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

DATE: JUL 7 1982

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

SUBJECT: Terbufos Registration on Sorghum 1F2540 and Soybeans 2F2608

FROM: William S. Rabert, Biologist W.S.R.
Ecological Effects Branch, HED

TO: William Miller, PM 16
Insecticide Section, RD

Attached is the EEB Branch Review for registration of Counter 15G on Sorghum and soybeans. In order to speed the review process I referred to the latest OES Biological Opinion for these crops and incorporated their conclusions for Thimet 20G, since both chemicals are similar in structure, toxicity, and formulation. Earl Possart of OES concurred with these conclusions during early telephone calls. When a letter of confirmation was forwarded through Clayton Bushong to OES, Clayton indicated that since OES had been inconsistent in previous opinions that only the nine Texas counties identified in the May, 1981 Carbofuran/Furadan opinion should be listed.

When OES was informed by letter of this change, Earl Possart called to indicate that a formal consultation should be initiated, since with those changes application of terbufos might endanger the Attwater's greater prairie chicken in some omitted Texas counties. OES has since reviewed the latest census counts and identified ten counties were the prairie chicken has been observed for the past three years. Loss of habitat in the remaining three counties has been interpreted to mean that the species would not sucessfully repopulate those counties. The ten counties, were jeopardy has been identified by OES, are Aransas, Austin, Brazoria, Colorado, FGort Bend, Galveston, Goliad, Harris, Rufugio, and Victoria. A letter confirming these conversations is being transmitted by OES to EEB.

If the registrant is willing to accept nonuse in these ten Texas counties and in the other habitats of the other three endangered species, no further consultations with OES or EEB are needed to complete the registration of Counter 15G on sorghum or soybeans. All the data requirements have been fulfilled and the ecological impacts have been duly noted.

If you have any further questions, I can be reached at (703) 557-7696.

Attachment

1 p. and 16 pp. attachment

105001
SHAUGHNESSEY NO.

10
REVIEW NO.

EEB BRANCH REVIEW

DATE: IN 4/26/82 OUT 6/15/82

FILE OR REG. NO. 241 - 238

PETITION OR EXP. PERMIT NO. 1F2540 Sorghum and 2F2608 Soybeans

DATE OF SUBMISSION 4/15/82

DATE RECEIVED BY HED 4/22/82

RD REQUESTED COMPLETION DATE 7/ 7/82

EEB ESTIMATED COMPLETION DATE 6/21/82

RD ACTION CODE/TYPE OF REVIEW 336 / Resubmission -- Amendment - New Food/Feed Use

TYPE PRODUCT(S): I, D, H, F, N, R, S Insecticide

DATA ACCESSION NO(S). 247274

PRODUCT MANAGER NO. W. Miller (16)

PRODUCT NAME(S) Counter 15G

COMPANY NAME American Cyanamid Company

SUBMISSION PURPOSE Submission of data in support of soybeans and sorghum and proposed "knifed-in" application method for sorghum

SHAUGHNESSEY NO.	CHEMICAL, & FORMULATION	% A.I.
105001	Terbufos (S-[[(1,1-Dimethylethyl)thio]methyl] o,o-diethyl phosphorodithioate	15.0

100 Pesticide Label Information

100.1 Pesticide Use

Counter 15G is proposed as an insecticide for control of greenbugs on grain sorghum at planting or bedding and for early season control of seed corn maggots, wireworms, and leafhoppers at planting in soybeans.

100.2 Formulation Information

Counter 15G -- 15.0 % a.i.

100.3 Application Methods, Directions, Rates

According to a telephone conversation with Lynne Melville on 14 May 1982, the label directions for use on soybeans and sorghum have remained the same as described in earlier reviews except for the addition of the knifed-in treatment provided on the sorghum label.

DIRECTIONS FOR USE

Crop	Pest Controlled	Rates Counter 15G	Application	Remarks
Sorghum At planting	Greenbugs	Banded 8-16 oz./1,000 ft. of row for any row spacing (minimum 20-inch row spacing)	Banded 1/ Place granules in a 5-7 inch band directly behind the planter shoe and in front of the press wheel	Do not place granules in direct contact with seed as crop injury may occur.
At bedding or at planting		Knifed-in 8-16 oz./1,000 ft. of row for any row spacing (minimum 20-inch row spacing) or or no more than 26 lbs per acre.	Knifed-in Drill granules 1-4 inches directly below the seed OR 1-4 inches below the seed and up to 5 inches to the side of the seed.	1/ Do not use banded applications in New Mexico, West Texas, and the Panhandle of Oklahoma
Soybeans At planting	For early season control of seed corn maggots, wireworms, leafhoppers.	Banded 8-12 oz./1,000 ft. of row for any row spacing. (30-inch minimum row spacing).	Banded Place granules in a 7-inch band directly over the row at planting. Incorporate into the upper few inches of soil.	Do not feed treated soybean foliage. When using Counter do not use metribuzin herbicides. Serious crop injury may result when preplant or preemergence applications of metribuzin herbicides are used with this product or other soil applied organophosphate insecticides.
		In-furrow 8 oz./1,000 ft. of row for any row spacing. (30-inch minimum row spacing).	In-furrow Place granules directly in the seed furrow behind the planter shoe.	

100.4 Target Organism(s)

Control of greenbugs in grain sorghum and for early season control of seed corn maggots, wireworms, and leafhoppers in soybeans.

100.5 Precautionary Labeling

No new precautionary labeling was submitted. The earlier label read:

ENVIRONMENTAL HAZARDS

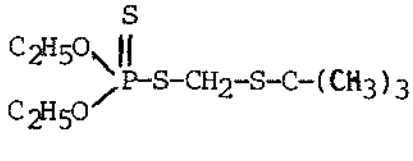
This product is toxic to fish, birds, and other wildlife. Treated granules exposed on the soil surface may be hazardous to birds and other wildlife. Keep out of any body of water. Do not apply where runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of waste.

101 Physical and Chemical Properties (Former review, 10/23/81)

101.1 Chemical Name

S-[[(1,1-Dimethylethyl) thio] methyl]-o,o-diethyl phosphorodithioate

101.2 Structural Formula



101.3 Common Name --- Terbufos

101.4 Trade Name --- Counter 15G

101.5 Molecular Weight --- 288.43

101.6 Physical State

	Technical	15G
Form and color:	clear, slightly brown liquid	fine, irregular gray granules (772 granules = 0.084 grams)
Odor:	mercaptan smell	
pH:		
Melting Point:	slightly below - 15° C	
Boiling Point:		
Vapor Pressure:		

101.7 Solubility

Soluble to 10 - 15 ppm in water at room temperature. Soluble in acetone, alcohols, aromatic hydrocarbons, and chlorinated hydrocarbons. Hydrolyzes under alkaline conditions.

102 Behavior in the Environment

(See reviews by Akerman 12/11/72, Cook 5/30/75, and Smith 12/3/81).

103 Toxicological Properties (Added new data on Quail LD50 and Daphnia EC50)

Test	Species	Material	LD/LC50	Validation Status
Oral LD50	Rat	86 % a.i.	1.5 mg/kg	
	Rat	86 % a.i.	1.7 mg/kg	
	Rat (Male)	Tech.	4.5 mg/kg	
	Rat (Female)	Tech.	9.0 mg/kg	
	Mouse (Male)	~~Tech.~~ 96.7% a.i.	3.5 mg/kg	
	Mouse (Female)	~~Tech.~~ 96.7% a.i.	9.2 mg/kg	
	Dog (Male)	Tech.	4.5 mg/kg	
	Dog (Female)	Tech.	6.3 mg/kg	
Dermal LD50	Rabbit	~~Tech.~~ 96.7%	1.1 mg/kg	
	Rabbit	15G (paste)	29-34 mg/kg	
	Rabbit	15G (dry)	900-1425 mg/kg	
Dietary Effects				
30 days	Rat	Tech.	Marked ChE depression at 2.0 ppm.	
30 days	Beagle Dog	Tech.	Depressed body weights at 0.25 ppm.	
31 days	Mice	Tech.	Significant body weight depression at 16.0 ppm	
Acute Oral LD50	Bobwhite	89.6 % a.i.	28.6 (22.2-57.2) mg/kg	Core Robert
8-Day Dietary LC50	Pheasant ~~Bobwhite~~	96.7 % a.i.	145 ppm	Tox
	Bobwhite	86 %	140 (107-183) ppm	Core Beth
	~~Pheasant~~ Mallard	96.7 % a.i.	185 ppm	Tox
	Mallard	86 % a.i.	160 (131-195) ppm	Invalid Beth
	Mallard	86 % a.i.	520 (400-676) ppm	Core (food rejection)
Avian Reprod.	Bobwhite	? % a.i.	Sign. diff. at 2.0 and 20 ppm	
	Mallard	? % a.i.	No sign. diff.	
Simulated Field Tests	Pheasants	1.03 and 5.15 lb/A	No acute or chronic effects	
	Pheasants	Simulated spill	2 out 3 hens died within 12 hours of exposure	

Test	Species	Test Material	LD/LC50	Validation Status
Aquatic 96-Hour LC50	Bluegill	86 % a.i.	0.77 (0.71-0.83) ppb	Core
	Brown Trout	86 % a.i.	16 (8 -31) ppb	Core
EPA	Bluegill	15 % a.i.	13.3 (10.08-17.56)ppb	Suppl./Core
EPA	Rainbow Trout	15 % a.i.	68 (50.19-92-14)ppb	Suppl./Core
Aquatic Invertebrate	Daphnia magna	88.6 % ai	0.31 (0.27 -0.36) ppb	~~Suppl.~~/Core
48-Hour EC50 EPA	Daphnia magna	15 % a.i.	13 (9.1 -18.6) ppb	Suppl./Core
Nontarget Insects	Carabid Beetles (5 species)	15 % G	100 % of all species died at recommended field rates (1 lb/A)	Scientifically Sound Study

104 Hazard Assessment

104.1 Discussion

For use in grain sorghum for control of greenbugs application of Counter 15G at the time of planting or at bedding is proposed at a rate of 8-16 oz. per 1,000 feet for any row spacing (minimum of 20-inch row spacing), which is equivalent to a maximum of 2 to 3.9 lb a.i. per acre. Counter 15G application at planting is either by banded or knifed-in treatments, while at bedding only the knifed-in treatment is used. Banded treatment is prohibited in New Mexico, West Texas, and the panhandle of Oklahoma.

For use in soybeans for early season control of seed corn maggots, wireworms, and leafhoppers, Counter 15G is applied at planting by either banded or in-furrow treatments. The granules are applied at 8-12 oz. per 1,000 feet of row for any row spacing (30-inch minimum row spacing), which is equivalent to 1.3 to 2 lbs a.i. per acre.

104.1.1 Likelihood of Exposure

In order to reduce the expose to spilled granules at the end of the rows to non-target species, the label states "Cover granules that may be exposed on the ends of the treated row and turns and loading areas by deep discing immediately after treating fields." While there may be some continued exposure to Counter granules using banded treatments (granules pressed into soil surface by press wheel) or some remaining exposed granules at row ends from knifed-in or in-furrow treatments following deep discing, the toxicity data indicate that these Counter 15G uses are unlikely to adversely affect terrestrial species to any significant degree with the possible exception of the some endangered species.

The granular nature of Counter 15G will most likely preclude the consumption of the small granules by most mammals. And while some birds may accidently pickup a sufficient number of granules adhering to earthworms, slugs, or as grit to be lethal, it is unlikely that the mortality will have a significant impact on bird populations

except for endangered species. A LD50 of 28.6 mg per kg of body weight is equivalent to about 1.68 granules per gram of body weight or about 30 granules for small birds, such as sparrows. Preliminary testing by EEB with male red-winged blackbirds indicated that 10 granules administered in gelatin capsules caused 80 percent mortality in 24 hours and 100 percent dead in 72 hours. The apparent descrepancy between the two tests probably lies in the differences between test species, reduced absorption caused by the corn oil in the technical grade test, and/or toxicity variation between the technical grade and the formulated product.

As a systemic insecticide, terbufos residues are translocated into the plant and are available to organisms feeding on the vegetation. Since the residues analyzed in one-month old plants indicated total radioactivity equivalent to 2.5 ppm following a 1.0 lb a.i./acre treatment are considerably below the 140 to 185 ppm dietary LC50 values reported for birds, it is unlikely that to effect depredating birds. Low levels of accumulation of terbufos reported in fish and crayfish studies (5.6 to 14 fold in edible portions and up to 107X in non-edible parts) indicate that the proposed uses are unlikely to adversely effect fish-eating birds or other predatory species.

With the exception of herbivorous insects which feed on plants in/or adjacent to treated fields, Counter 15G is not likely to adversely impact on beneficial non-target insects. No adverse effects on bees or other beneficial insects would be expected from the use of these low volatility granules.

Another major area of concern is the aquatic environments. Terbufos is highly toxic to aquatic species, especially bluegill sunfish and daphnids. Their LC50 and EC50 values indicate that some aquatic species may be affected by terbufos residues or granules carried in runoff from adjacent, treated fields. During the bluegill accumulation study with 30-day aged soils, all of the bluegills died within ten days.

While incorporation of the terbufos granules into the soil by either knifed-in (1 to 5 inches) or in-furrow (1/2-2 inches) treatments will reduce the probability that the granules will be washed into adjacent waters, high transport potential remains from banded treatments which spread the granules on the surface of the soil and/or dissolution from the granules themselves. While the bulk density of Counter 15G should be sufficent that the granules are not likely to float upon runoff water, transport of the granules themselves via erosion into receiving waters remains a potential problem. It is unknown to what degree the solubility of terbufos will permit residues to be released from the granules into runoff.

104.3 Endangered Species Considerations

The impact of terbufos on endangered species from use on sorghum and soybeans was analyzed by reviewing the former OES biological opinion reviews for two other granular chemicals (Phorate/Thimet 20G, dated 1/22/82 and Carbofuran/Furadan 10G and 15G, dated 5/1/81) and an emulsion, Chlorpyrifos/Lorsban 4E, dated 7/1/81 which were conducted

on sorghum and/or soybeans as well as other crops. The structural similarity to phorate, the similar toxicity for most species, their common granular formulation, and the similar use patterns indicate that the same endangered species might be affected. Therefore, these two chemicals should carry the same use restrictions relative to endangered species for grain sorghum and soybeans. The species of concern include the Alabama cavefish, the Delmarva Peninsula fox squirrel, the Attwater's greater prairie chicken, and the Aleutian Canada goose.

Only the Attwater's greater prairie chicken and the Aleutian Canada goose were identified as likely to be jeopardized. The prairie chicken are frequently present in areas adjacent to sorghum fields and use the fields extensively for cover and feeding during the brood-rearing period (April - August). Following a reanalysis of recent bird censuses, OES identified ten counties where the prairie chicken has been found during the past three counts and consequently they recommended that terbufos use should be prohibited in the Texas counties of Aransas, Austin, Brazoria, Colorado, Fort Bend, Galveston, Goliad, Harris, Refugio, and Victoria.

The Aleutian Canada goose extensively use agricultural lands on its wintering grounds in California. OES recommended that terbufos use should be prohibited from mid-August through the end of December in the California counties of Butte, Colusa, Glenn, Solano, Sutter, and Yolo; and from mid-September through mid-March in the counties of Merced, San Joaquin, and Stanislaus.

While populations of the Alabama cavefish and Delmarva Penisula fox squirrel were not jeopardized, OES suggested that prudence dictated that terbufos also not be applied to soybeans in their geographic areas, until more evidence is available. OES recommended that the registration should prohibit use of terbufos in Lauderdale County, Alabama until such time as the full extent of the aquifer system has been identified and the existing or potential threat from pesticide contamination has been determined and that since the Delmarva Peninsula fox squirrel utilizes newly planted agricultural fields for feeding, the registered use of terbufos should be prohibited in the Maryland counties of Dorchester, Kent, Queen Anne, and Talbot and in Accomack County, Virginia.

If the registrant wishes to remove these geographic restrictions, they should submit supporting data showing safety for the formulated product. The marginal toxicity, as indicated by the acute oral LD50 values of terbufos, may be clarified by the submission of a study conducted on the most sensitive species or closely related species using the actual formulation. Gelatin capsules are suggested as an appropriate vehicle for the 15G granules. Plain gelatin capsules without corn oil or any other solvent should be used to simulate actual exposure conditions. The mallard duck is suggested for the avian species since it was the most acutely sensitive species tested in structurally-similar phorate. The eastern fox squirrel is suggested for the mammalian test species since it is closely related to the Delmarva Penisula fox squirrel.

104.4 Adequacy of Toxicity Data

With the new addition of the avian acute oral LD50 and the 48-hour aquatic invertebrate tests, the basic studies which were submitted have been found to be adequate to satisfy registration requirements. They include:

Technical grade test material:

1 - Avian acute oral LD50 - Bobwhite Quail
3 - Avian dietary LC50 tests - Bobwhite, Mallard and Ring-necked Pheasant
1 - 96-Hour warmwater fish LC50 - Bluegill Sunfish
1 - 96-Hour coldwater fish LC50 - Brown Trout
1 - 48-Hour aquatic invertebrate EC50 - Daphnia magna
2 - Avian reproduction tests - Mallard Duck and Bobwhite Quail

Formulated product - 15G test material:
1 - 96-Hour warmwater fish LC50 - Bluegill Sunfish
1 - 96-Hour coldwater fish LC50 - Brown Trout
1 - 48-Hour aquatic invertebrate EC50 - Daphnia magna

104.5 Additional Data Required

No additional studies are presently required to support the proposed registration of Counter 15G granular formulation for use on grain sorghum or soybeans.

107 Conclusions

107.1 Environmental Fate and Toxicology Acknowledgement

EFB reviews by Ney and Cook, dated 11/14/74, and 5/20/75 and Ney and Schenck, dated 9/18/75. No reviews were ever received from Tox Branch, so data on mammalian toxicity were used from the EUP dated 12/11/72 and Betz, 6/30/79.

107.2 Classification Labeling

EEB suggests a Restricted Use classification for protection of nontarget wildlife and endangered species.

107.3 Environmental Hazards Labeling

The existing labeling is appropriate, except that geographical restrictions should be added to protect four endangered species. Use of terbufos should be prohibited in the Texas counties of Aransas, Austin, Brazoria, Colorado, De Witt, Fort Bend, Galveston, Goliad, Harris, Refugio, Victoria, Waller, and Wharton to protect the Attwater's greater prairie chicken and from the California counties of Butte, Colusa, Glenn, Solano, Sutter, and Yolo from mid-August through the end of December and from mid-September through mid-March in the counties of Merced, San Joaquin, and Stanislaus to protect the Aleutian Canada goose. Both of these species were identified by OES

as being in jeopardy. OES also recommended that prudence indicated that terbufos use should also be prohibited from Lauderdale County, Alabama to protect the Alabama cavefish and in the Maryland counties of Dorchester, Kent, Queen Anne, and Talbot and in Accomack County, Virginia to protect the Delmarva Peninsula fox squirrel, until the potential impact on these two species is clarified.

prudence not jeopardy - not regulated W.S.R.

107.4 Data Adequacy Conclusions

Adequate data are available to support the requested registration of Counter 15G formulation for use on grain sorghum and soybeans.

107.5 Data Requests

No additional data are necessary to support this registration, however, the registrant may wish to submit avian and mammalian acute oral LD50 studies tested with the Counter 15G formulation to demonstrate safety, if they wish to have the geographic restrictions for these endangered species removed from the label. The test material should be placed in gelatin capsules without a carrier in order to simulate the anticipated exposure. The avian test species should be young adult mallard ducks, which were found to be particularly sensitive to structurally-similar phorate. The mammalian test species should be a fox squirrel, which is closely related to the endangered species of concern.

107.6 Special Notes

American Cyanamid is currently reviewing the geographic restrictions proposed for labeling to protect endangered species possibly effected by the use of phorate on sorghum, soybeans, corn, and several other crops. As of June 9, 1982, the company has not responded to the proposed labeling restrictions.

While the above restrictions also reflect endangered species impacts from phorate corn uses, the previously registered uses of terbufos on corn and sugar beets should be reviewed for impact on endangered species during the registration standard process.

107.7 Recommendations

EEB has reviewed the proposed conditional registration of terbufos for use on grain sorghum at planting and bedding and for soybeans at at planting. Based on the available data and use information EEB concludes that the proposed uses provide for minimal hazards to nontarget populatons, except for four possible endangered species (Attwater's greater prairie chicken, Aleutian Canada goose, Alabama cavefish, and Delmarva Penisula fox squirrel). Hazard to these species may be avoided by labeling to prohibiting the use of terbufos in their respective geographic areas. Labeling for cavefish and fox squirrel deleted in accordance with EEB policy to regulate only those species which OE identifies as in jeopardy. 11/4/82 W.S.R.

William S. Rabert

William S. Rabert, Biologist
Section 2, EEB, HED

Date: June 10, 1982

David Coppage, Section Head
Section 3, EEB, HED

Date: June 10, 1982

Clayton Bushong, Chief
Ecological Effects Branch, HED

Date: 6/14/82

APPENDIX

Calculation of acute avian hazard following consumption of granules from acute oral LD50 value:

$$\text{\# of granules/gram of body weight causing 50 percent mortality} = \frac{(\text{No. of granules/lb})\ (\text{LD50 in mg/kg})}{(453{,}592\ \text{mg/lb})\ (\%\ \text{a.i.})\ (1000)}$$

$$\text{\# of granules/gram of body weight causing 50 percent mortality} = \frac{(4{,}000{,}000\ \text{granules/lb})\ (28.6\ \text{mg/kg})}{(453{,}592\ \text{mg/lb})\ (15\ \%\ \text{a.i.})\ (1000)}$$

$$= 1.68 \text{ granules per gram of body weight}$$