



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, DC 20460

OFFICE OF
PESTICIDES AND
TOXIC SUBSTANCES

February 15, 1989

MEMORANDUM

SUBJECT: Biological Review of Public Interest Document for
Isoxaben (Gallery (TM) 75 Dry Flowable Herbicide)
Proposed by Elanco for weed control in turf,
ornamentals, and noncrop land

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We have reviewed the Public Interest Document submitted by Elanco in support of the Section 3 Conditional registration of Gallery (TM) 75 Dry Flowable Herbicide. We offer the following discussion and conclusions for your consideration.

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PUBLIC INTEREST FINDING FOR ISOXABEN

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I. INTRODUCTION

Isoxaben, under the name of Flexidor, is reported as a 75% dry flowable in Canada, as a 50% suspension concentrate in the United Kingdom, and as a 12.5% suspension concentrate in France. Isoxaben is also known by the code name E1-107. In the United States the proposed name is Gallery, formulated as a 75% dry flowable (Sine, 1988).

Elanco proposes a single, preemergent, soil-applied application of isoxaben in the fall, late winter, or early spring by professional applicators only. The chemical would be mixed with 20-200 gallons of water per acre and applied with a fixed boom. Registration of the herbicide is proposed to control seedling broadleaf weeds in: (a) turf (e.g., golf courses, lawns, and turf farms); (b) ornamentals (e.g., nurseries); and (c) noncrop land (e.g., roadsides, utility substations, and railroad rights-of-way) (Bjerregaard and Pafford, 1989).

The majority of isoxaben use on turf and ornamentals will be in population centers where golf courses and lawn care companies are located, for example, in the Midwest, Northeast, Sunbelt (south) and California. The total vegetation control (TVC) or noncrop use will be on areas of roadsides, utility substations and railroads scattered over the USA (Bjerregaard and Pafford, 1989).

The general use rate of isoxaben will be 0.75 pounds active ingredient (lb A.I.) per acre. Isoxaben is effective at rates of 0.5 to 1.0 lb A.I. per acre.

II. CURRENT SITUATION

Elanco claims that isoxaben controls a broad spectrum of annual broadleaf weeds including "difficult-to-control" species. Annual broadleaf species may be divided into two broad groups based on the timing of life cycles: cool season annuals and warm season annuals. Cool season annuals have accelerated germination and development during fall, winter and early spring and mature by late spring or early summer. Warm season annuals germinate after soil temperature has warmed in spring to early summer, develop during warm summer weather, and mature in late summer and fall. Generally, annual weeds interfere with crops via competition for light, moisture, nutrients and space. In some crops, competition is negligible during the early stages of

growth when both crop and weeds are small. In other crops, such as turf, where the crop plants are closely spaced, competition can begin soon after germination. Annual weeds manifest damage in the form of loss of crop stand, unsightly crop appearance, and health problems for persons allergic to pollen produced by certain species (Bjerregaard and Pafford, 1989).

Chemical Alternatives:

The primary chemical alternatives for isoxaben in cool season turf are 2,4-D, MCPP, dicamba, and dichlorprop. Primary chemical alternatives for isoxaben in warm season turf include 2,4-D + MCPP + dicamba (Trimec) for broadleaf control. Two primary chemical alternatives for isoxaben in ornamentals are simazine (Princep) and oxyfluorfen (Goal). Additional alternatives are listed in Table 1.

Nonchemical Alternatives:

- A. for turf, include weed control methods of hand weeding, and mowing;
- B. for ornamentals, nurseries, and nonbearing trees and vines, include use of organic mulches in combination with mowing, hand weeding and/or mechanical cultivation;
- C. for noncropland, include hand weeding, mowing, and use of organic or inorganic mulches.

III. REVIEW

BEAD has received supporting data from Elanco concerning weed control and crop injury. The registrant (Elanco) submitted their own screening trials and a few university trials. BEAD also collected results of university and experiment station trials from CT, NY and RI.

While Elanco claims certain benefits of isoxaben in comparison with currently registered alternatives, these benefits are only expressed qualitatively; benefits were not quantified by the registrant. In addition, since comparative product performance data were not submitted it is not possible for BEAD to describe the benefits in quantitative terms. The registrant's claims of benefits fall into five categories as follows.

1. Crop safety

Elanco claims greater crop safety from isoxaben compared to other chemical pest control methods. After reviewing the data, BEAD generally agrees with this claim.

In warm season turf, simazine can cause injury if it contacts roots of nearby ornamentals and trees. Simazine is not registered for use on cool season turf and can cause injury if

used there. Isoxaben is safe for use on warm season turf and it is not anticipated from data that isoxaben will have this phytotoxicity problem. Data from Rhode Island show isoxaben to be safe to use on seedling cool season turf (e.g., red fescue, Kentucky bluegrass and perennial ryegrass) especially when tillering starts (about four weeks after seeding).

In ornamentals, over-the-top spray of simazine and oxyfluorfen may cause injury to various herbaceous flowering perennials and several species of ornamental landscape grasses as stated in a letter from New York. Data from New York show isoxaben to be safe on a wide variety of herbaceous and ornamental plants. These are general statements only; detailed comparisons of isoxaben and alternative herbicides were not presented by species of ornamentals. The dollar value of this benefit was not presented.

During experiments in New York, isoxaben applied at proposed label rates of 0.5-1.0 lb A.I. per acre injured lilac (*Syringa vulgaris*) and was found not to be safe for use on Douglas fir, dogwood (*Cornus* spp.) or honey locust seedbeds (Neal and Senesac, 1988a). Isoxaben at either 0.6 or 1.12 kg/ha significantly reduced the fresh weight or vigor of the following: container-grown gaillardia (*G. aristata*, 'Goblin'), pasqueflower (*Anemone pulsitila* 'Red Pasque'), foxglove (*Digitalis purpurea* 'Excelsior hybrids'); field-grown zinnia (*Zinnia elegans*), snapdragon (*Antirrhinum majus*), veronica (*V. spicata*) and Shasta daisy (*Chrysanthemum x superbum* 'Alaska') (Senesac and Neal, 1988b). At the high rate of 1.12 kg/ha, isoxaben injured the following: container-grown baby's breath (*Gypsophyla paniculata* 'Perfecta'), leopard's-bane (*Doronicum caudatum* L.), field-grown allyssum (*Aurinia saxatilis* L.) (Senesac and Neal, 1988b).

2. Safety to non-target plants

Injury to non-target plants results from two main mechanisms: 1) drift which occurs during the application process and 2) volatilization of the pesticide off the target with subsequent deposition on surrounding areas. While drift control is mainly an application process, volatilization is a function of the pesticide chemistry. For the proposed use sites (turf, ornamentals, and TVC) the surrounding non-target plants are most likely to be other turf and ornamental plants. Food crops are more likely to be at risk in backyard gardens than in commercial field production. As noted in a letter from New York, currently registered herbicides, e.g., 2,4-D, dicamba, and MCPP, if used in turf may cause injury to surrounding broadleaf ornamentals and food crops due to both drift and volatility. Also in turf, as reported from a Texas letter, the use of simazine is limited by its persistence in the soil and injurious effect on certain trees and ornamental species. In California, certain herbicides, such as Oust, have potential liability due to off-site movement. All

letters were submitted as a part of the registrant's package (Bjerregard and Pafford, 1989).

Elanco claims that isoxaben will cause less injury to non-target plants when compared with currently registered herbicides. A review of the volatility potential of isoxaben is beyond the scope of this report. Isoxaben's safe use on most turf and ornamental crops indicates that it is less likely to injure non-target plants than currently used turf and ornamental herbicides. However, exceptions exist as noted under "Crop safety".

3. Weed control

Elanco claims four types of benefits resulting from the weed control properties of isoxaben: 1) control of a greater overall number of difficult-to-control weeds, 2) control of specific difficult-to-control weeds, 3) more effective reduction of competition due to its timing of application, and 4) the retardation of herbicide resistance development when isoxaben is alternated with current herbicides.

The first claim is artificially produced and extraneous. In Table 3 of the registrant's Benefits Analysis, Elanco concludes that isoxaben controls 15 of the 17 weeds listed while their nearest competitor controls only 11. Why these particular weeds are listed is not explained. Their contention is that these species are "difficult" to control but this list includes several species not mentioned as being important in a survey of golf course superintendents and landscapers included in the appendix of the registration packet. In addition, there are numerous discrepancies between their Table 3 and the compilation of state recommendations that they provided. The state recommendations note excellent to good control of certain weed species with various herbicides for which the registrant's Table 3 notes NC (not controlled).

BEAD agrees with the second claim regarding control of specific weeds. The data submitted show isoxaben to be effective on the weeds listed in Table 3. However, the state recommendation compilation shows that effective, currently registered alternatives exist for almost all of these species. In fact, a few chemical alternatives do a better job of controlling these species than isoxaben. On turf, dicamba gives better control of white clover and simazine gives better control of woodsorrel than does isoxaben. On ornamentals, simazine gives better control of groundsel than does isoxaben. BEAD concludes that for most weeds isoxaben is only another alternative chemical in the current arsenal.

According to the registrant's state recommendation compilation isoxaben does appear to provide superior control of horseweed and lawn pennywort in turf, and Carolina geranium, horseweed, and

lawn pennywort in ornamentals. Letters from state extension specialists point out that isoxaben may have certain unique niches in weed control in addition to these three weeds. Iowa notes the good control of prostrate spurge. In established Kentucky bluegrass and tall fescue Kansas notes control of cinquefoil, dandelion, purslane, black medic, eveningprimrose, plantain, redroot pigweed, shepherdspurge, wild carrot, sheep sorrel, ragweed, lambsquarters, spotted spurge, and curly dock. Isoxaben used in Rhode Island on cool season turfgrass provided control of common chickweed, henbit, prostrate spurge, purslane, and speedwell as well as reduction of dandelion and oxalis. Florida notes control of bittercress in ornamentals.

Elanco demonstrates unique benefits regarding the third claim, i.e. the use of isoxaben as a preemergence chemical to reduce competition to the crop. The chemicals currently in use are usually applied postemergence. This means that both weeds and crop exist side by side for some period of time. In ornamentals, some noncrop space usually surrounds the crop plant in a pot, tray, or the field. It may be possible for such a crop to tolerate small weeds for a short period of time. Thus, a timely postemergence control may effectively prevent significant competition. This is less likely to be the case in turf where the crop plants are tightly spaced from the start. The relatively larger broadleaf weed seedlings quickly begin to compete with the grass seedlings. A preemergence means of controlling weeds would have an advantage over postemergence chemicals.

Finally, in the fourth claim, Elanco states that the registration of isoxaben can expand the total number of available herbicides, thus allowing for a rotation between the alternatives in order to retard the development of resistance by the target weeds. This is a valid statement regarding a commendable weed control strategy.

4. Exposure - human

Elanco claims that the use of isoxaben would decrease human exposure compared to currently registered herbicides due to 1) time of application (fall or late winter/early spring), 2) lower volatility potential, 3) frequency of application (once per year), and 4) lower use rates (0.5 - 1.0 lb ai/A). At least in temperate climates, we agree that the general public is less likely to be outside and, therefore, less likely to come in contact with isoxaben when it is applied when compared to the currently registered herbicides which are applied during the summer. However, the combination of frequency and use rate would reduce human exposure as compared to alternatives chemicals in only certain cases. While their application rates are not greatly different, multiple applications allowed for 2,4-D, dicamba, simazine, and Trimec in turf and 2,4-D, oxyfluorfen, and

simazine in ornamentals do result in greater potential exposure to these chemicals. The frequency of application and rates of selected alternatives for isoxaben are shown in Table 2.

5. Exposure - environmental

Elanco claims lower environmental exposure from isoxaben due to: 1) limited soil movement (they claim isoxaben remains in the upper few inches of the soil profile) and 2) lower volatility potential (Bjerregard and Pafford, 1989). While neither of these claims regarding product chemistry are reviewed in this report, they are important to the question of ground water contamination. In California, the use of both the currently used alternatives diuron and simazine are threatened due to ground water concerns (Bjerregard and Pafford, 1989).

IV. CONCERNS

BEAD wishes to raise the following questions concerning the registrant's application:

- A. Would a typical application area for isoxaben be larger than one acre? Therefore, would the small package size (one pound), which treats one acre, increase the possibility of human exposure?
- B. If a single application provides season long control, is there a potential for carryover due to slow breakdown?
- C. What is the source of the data in Table 3 on page 16.1 of the applicant's Benefits Assessment for use on Turf, Ornamentals, Noncropland? Why were these particular weed species chosen for this listing? (Table 3 gives a comparison of isoxaben to alternatives by species with results given as either control or non control).
- D. Many of the experiments shown in the applicant's submission do not contain controls. This is especially important for determining weed control efficacy. Also, base weed densities are not provided.
- E. Where comparative data do exist, data were not analyzed by comparative statistical procedures (e.g., ANOVA). It is not possible to tell if differences in weed control efficacy or crop injury were due to treatments or to random variation.
- F. BEAD notes that there is a discrepancy in the applicant's submission under Sec. III. Benefits (Table 3) on page 16.1 and Sec. IV. Field Data on page 32.
- G. Limitations of the data provided by the applicant do not permit side-by-side comparison of weed control efficacy.

H. Conclusions regarding comparative product performance were drawn from state recommendations and testimonial letters from state extension specialists.

V. CONCLUSIONS

BEAD has, based on available data, reached the following conclusion concerning Elanco's application for use of isoxaben:

1. There is probably greater crop and non-target safety in preemergence use of isoxaben as compared to currently registered alternative herbicides.
2. There appears to be less potential human exposure (in temperate regions of USA) as derived from preemergence applications of isoxaben when compared to postemergence applications of alternative chemicals.
3. Preemergence application of isoxaben is important in turf because turf cannot tolerate early competition. Ornamentals, in comparison, can tolerate small weeds and thus preemergence application may not be as advantageous as in turf.
4. BEAD does not agree with Elanco that isoxaben has a unique advantage in weed control because there are several alternative herbicides for most weeds. The unique advantage arises from the chemical's preemergent use pattern.

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Table 1. Selected Chemical Alternatives to Use of Isoxaben

Trade Name	Common Name	Company	Type Activity	Registered Use Turf Orn TVC
Gallery	isoxaben	Elanco	PRE	X
Aatrex	atrazine	Ciba-Geigy	PRE/POST	X
Banvel	dicamba	Sandoz	POST	X
Betasan	bensulide	ICI Americas	PRE	X
Dacthal	DCPA	Fermenta	PRE	X
2,4-D	2,4-D	several	POST	X
Goal	oxyfluorfen	Rohm and Haas	PRE/POST	X
Karmex	diuron	du Pont	PRE/POST	X
Oust	sulfometuron methyl	du Pont	PRE/POST	X
Pre-M	pendimethalin	American Cyanamid	PRE	X
Ronstar	oxadiazon	Rhone-Poulenc	PRE	X
Princep	simazine	Ciba-Geigy	PRE/POST	X
Surflan	oryzalin	Elanco	PRE	X
Treflan	trifluralin	Elanco	PRE	X
Trimec	2,4-D + mecoprop + dicamba	PBI/Gordon	POST	X
Turflon	2,4-D + triclopyr	Dow	POST	X

Table 2. Frequency of application and rates of selected herbicides

product	Applic. rate (lbs AI/A)	Maximum Number of applic. year
2,4-D	0.5-1.0	4-5
dicamba	0.25-1.0	3
oxyfluorfen	1.0-2.0	3-4
simazine	1.0-4.0	2
2,4-D + mecoprop + dicamba	1.33-1.66	4-5
isoxaben	0.5-1.0	1