

100.0 Pesticidal Use

GOAL 2E is a contact herbicide for control of various weed species in cotton.

100.1 Application Methods/Directions

Two distinct cotton growing areas will be involved in the proposed EUP program. The Western program will involve Arizona and California, while the Southern program will involve eight states in the Southeastern U.S.

1. For both areas: For best results, weeds present at application should be in the early postemergence stage of 1 - 2 inches. Larger plants may only be stunted by treatment. Accurate, uniform placement of GOAL spray is essential for effective weed control and to minimize cotton injury. Cotton leaves that are accidentally sprayed may show spotting or turn yellow and drop from the plant. The use of a nonionic surfactant is suggested to assist in contact activity of dusty weeds. Do not spray in cotton fields within 60 days of harvest.
2. Specific directions for Western cotton: Apply as a post-directed spray at final cultivation of layby. Cotton plants should be a minimum of 16 inches tall. In areas where soils are known to crack upon drying, it is suggested that GOAL be shallow incorporated, 1½ - 2 inches. For greatest benefit of preemergence activity, irrigation should follow within two weeks.

In cotton fields requiring additional grass control at layby, a tank mixture of GOAL 2E + TREFLAN 4E is suggested. Application should be as for GOAL alone, except shallow soil incorporation must be a part of the application.

Applications will be made from May through July.

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3. Specific directions for Southern cotton: Apply as a post-directed spray to cotton plants just big enough to spray using precision equipment. Cotton plants at this stage will be 8 - 12 inches tall, and the spray will be aimed at the young weeds and the bottom 3 inches of the cotton stems. No soil incorporation is planned. All activity will come from herbicidal activity at the time of treatment; should precipitation occur shortly after treatment, some residual activity as a pre-emergence herbicide may result.

A tank mixture with MSMA herbicide is planned, although no reasons are given for using a mixture.

Applications will be made during June and July.

100.2 Application Rates

The standard dosage will be 0.5 pounds a.i. per acre (broadcast), however, in tank mixture combinations half this dosage will be investigated to try to demonstrate efficacy.

In Western areas, one quart (0.5 lb. a.i.) should be mixed with 30-60 gallons of water for each acre. In GOAL 2E - TREFLAN 4E tank mixtures, 1 quart of GOAL plus 1 pint of TREFLAN (0.5 lb a.i.) is suggested as a combination treatment.

In Southern areas, 1/2 to 1 quart (0.25-0.5 lb. a.i.) of GOAL should be mixed in 20 - 30 gallons of water per acre. In GOAL 2E - MSMA tank mixtures, 1/2 to 1 quart of GOAL plus 1 - 2 pounds active of MSMA is recommended.

100.3 Precautionary Labeling

"This product is toxic to fish and birds. Keep out of lakes, ponds, or streams. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not apply when weather conditions favor runoff or drift from areas treated. Apply this product only as specified on the label."

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100.4 Proposed EUP Program

100.4.1 Objectives

1. Demonstrate that GOAL will effectively control weeds in cotton not adequately being controlled by registered herbicides.
2. Collect yield information to support the usefulness in controlling certain weeds of cotton.
3. Provide cotton growers with a herbicide possessing minimal plant back restrictions.

100.4.2 Duration/Date/Amount Shipped

Applicant proposes a two year program commencing April 15, 1978. The time period will allow for adequate testing under various climatic conditions.

The entire program will require 386 pounds active ingredient on a yearly basis. The states of Arizona/California will treat the entire growing area between the plants, therefore, 420 acres at 0.5 pound active per acre will require 210 pounds active. The remaining states will treat approximately half the total land area for the 605 acres which are estimated to require 176 pounds active GOAL.

Amounts requested on a state by state basis are:

Western Area

<u>State</u>	<u>Lb. Active GOAL</u>	<u>Acreage</u>
Arizona	50	100
California	150	300

Note: Entire Soil Area Treated

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Southern Area

<u>State</u>	<u>Lb. Active GOAL</u>	<u>Acreage</u>
Alabama	7	25
Arkansas	38	150
Georgia	7	25
Louisiana	25	100
Mississippi	38	150
North Carolina	7	25
South Carolina	7	25
Texas	7	25

Note: For Calculation Purposes One-Half
The Soil Area Treated.

In addition to the field trials we are requesting sufficient material to allow up to 10 acres of testing "off the station" by various state weed investigators. This could involve a total of 10 states times 10 acres per state or 50 additional pounds active GOAL.

Total Material Required For Yearly Program

	<u>GOAL Active</u>	<u>Acres</u>
Rohm and Haas investigators	336	925
State investigators	50	100
Total	386	1025

In addition to the states of Alabama, Arizona, Arkansas, California, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Texas we wish to add the states of Florida and Tennessee for states where shipments can be made. Since two of our investigators live in these states, it will facilitate shipping and handling. No field tests are planned, however, in the states of Florida or Tennessee.

100.4.3 Application Procedures

See Sections 100.1 and 100.2

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100.4.4 Target Pests

1. Western areas:

Weeds Observed as Controlled by a Post-Directed Application of GOAL in Test Plots

Ground Cherry	-	<u>Physalis wrightii</u>
Lambsquarters	-	<u>Chenopodium album</u>
Malva	-	<u>Malva parviflora</u>
Morningglory	-	<u>Ipomoea hirsutula</u>
Nightshade	-	<u>Solanum spp.</u>
Pigweed	-	<u>Amaranthus spp.</u>
Purslane	-	<u>Portulaca oleraceae</u>

Weeds Observed as Controlled by Preemergence Activity Resulting From a Post-Directed Application to Cotton

Ground Cherry	-	<u>Physalis wrightii</u>
Lambsquarters	-	<u>Chenopodium album</u>
London rocket	-	<u>Sisymbrium irio</u>
Malva	-	<u>Malva parviflora</u>
Morningglory	-	<u>Ipomoea hirsutula</u>
Mustards	-	<u>Brassica spp.</u>
Nightshade	-	<u>Solanum spp.</u>
Pigweed	-	<u>Amaranthus spp.</u>

2. Southern areas:

Weeds Observed as Controlled by a Post-Directed Application of GOAL in Test Plots

Carpetweed	-	<u>Mollugo verticillata</u>
Cocklebur	-	<u>Xanthium pensylvanicum</u>
Crabgrass	-	<u>Digitaria sanguinalis</u>
Florida Pursley	-	<u>Richardia scabra</u>
Lambsquarters	-	<u>Chenopodium album</u>
Morningglory	-	<u>Ipomoea spp.</u>
Nutsedge	-	<u>Cyperus spp.</u>
Pigweed	-	<u>Amaranthus spp.</u>
Prickly sida	-	<u>Sida spinosa</u>
Ragweed	-	<u>Ambrosia artemisiifolia</u>
Sicklepod	-	<u>Cassia obtusifolia</u>

Efficacy review indicated that preliminary results showed acceptable herbicidal activity against four of the claimed weed species, which are lambsquarter, morningglory, pigweed, and purslane.

100.4.5 Geographical Site Features

No information was submitted except the amounts to be used by state. This reviewer assumes that test plots will be typical cotton fields for Western and Southern areas.

100.4.6 Test Program Description/Features

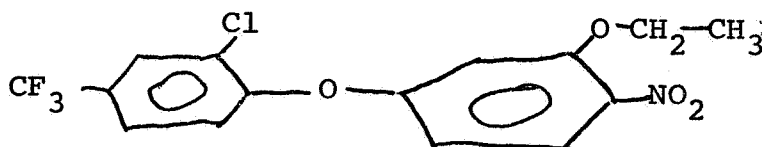
None were submitted other than as noted in previous sections.

101.0 Chemical and Physical Properties

101.1 Chemical name: 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene

101.2 Common name: RH-2915, Oxyfluorfen

101.3 Structural formula:



101.4 Molecular Weight

361.72

101.5 Physical State

An orange crystalline solid (at room temperature) with a faint odor.

101.6 Solubility

Less than 0.1 ppm in water at 25°C; soluble in most organic solvents.

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102.0 Behavior in the Environment

Two major reviews are available from environmental chemistry. Most information is from the older review (R.E. Ney 4/7/75), but these studies were not rated as acceptable or unacceptable. In most recent review (N. Dodd/R. E. Ney, 1/24/77), no studies were found acceptable to support registration.

102.1 Soil

In a greenhouse soil metabolism study no signs of degradation occurred in 90 days under either aerobic or anaerobic conditions; under aerobic conditions, the half-life in silt loam and sandy loam soils was over 400 days.

However, in a field study, the half-life was found to be 36 - 50 days in several soil types, with 90% being lost in 125 - 160 days. In a more recent study, residues of 0.06 ppm were found remaining from treatment two years previously with 0.75 lb/acre; this study showed a half-life of less than 9 days when pesticide is not incorporated and no crops were grown (EC did not find this to be an acceptable study).

In a laboratory photodegradation study under UV light, the half-life of RH-2915 was reported as 5 hours, although reviewer considered that other factors, such as volatility, may have been involved. In a field study, no photodegradation products were detected by TLC in soil extracts after 48 hours of exposure to light; based on trapped volatiles, only 0.2% photodegraded after 48 hours (this study was not acceptable because it was not of long enough duration).

In several unacceptable studies, leaching and runoff were negligible; the pesticide apparently binds substantially to soil.

102.2 Water

RH-2915 is stable to hydrolysis at pH 5, 7, and 9. In an unacceptable study of photodegradation

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in water, the half-life of labeled RH-2915 was 12 hours.

102.3 Plant

In a 17 day study on soybeans, RH-2915 was not metabolized; plants contained 0.5 - 0.6 ppm of RH-2915.

The extent of uptake and translocation by ¹⁴C-labelled oxyfluorfen in sorghum and pea was determined. Less than 2% of the total applied material was translocated from the roots from application through nutrient solution and less than 1% of the material was translocated after foliar application.

102.4 Animal

In rats 99.5% of the applied ¹⁴C was found in the feces; some 72% was found as RH-2915. In goats most applied radioactivity was recovered in feces, and residues did not accumulate in milk. Environmental chemistry concluded that RH-2915 does not accumulate in catfish.

103.0 Toxicological Properties

See review of S. Fredericks (11/21/75) for mammal toxicity. See validation sheets for fish and avian toxicity.

103.1.5 Phytotoxicity R.W. Holst 28 Feb 78

Test: Oxyfluorfen (formulated EC) on four Leguminosae species.

Species: Glycine max (soybean)
Phaseolus vulgaris (greenbean)
Phaseolus coccineus (scarlet runner bean)
Pisum sativum (pea, 'Alaska')

Results: In a greenhouse study, the I_{50} s were:

<u>Preemergence</u>	<u>I_{50} (kg ai/ha)</u>
Greenbean	0.6
Soybean	4.5
Pea	2.8
SR bean	4.5
<u>Postemergence</u>	
Greenbean	0.06
Soybean	0.14
Pea	0.41
SR bean	0.06

The preemergence study utilized pots containing a silt loam (pH 6.6, 2.3% organic matter). For the postemergence study, a soil-perlite mixture (3:1 v/v) was used.

In two field studies, the I_{50} s were:

	I_{50}		
	Surface	Shallow	Deep
	(Preemergence)		(PPI)
	(kg ai/ha)		
Soybean	0.46	0.25	0.56
Greenbean	0.06	0.07	0.19
<u>Digitaria sanguinalis</u> <u>+ Eragrostis cilianensis</u> (grass mixture)	0.03	0.06	0.11

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The field studies were done from 12 June to 10 July 1974 in central Indiana on an Ockley silt loam (pH 6.0, 2.5% organic matter).

In both greenhouse and field studies, the herbicide was watered in.

References: Fadayomi, O., and G. F. Warren. 1977. Differential activity of three diphenyl ether herbicides. Weed Sci. 25:465-468.

Abstract: There is no direct relationship between pre- and postemergence treatment. Plant injury was reduced with deep incorporate possibly due to a dilution factor with the soil mixing.

In a second oxyfluorfen study (Fadayomi and Warren, 1977), the following concentrations were determined to cause a 50% reduction in fresh weight (ED_{50}) of sorghum seedlings under controlled growth chambers conditions (16/8; D/N photoperiod; 35 ^{day} ~~max~~; 30/20, D/N temperatures):

	ED_{50}	pH (end)
Silica sand	289 ppm	6.7
Silica sand + 1% muck	3979 ppm	5.2
Silica sand + 1% Ca-kaolinite	542 ppm	6.7
Silica sand + 1% H-AL-kaolinite	470	6.3
Silica sand + 1% Ca-bentonite	378 ppm	6.8

Ref: Fadayomi, O., and G. F. Warren. 1977. Adsorption, desorption, and leaching of nitrofen and oxyfluorfen. Weed Sci. 25: 97-100.

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VALIDATION SHEET

FORMULATION: Percent a.i. - 94%

CHEMICAL NAME: RH-2915

TEST ID NO: ES-F1

TEST TYPE: Fish acute 96-hour LC_{50} (flow through)
Bluegill sunfish

VALIDATOR: Larry Turner

DATE: 3/2/78

CITATION: Bentley, Robert E. 1973. Acute toxicity of
RH-2915 to Bluegill (Lepomis macrochirus) and
Rainbow trout (Salmo gairdneri). 6 p. submitted
by Thomas Haas Company, Acc # 095583, 11/9/76.

RESULTS: Bluegill sunfish LC_{50} = 0.200 ppm (95% C.I.
0.130 - 0.310 ppm). No mortality occurred at
0.056 ppm; 83% mortality occurred at highest level
of 0.320 ppm. Toxic symptoms included darkening,
lethargy, and loss of equilibrium.

VALIDATION CATEGORY: Core

ABSTRACT: Bluegill sunfish were exposed to concentrations of
RH-2915 of 0 (control), 0.056, 0.075, 0.100, 0.140,
0.180, 0.240, and 0.320 ppm. Procedures followed
the 1970 edition of Standard Methods (APHA),
according to investigators, although methods were
not described so that this reviewer could compare
them with the protocol. All reporting recommended
in the protocol was furnished. Thirty fish were
tested at each dose level. Fish had a mean length
of 42 mm and weight of 1.0 g. Flow rate to the
30 liter test vessels was 5 l/hour. Water chemistry
was reported and included a pH of 7.1 and tempera-
ture of $21^{\circ}C \pm 1^{\circ}$. Mortality was analyzed by
linear regression using logs and probits. Using
the linear regression program on the TI calculator,
this reviewer calculated an identical LC_{50} value
of 0.20 ppm.

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VALIDATION SHEET

TEST ID NO: ES-G1

TEST TYPE: Fish acute 96-hour LC_{50} (flow through)
Rainbow trout.

FORMULATION: Percent a.i. - 94%

CHEMICAL NAME: RH-2915

VALIDATOR: Larry Turner

DATE: 3/2/78

CITATION: Bentley, Robert E. 1973. Acute toxicity of RH-2915 to Bluegill (Lepomis macrochirus) and Rainbow trout (Salmo gairdneri). 6 p. submitted by Rohm & Haas Company, Acc # 095583, 11/9/76.

RESULTS: Rainbow trout LC_{50} = 0.410 (95% C.I. 0.310 - 0.560 ppm). No mortality occurred at the two lowest levels of 0.14 and 0.18 ppm; 83% mortality occurred at the highest level of 0.75 ppm. Toxic symptoms included darkening, lethargy, and loss of equilibrium.

VALIDATION CATEGORY: Core

ABSTRACT: Rainbow trout were exposed to concentrations of RH-2915 of 0 (Control), 0.14, 0.18, 0.24, 0.32, 0.42, 0.56, and 0.75 ppm. Procedures followed the 1970 edition of Standard Methods (APHA), according to investigators, although methods were not described so that this reviewer could compare them with the protocol. All reporting recommended in the protocol was furnished. Thirty fish were tested at each dose level. Fish had a mean length of 80 mm and weight of 2.4 g. Flow rate to the 30 liter test vessels was 5 l/hour. Water chemistry was reported and included a pH of 7.1 and temperature of $11^{\circ}C \pm 1^{\circ}$. Mortality was analyzed by linear regression using logs and probits. Using the linear regression program on the TI calculator, this reviewer calculated an identical LC_{50} value of 0.41 ppm.

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VALIDATION SHEET

TEST ID NO: ES-D1

TEST TYPE: Avian subacute dietary LC₅₀ - Bobwhite quail.

FORMULATION: Percent a.i. - ~~approx 86-87%~~. (Phone communication from S. Krzminski, 3/21/78)
94% (letter from Cannon Labs to Rohm & Haas, 5/4/78)

CHEMICAL NAME: RH-915

VALIDATOR: Larry Turner

DATE: 3/2/78

CITATION: Terrell, York. 1973. Eight day dietary LC₅₀ study of RH-915 on Bobwhite quail and Mallard ducks. 30 p. submitted by Rohm and Haas Company, Acc 4095583, 11/9/76.

RESULTS: Bobwhite quail dietary LC₅₀ = 390 ppm (standard error = + 22.7 ppm). No mortality occurred at 100 ppm; 100% mortality occurred at 1000 ppm. Toxic symptoms were dose related and included depression, feather erection, and staggering. Food consumption was markedly reduced at 500 ppm and higher levels.

VALIDATION CATEGORY: Core

CATEGORY RATIONALE: This study was classed as core in spite of the disparity between the submitted LC₅₀ value and that obtained by this reviewer. Since the reported value is the lower value, the discrepancy would work against the registrant. No other significant flaws were noted.

ABSTRACT: Bobwhite quail were exposed to dietary concentrations of RH-915 of 0 (control), 100, 300, 400, 500, 750, and 1000 ppm. Procedures generally followed Subpart E, Hazard Evaluation, Wildlife and aquatic organisms except as noted:

1. Birds were 5-7 days old at the start of the test.
 2. No source or breeding history of birds was reported.
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3. Housing conditions were not reported.

4. Percent a.i. was not reported.

Statistical analysis followed methods of Miller and Tainter (Experimental Biology and Medicine, Vol. 57, pp 2610264. 1944), which is an early log-probit method. Data were checked on TI 59, using Finney Probit, and yielded a substantially higher value of 479 ppm (95% c.i. 392-586 ppm).

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VALIDATION SHEET

TEST ID NO: ES-E1

TEST TYPE: Avian subacute dietary LC₅₀ - Mallard duck.

FORMULATION: Percent a.i. - approx. 86-87% (phone communication from S. Krzminski, 3/21/78).
94% (letter from Cannon Labs to Rohm & Haas, 5/4/78)

CHEMICAL NAME: Larry Turner

DATE: 3/2/78

CITATION: Tyrell, York. 1973. Eight day dietary LC₅₀ study of RH-915 on Bobwhite quail and Mallard ducks. 30 p. submitted by Rohm and Haas Company, Acc #095583, 11/9/76.

RESULTS: Mallard duck dietary LC₅₀ >4000 ppm. No mortality occurred at any tested level from 1000 to 4000 ppm. Toxic symptom of depression was observed at all levels, with more birds affected at higher levels. Food consumption was somewhat reduced at higher levels.

VALIDATION CATEGORY: Core

ABSTRACT: Mallard ducks were exposed to dietary concentrations of RH-915 of 0 (control), 1000, 1500, 2000, 2500, 3000, and 4000 ppm. Procedures generally followed Subpart E - Hazard Evaluation - wildlife and aquatic organisms except as noted:

1. Birds were 5-7 days old at start of test.
2. No source or breeding history of birds was reported.
3. Housing conditions were not reported.
4. Percent a.i. was not reported.

Statistical analysis was not performed because no mortality occurred.

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104.0 Hazard Assessment

104.1 Discussion

GOAL is a relatively new contact herbicide. When applied at the maximum rate proposed for this program (0.5 pound a.i./acre), residues on soil would be 5.2 mg/ft² with 11 ppm in the top 0.1 inch of soil. No residues would be expected on the cotton foliage if directions for a post-directed spray using precision equipment are followed.

There is some question regarding the persistence of GOAL. Soil half-life studies have yielded values from 9 to 400 days. It does apparently photodegrade rapidly (half-life approximately 5 hours). For the proposed use on young cotton plants, there is a high probability that photodegradation will occur in a reasonable time, thus making persistence secondary in importance. In applications where GOAL might be soil incorporated or shaded, persistence could be very important.

Where incorporation may occur, the residual effects on next years dicotyledonous crop (cotton or soybeans) may be injurious especially if an application is made in the succeeding year to these crops for weed control. Grass species crops such as corn and sorghum are more tolerant to the application of GOAL and its residual effects.

104.1.1 Likelihood of Exposure to Non-target Organisms

Considering the application method and rate, it seems unlikely that GOAL will cause any hazard off the site, especially in view of the high degree of soil binding. On site, hazard would then be limited to species using cotton fields during the early postemergent period. Since GOAL is only moderately toxic to avian species, no hazard would be expected from the proposed EUP program for 1000 acres. If label directions are followed, minimal hazard would be expected to aquatic species, even though fish toxicity is high.

104.1.2 Endangered Species Considerations

Considering the limited acreage proposed, the low avian toxicity, and the apparent low mobility into aquatic environments, endangered species would be unlikely to be adversely affected.

104.1.3 Adequacy of Toxicity Data

All submitted fish and wildlife studies (2 avian dietary, 2 fish acute) have been classified as Core. See validation sheets for more information.

104.1.4 Additional Data Required

An avian acute LD₅₀ and an aquatic invertebrate LC₅₀ are necessary to meet basic requirements. Other studies may be necessary pending a better determination of soil and water persistence.

107.0 Conclusions

107.1 Environmental Fate and Toxicology

Environmental chemistry reviews by R. E. Ney (4/7/75) and N. Dodd/R.E. Ney (1/24/77) were conducted. Toxicology data was taken from Environmental Safety Review by Scott Fredericks (11/21/75).

107.4 Data Adequacy

Submitted avian dietary and fish acute studies satisfy the requirements for those studies.

107.5 Data Requests

The following studies on the technical grade must be submitted in support of proposed registration of GOAL:

1. An avian acute oral LD₅₀ for either Bobwhite quail or Mallard duck.
2. An aquatic invertebrate 48-hour LC₅₀, preferably for Daphnia sp.

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Additional studies may also be requested to support registration, depending upon the results of all required studies.

107.6 Special Notes

Written confirmation of the percent a.i. on avian dietary tests was to have arrived by the end of March but has not yet. Situation is acceptable for EUP, but further reviewers may wish to confirm this. (LWT 5/8/78). 5/31/78 written confirmation has been received, percent a.i. is 94%. *Just*

107.7 Recommendations //

The environmental safety staff concurs with the proposed EUP program on cotton.

Larry W. Turner
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