The registrant also indicated that the increased label rates would require increases in tolerances for trifluralin residues in or on alfalfa hay and forage. The registrant stated that with a 14-day posttreatment restriction on the grazing or cutting of treated alfalfa, the submitted data support tolerances of 3 and 1 ppm for alfalfa hay and forage, respectively. To support the EC formulations, DowElanco and the Trifluralin Data Development Consortium submitted data (1992; MRIDs 42466003, 42466006, and 42466007) from six tests conducted in CA(2), NY(2), and SD(2) depicting residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following a broadcast over-the-top spray of trifluralin (4 lb/gal EC) at 2 lb ai/A (1x) using ground equipment at 25 gal/A. At each location, trifluralin was applied to actively growing alfalfa (6-12 inches tall) and dormant (NY and SD) or semidormant (CA) alfalfa. The two tests at each site shared a common control plot. In each test, samples of forage were collected at regular intervals between 0-47 days posttreatment, prior to the first harvest of hay. Subsequently, forage or hay samples were collected at regular intervals up to 119-150 days posttreatment. A single sample was collected from each plot at each sampling interval. Three harvests of hay were obtained at the NY and SD locations, and four hay harvests were obtained from CA. After cutting, hay samples were dried in the field for 1-4 days prior to sampling. Samples were immediately frozen and stored at an unspecified temperature for 9-238 days prior to extraction and

analysis. Residues of trifluralin in or on alfalfa forage and hay were determined using a method equivalent to method AM-AA-CA-R023-AA-755. Concurrent method recoveries from 32 control samples of forage and 12 control samples of hay each fortified at 0.1 ppm were 88-107% and 71-110%, respectively.

Residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following a single broadcast application of trifluralin (4 lb/gal EC) are summarized in Table 4. Residues of trifluralin were 27-111 ppm in or on forage immediately following treatment (day 0) of actively growing alfalfa and were 0.81-1.6 ppm in or on forage harvested 6-9 days following treatment of semidormant or dormant alfalfa. By 47 days posttreatment, trifluralin residues were $\leq$0.017 ppm in or on forage harvested from alfalfa treated while dormant or actively growing. From an application at either growth stage, trifluralin residues were $<$0.01-0.039 ppm in or on the first cutting of alfalfa hay harvested at 31-54 days posttreatment, and ranged from $<$0.01 to 0.01 ppm in or on hay from all subsequent cuttings.

To support the proposed use pattern for G formulations, DowElanco and the Trifluralin Data Development Consortium submitted data (1992; MRIDs 42466001, 42466002, and 42466004) from six tests conducted in CA(2), NY(2), and SD(2) depicting residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following broadcast application(s) of trifluralin (10% G) at 2 lb ai/A (1x the maximum single application rate).

In tests conducted in CA, the first application was applied at the start of the growing season to semidormant and actively growing alfalfa plants (6-12 inches tall) and the second application was made 60 days later to alfalfa stubble following the first hay harvest, for a seasonal application rate of 4 lb ai/A (1x). In tests conducted in NY, the first application was applied at the start of the growing season to dormant and actively growing alfalfa plants (3-6 inches tall), and the second application was made 93-102 days later to alfalfa stubble following the second hay harvest, for a seasonal application rate of 4 lb ai/A (1x). In the SD tests, trifluralin was applied only once at the start of the growing season to dormant and actively growing alfalfa plants (3-6 inches tall) for a total seasonal application of 2 lb ai/A (0.5x). Trifluralin was incorporated by irrigation at each test site, and the two treatments at each site shared a common control plot.

Samples of forage were collected at regular intervals throughout each study, and hay was harvested in accordance with normal agricultural practices. A single sample of forage or hay was collected from each plot at each sampling interval. Three harvests of hay were obtained at the NY and SD locations, and four hay harvests were obtained from CA. After cutting, hay samples were dried in the field for 1-4 days prior to sampling. Samples were immediately frozen and stored at an unspecified temperature for 9-204 days prior to extraction and analysis. Residues of trifluralin in or on alfalfa forage and hay were determined using a method equivalent to method AM-AA-CA-R023-AA-755. Concurrent

method recoveries from 33 control samples of forage and 12 control samples of hay each fortified at 0.1 ppm were 73-105% and 71-105%, respectively.

Residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following broadcast application(s) of trifluralin (10% G) at 2 lb ai/A are summarized in Table 5. Within 13-17 days of the first application of trifluralin (10% G) at 2 lb ai/A to semidormant, dormant, or actively growing alfalfa, residues of trifluralin were 0.138-0.850 ppm in or on forage. Trifluralin residues in or on hay (10% moisture content) harvested 31-54 days posttreatment were 0.02-0.34 ppm from application to dormant, semidormant, or actively growing alfalfa fields. Residues of trifluralin were 0.055-0.096 ppm in or on forage harvested 10-12 days following the second application of trifluralin to alfalfa stubble in CA and NY, and declined in all subsequent forage samples. Residues of trifluralin were 0.045-0.14 ppm in or on the first harvest of hay taken (29-48 days posttreatment) after the second application.

Table 4. Residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following a broadcast application of trifluralin (4 lb/gal EC) at 2 lb ai/A to dormant, semidormant, and actively growing alfalfa.

		Residues of Trifluralin (ppm)[a]					
		CA		NY		SD	
Commodity	Posttreatment Interval (days)	semidormant[b]	active growth	dormant	active growth	dormant	active growth
Forage	0	-	27.1	-	111, 104[c]	-	33.4, 32.8[c]
	6-9	-	-	0.806	0.301	1.60, 1.56[c]	-
	13-17	0.303	0.159	0.259	0.056	-	0.091
	20-24	0.062	0.071	0.120	-	0.102	<0.01
	29-36	0.014	0.032	-	-	0.011	-
	43-47	<0.01, 0.017	0.01, 0.016	-	-	-	-
	58-142[d]	<0.01-0.013	<0.01	<0.01	<0.01	<0.01	<0.01
Hay	31-54[e]	0.030	0.030	0.028	0.039	<0.01	0.011
	70-150[f]	<0.01-0.01	<0.01	<0.01	<0.01	<0.01	<0.01

[a] Residues in or on forage are not corrected for method recovery; whereas, residues in hay are corrected to reflect a 10% moisture level in hay and concurrent method recoveries.
[b] Condition of alfalfa field at time of treatment.
[c] Duplicate analysis of a single sample.
[d] Between 58-142 days posttreatment, 6-7 forage samples were collected and analyzed from each test.
[e] First cutting of hay after treatment.
[f] Data include samples from the 2nd through the 4th cuttings of hay from CA and the 2nd and 3rd cuttings of hay from NY and SD.

Table 5. Residues of trifluralin in or on alfalfa forage and hay harvested at regular intervals following one or two broadcast applications of trifluralin (10% G) each at 2 lb ai/A to dormant, semidormant, and actively growing alfalfa.

			Residues of Trifluralin (ppm)[a]					
			CA		NY		SD	
Commodity	Application Rate	Posttreatment Interval (days)	semidormant[b]	active growth	dormant	active growth	dormant	active growth
Forage	2 lb ai/A	0	-	<0.01	-	4.15	-	1.90
		6-9	-	-	0.272	3.75	2.26	-
		13-17	0.400	0.850	0.138	0.495	-	0.150
		20-24	0.134	0.770	0.046	-	0.044	0.036
		29-36	0.061	0.496	-	-	0.010	-
		43-47	0.043, 0.033	0.082, 0.098	-	-	-	-
		58-69	-	-	0.016	0.031, 0.053	<0.01 (2)	<0.01 (3)
		73-125	-	-	<0.01, 0.047	0.011	<0.01 (5)	<0.01 (4)
	2 x 2 lb ai/A[c]	4	0.376	0.784	-	-	-	-
		10-12	0.072	0.055	0.085	0.096	-	-
		17-26	0.084	0.024	0.040, 0.053	0.077, 0.024	-	-
		42-49	0.019, 0.016	0.019, 0.015	-	-	-	-
		68	0.016	0.013	-	-	-	-
		76-82[d]	<0.01	<0.01	-	-	-	-
Hay	2 lb ai/A	31-54	0.34	0.23	0.14	0.34	0.02	0.02
		70-113	-	-	0.036	0.038	<0.01 (2)	<0.01 (2)
	2 x 2 lb ai/A[c]	29-48	0.14	0.13	0.071	0.045	-	-
		59	0.05	0.04	-	-	-	-
		90	0.02	<0.01	-	-	-	-

[a] Residues in or on forage are not corrected for method recovery; whereas, residues in hay are corrected by the registrant to reflect a 10% moisture level in hay and daily method recoveries.

[b] Condition of alfalfa field at time of the first application.

[c] A second application of trifluralin (10% G) was applied to stubble immediately following the first hay harvest in CA and the second hay harvest in NY.

[d] Two forage samples were harvested between 76-82 days posttreatment from each test in CA.

DowElanco and the Trifluralin Data Development Consortium also submitted data (1992; MRID 42466008) from four tests conducted in AZ(1) and CA(3) depicting residues of trifluralin in or on alfalfa hay harvested at normal harvest intervals following two broadcast applications of trifluralin (10% G) at 2 lb ai/A (1x) for a seasonal application rate of 4 lb ai/A (1x). The first application was applied at the start of the growing season to semidormant or actively growing alfalfa plants (5-12 inches tall), and the second application was applied 60-87 days later to alfalfa stubble following the second hay harvest. Each test consisted of a control and treated plot. Hay was harvested at 25-45 day intervals in accordance with normal agricultural practices and was dried in the field for 1-4 days prior to sampling. Six or eight harvests of hay were obtained from each location, and forage samples were collected at termination of two of the studies in CA. After sampling, hay and forage were immediately frozen and stored at an unspecified temperature for 15-210 days prior to extraction and analysis. Residues of trifluralin in or on alfalfa hay and forage were determined using a method equivalent to method AM-AA-CA-R023-AA-755. A single sample was analyzed from each treatment, harvest interval, and test site.

Residues of trifluralin in or on hay harvested at normal harvest intervals following repeat applications of trifluralin (10% G), each at 2 lb ai/A, at the beginning of the growing season and again after the second cutting of hay are summarized in Table 6. Residues are corrected for daily method recoveries (92-110%) and to reflect a 10% moisture level in the hay. Following the first trifluralin application, residues of trifluralin were 0.22-2.6 ppm in or on hay from the first cutting and declined to 0.03-0.19 ppm by the second cutting of hay. Following the repeat application to stubble remaining after the second cutting, residues were 0.15-0.27 ppm in the subsequent cutting of hay (22-29 days posttreatment) and were $\leq$0.06 ppm in hay harvested thereafter. Trifluralin residues were nondetectable ($<$0.01 ppm) in or on the two forage samples collected at 173 days following the second trifluralin treatment.

Table 6. Residues of trifluralin in or on hay following two broadcast applications of trifluralin (10% G) each at 2 lb ai/A, first to semidormant and actively growing alfalfa at the start of the growing season, and again to alfalfa stubble after the second hay harvest.

Alfalfa Hay	Posttreatment Interval (days)[a]	# of Samples	Residues of Trifluralin (ppm)[b]
1st cutting	20-47	4	0.22-2.6
2nd cutting[c]	54-81	4	0.03-0.19
3rd cutting	22-29	4	0.15-0.27
4th cutting	54-66	4	0.01-0.06
5th cutting	83-103	4	<0.01-0.02
6th cutting	111-148	4	<0.01
7th & 8th cuttings	139, 178	2	<0.01

[a] Number of days following the last application of trifluralin.
[b] Residue values were corrected by the registrant for daily method recoveries (92-110%) and to reflect a 10% moisture content in the hay.
[c] The second application of trifluralin was applied following the second hay harvest.

Geographic representation is not adequate. In 1990, the test states of AZ(1.6%), CA(8.4%), NY(2.6%), and SD(4.5%) accounted for approximately 17% of the U.S. production of alfalfa and represent the neighboring alfalfa growing regions (IA, MN, MT, ND, NE, NM, NY, PA, WI, and WY) that accounted for an additional 43% of the 1990 production (Agricultural Statistics, 1991, p. 231). However, no data on the EC or G formulations are available from the Pacific Northwest Region (ID, OR, and WA), which accounted for 9% of the 1990 U.S. alfalfa production. In addition, data representing the 2+2 lb ai/A use pattern of the G formulation are not available from the Northern Tier States (MN, MT, ND, SD, and WI) nor from ID, OR or WA; nor MI, IL or OH; nor KS, CO, and UT. A complete data base for alfalfa is necessary because this use pattern for trifluralin results in significant residues in RACs and because the increased tolerances suggested by the registrant (1 ppm in or on forage; 3 ppm in or on hay) will result in a major additional dietary burden for livestock.

The submitted data for both the EC and G trifluralin formulations indicate that residues of trifluralin can exceed the established tolerance for legume forage (0.05 ppm) in or on alfalfa forage harvested up to the first hay cutting following treatment of dormant, semidormant, and actively growing alfalfa fields with trifluralin (EC and G) at 2 lb ai/A (1x). Data on the G formulation also indicate that residues of trifluralin can exceed the established tolerance for alfalfa hay (0.2 ppm) in or on the first cutting of alfalfa hay following treatment with trifluralin at 2 lb ai/A (1x).

The trifluralin residue studies on alfalfa forage and hay are not adequate. Geographic representation is not sufficient and storage temperatures were not reported. Additional tests should be conducted using trifluralin EC and G formulations at the maximum intended labeled rates in separate tests in (i) ID, OR or WA; (ii) MI; (iii) IL or OH (iv) KS; (v) CO; and (vi) UT, and tests using the G formulation applied at 2+2 lb ai/A should be conducted in (i) the Northern Tier States (MN, MT, ND, SD, and WI) (ii) ID, OR or WA; (iii) MI; (iv) IL or OH; (v) KS; (vi) CO; and (vii) UT.[1]. In addition, storage conditions for alfalfa samples from all tests must be reported. Once the required data have been submitted, the registrant must propose a tolerance for alfalfa forage and a revised tolerance for alfalfa hay, along with any label restrictions. Recommendations for tolerances and PHIs for forage and hay will be made after all the requested alfalfa residue data have been reviewed.

Alfalfa seed. DowElanco and the Trifluralin Data Development Consortium submitted data (1992; MRID 42466005) from two tests conducted in CA(1) and SD(1) depicting residues of trifluralin in or on hay and seed harvested at normal maturity following a broadcast over-the-top spray of trifluralin (4 lb/gal EC) at 10 lb ai/A (5x). Trifluralin was applied to actively growing alfalfa (6 inches tall) in CA and to alfalfa stubble 2 days after cutting in SD. Each test site consisted of a control and treated plot. The alfalfa was cut 68-69 days posttreatment, and seed samples were obtained by combining the cured hay. At each test site, single control and treated samples of each commodity were harvested and immediately frozen. Samples of hay and seed were stored frozen at an unspecified temperature for 56-159 days prior to extraction and analysis. Trifluralin residues in or on hay, seed, and combined hay were determined using a method equivalent to method AM-AA-CA-R023-AA-755. In addition to GC/ECD analysis, residues were confirmed by GC/MS analysis. Residue values for hay samples were corrected to reflect a 10% moisture level in the hay.

In the CA test, residues of trifluralin were <0.01 ppm in or on alfalfa hay and seeds harvested at normal maturity (68 days posttreatment) following a treatment with trifluralin at 5x the maximum registered rate. In the SD test, residues of trifluralin in or on treated alfalfa hay, seed, and combined hay were 0.026, 0.018, and 0.017 ppm. Apparent residues of trifluralin were nondetectable (<0.01 ppm) in or on control samples of hay and seeds, with one exception. Apparent residues of trifluralin were 0.018 ppm in or on the control seed sample from SD. No additional data on residues of trifluralin in or on alfalfa seed are required. Residues of trifluralin did not concentrate in seed obtained from treated hay bearing measurable weathered residues.

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[1] The registrant is requesting that tolerances be established at 3 and 1 ppm for alfalfa hay and forage, respectively. This represents a new use and an increase in the tolerance for hay and forage by factors of 6x and 20x, respectively, and would be by far the highest trifluralin tolerance levels established for any agricultural commodity. The registrant is also doubling the application rates. CBRS is interested in gauging the variability in expected trifluralin residue concentrations, and is thus requiring data from the states discussed above.

Peanut vines and hay. A tolerance of 0.05 (N) ppm has been established for trifluralin residues in or on peanuts and 0.1 ppm in or on peanut hulls (40 CFR §180.207); however, no tolerance has been established for trifluralin residues in or on peanut vine and/or peanut hay. A REFs search, dated 10/8/92, of DowElanco's trifluralin labels indicates that trifluralin (formulated as a 4 or 5 lb/gal EC, 10% G, and an undetermined 80% dry formulation) is currently registered for use on peanuts. Trifluralin can be applied to peanuts as a soil incorporated, broadcast preplant or preemergence application at 0.5-0.75 lb ai/A, depending on soil type. No PHI is listed for peanuts.

DowElanco and the Trifluralin Data Development Consortium submitted data (1992; MRID 42472302) from three tests conducted in FL(1), GA(1), and TX(1) depicting trifluralin residues in or on peanut vines and hay harvested at various intervals following a preplant broadcast application of trifluralin (4 lb/gal EC) at 0.75 lb ai/A (1x). Peanuts were planted immediately following trifluralin application. Each test site consisted of a control and treated plot. Vines were sampled at 30, 60, and 90 days posttreatment, and at digging (109-148 days posttreatment), and hay was sampled at threshing (113-152 days posttreatment). Single control samples and three treated samples of vines and hay were collected from each test site at each interval and were immediately frozen. Peanut vine and hay samples were stored at $\leq$-18 °C for 78-114 and 95-113 days, respectively, prior to extraction and analysis. Trifluralin residues in or on peanut vines and hay were determined using method AM-AA-CA-R023-AA-755.

Residues of trifluralin were nondetectable (<0.01 ppm) in or on 35 vine samples harvested 30-148 days following a preplant incorporated application of trifluralin at 1x the maximum registered rate. Only one vine sample, harvested at 30 days posttreatment from FL, had detectable (0.016 ppm) residues of trifluralin. Residues of trifluralin in or on peanut hay harvested 113-152 days posttreatment were nondetectable (<0.01 ppm) in seven samples and 0.014 and 0.01 ppm in two samples. Apparent residues of trifluralin were nondetectable (<0.01 ppm) in or on 15 control samples of vines and six control samples of hay.

Geographic representation is adequate. The test states of FL(6%), GA(37%), and TX(15%) accounted for approximately 58% of the U.S. peanut production during 1990 and adequately represent the major peanut growing regions of the U.S. (Agricultural Statistics, 1991, p. 119).

The trifluralin residue study on peanut vines and hay is adequate. The data indicate that trifluralin residues in or on vines harvested $\geq$30 days following a 1x application of trifluralin are not likely to exceed the established tolerance of 0.05 ppm for legume forage. The data also indicate that residues of trifluralin in or on peanut hay harvested at maturity are not likely to exceed 0.05 ppm. No additional data are required on peanuts. The registrant should propose a tolerance for residues of trifluralin in or on peanut vines and hay. The available data indicate that a tolerance of 0.05 ppm is appropriate. In addition, the registrant should amend trifluralin labels to restrict the grazing or feeding of treated peanut vines to livestock within 30 days of treatment.

References

Citations for the MRID documents referenced in this review are presented below. Submissions reviewed in this document are indicated below.

42466001 West, S.; Ervick, D. (1992) 1991 Trifluralin Residue Study on Alfalfa Forage and Hay Following Applications of Treflan TR-10 (10G) in South Dakota: Lab Project Number: RES91035. Unpublished study prepared by DowElanco. 25 p.

42466002 West, S.; Ervick, D. (1992) 1991 Trifluralin Residue Study on Alfalfa Forage and Hay Following Applications of Treflan TR-10 (10G) in New York: Lab Project Number: AAC9026. Unpublished study prepared by DowElanco. 25 p.

42466003 West, S.; Ervick, D. (1992) 1991 Trifluralin Residue Study on Alfalfa Forage and Hay Following a Single Application of Treflan EC in South Dakota: Lab Project Number: RES91034. Unpublished study prepared by DowElanco. 25 p.

42466004 West, S.; Ervick, D. (1992) Trifluralin Residue Study on Alfalfa Forage and Hay Following Two Applications of Treflan TR-10 (10G) California: Lab Project Number: AAC9022. Unpublished study prepared by DowElanco. 29 p.

42466005 West, S.; Ervick, D. (1992) Trifluralin Residue Study on Seed and Hay Produced from Alfalfa Treated with Treflan EC: Lab Project Number: AAC9029.z Unpublished study prepared by DowElanco. 32 p.

42466006 West, S.; Ervick, D. (1992) Trifluralin Residue Study on Alfalfa Forage and Hay Following Application of Treflan EC Herbicide to Dormant and New Growth Alfalfa in New York: Lab Project Number: AAC9027. Unpublished study prepared by DowElanco. 25 p.

42466007 West, S.; Ervick, D. (1992) Trifluralin Residue Study on Alfalfa Forage and Hay Following a Single Application of Treflan EC in California: Lab Project Number: AAC9024. Unpublished study prepared by DowElanco. 25 p.

42466008 West, S.; Ervick, D. (1992) Trifluralin Residue Study on Alfalfa Hay from Arizona and California Following Two Applications of Treflan TR-10 Granules Herbicide: Lab Project Number: AAC9021. Unpublished study prepared by DowElanco. 38 p.

42466009 Fisher, S.; Rutherford, B. (1991) Determination of Trifluralin in Alfalfa: Lab Project Number: AM-AA-CA-R146-AA-755. Unpublished study prepared by DowElanco. 14 p.

42466010 Day, E. (1992) Summary of Findings from Residue Studies Conducted with Treflan on Alfalfa: Lab Project Number: ECL92002. Unpublished study prepared by DowElanco. 15 p.

42472301 Decker, O.; Shackelford, D.; Morgan, R. (1992) Magnitude of Trifluralin Residues in/on Corn Forage Following Post-emergence Treatment with Treflan EC Herbicide: Lab Project Number: AAC9011. Unpublished study prepared by DowElanco in cooperation with Stewart Ag. Research Services, Inc. and others. 147 p.

42472302 Decker, O.; Morgan, R. (1992) Magnitude of Trifluralin Residues in/on Peanut Forage Following Preplant Treatment of Peanut with Treflan EC Herbicide: Lab Project Number: AAC9013. Unpublished study prepared by DowElanco in cooperation with Stewart Agricultural Research Services, Inc. and others. 190 p.

Agency Memoranda

CBRS No.	None
Subject:	Trifluralin Registration Standard Follow-up. DEB Response to Elanco Letter dated 7/21/89.
From:	S. Willett
To:	L. Rossi
Dated:	10/17/89
MRID(s):	None