Agriculture Canada

Food Production
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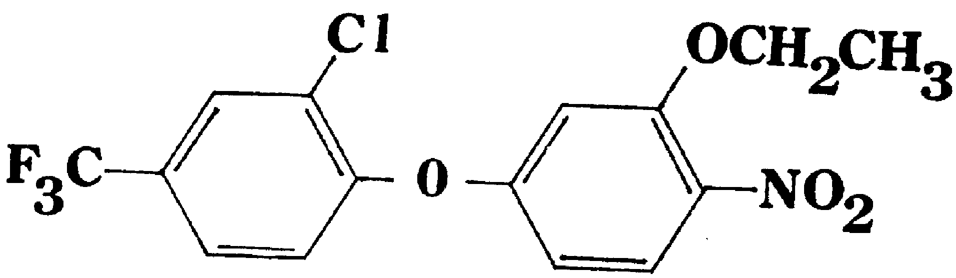
Direction générale,
Production et inspection des aliments

Pesticides Directorate

Direction des pesticides

Discussion Document D87-01

OXYFLUORFEN



Herbicide

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Oxyfluorfen (Goal) Herbicide

1. Summary

The purpose of this document is to provide a summary of the data reviewed and outline the regulatory action on the active ingredient oxyfluorfen.

The registration status of oxyfluorfen represents an important ongoing regulatory issue concerning onion production in Canada. Because onions do not compete well with weeds, production without appropriate weed control is not practical. Allidochlor (Randox), the traditional onion herbicide, is no longer manufactured and stocks have gradually been depleted. As a result, oxyfluorfen has now become the only viable herbicide available for post-emergent broadleaf weed control in onions.

Agriculture Canada, with the assistance of advisors from Environment Canada, Fisheries and Oceans Canada and Health and Welfare Canada, has completed a review of the available data supporting oxyfluorfen. Although the data base is modern, certain environmental and health studies are either incomplete or inadequate.

Risks as a result of occupational exposure could not be identified due to the inadequacy of the study submitted. In light of the lack of data, growers are requested to use protective clothing in order to keep exposure to a minimum.

Exposure of consumers to residues in food will be minimal, because residues of oxyfluorfen and its metabolites on the harvested bulb onion are expected to be less than 0.01 ppm.

With respect to environmental impact, the high fish toxicity and persistence in sediments are of special concern. Adequate data are not available on the environmental fate of oxyfluorfen in the muck soils where dry bulb onions are generally grown in Canada. However, the impact of this use of oxyfluorfen on the environment is expected to be minimal because of the small onion acreage and the chemistry characteristics of oxyfluorfen. Oxyfluorfen is strongly adsorbed to soils with high organic matter content, such as muck soils and it is not particularly subject to teaching/runoff.

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Based on a review of all available information and in view of the critical need for this herbicide, the restricted class temporary registration for Goal for use on dry bulb onions has been extended to 1987 under the following conditions:

l.a) A cautionary label statement to read: "Safety studies relative to users and spray operators are not complete. Exposure to this product may be hazardous to your health. Care must be taken when handling to minimize exposure. Follow all label directions and precautions carefully".

b) Requirements for the use of protective clothing including goggles, gloves, long trousers and long-sleeved shirts when handling the product and spray equipment.

c) Requirement for a 56-day pre-harvest interval.

d) A precautionary statement regarding aquatic sites to read: "This pesticide is highly toxic to aquatic plants, aquatic invertebrates, wildlife and fish. Use with care when applying in areas frequented by wildlife or adjacent to any body of water or wetland area. Do not apply when weather conditions favour drift or erosion from target area. Do not contaminate water bodies by cleaning of equipment or disposing of wastes".

The manufacturer of oxyfluorfen has initiated a program to reduce or eliminate some impurities in technical oxyfluorfen, which may be responsible for some of the observed toxic effects. New studies may be conducted with this purer form of the technical oxyfluorfen. However, the small market in Canada may not justify the expenditures needed to produce all the additional data required in Canada. This product has already been unconditionally accepted for registration in many countries including the United States.

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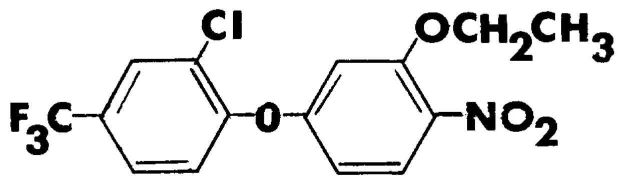
2. Product Chemistry

Common name: oxyfluorfen
Chemical name: 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
Trade name: Goal
Structural Formula:



Empirical formula:	$C_{15}H_{11}ClF_3NO_4$
Molecular weight:	361.7
Melting point:	65-80°C
Decomposition temperature:	250-300°C
Vapor pressure:	2×10^{-6} mm Hg at 25°C
Solubility:	water 0.1 ppm Soluble in most organic solvents.
Stability:	No evidence of decomposition when stored at room temperature for one year. Subject to decomposition by UV irradiation

3. Development and Use History

Oxyfluorfen is manufactured and developed by Rohm and Haas Company as a herbicide for selective weed control in croplands. It has been registered for use in many countries including the United States, where it is currently registered for use on ornamental stocks, tree fruits, corn, coffee, soybeans and onions.

In Canada, this herbicide was given a provisional restricted class temporary registration in 1985 and 1986 for use on dry bulb onions only.

4. Regulatory Position and Rationale

Due to the scarcity of onion herbicides, oxyfluorfen continues to be essential for Canadian onion production. In fact, it is the only viable replacement for allidochlor for post-emergent broadleaf weed control in onions. Production of allidochlor has been discontinued and existing stocks have almost been depleted.

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Oxyfluorfen is fully registered for use on onions in other countries, including the United States, which export onions to Canada.

Primary exposure involves farmers during application - a risk that growers and their organizations indicate they are willing to assume. Exposure can be reduced through the use of protective clothing.

Exposure of consumers to oxyfluorfen in food will be minimal because residues in harvested bulb onions are expected to be less than O .01 ppm.

Based on these considerations, the restricted class temporary registration has been extended to 1987 with appropriate cautionary label statements and limitations:

a) A cautionary label statement to read:

"Safety studies relative to users and spray operators are not complete. Exposure to this product may be hazardous to your health. Care must be taken when handling to minimize exposure. Follow all label directions and precautions fully."

b) Requirements for the use of protective clothing including goggles, gloves, long trousers and long-sleeved shirts when handling the product and spray equipment.

c) Requirement for a 56-day pre-harvest interval.

d) A precautionary statement regarding aquatic sites to read:

"This pesticide is highly toxic to aquatic plants, aquatic invertebrates, wildlife and fish. Use with care when applying in areas frequented by wildlife or adjacent to any body of water or wetland area. Do not apply when weather conditions favour drift or erosion from target area. Do not contaminate water bodies by cleaning of equipment or disposing of wastes".

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5. Benefit of Oxyfluorfen for Onion Production (Input of the Policy Branch, Agriculture Canada)

5.1 Summary

Economic production of onions in Canada is dependent on the availability of an effective herbicide for broadleaf weed control. The loss of the registration of the herbicide oxyfluorfen would lead to the virtual loss of commercial onion production in Canada. This would affect $20-30 million of onion production at the farm level and affect approximately $7 .5 million worth of exports.

The economic impact will be concentrated in vegetable producers on organic soil in Ontario and Quebec. Producers in the Ontario Bradford Marsh region will be most affected. The economic impact will affect not only onion producers, who must switch to alternative crops, but also the producers of the alternative crops as a result of increased supplies and lower prices.

Onion consumers should not be affected to any significant extent except that they will be consuming onions imported from the United States, likely produced using herbicides not registered in Canada.

5.2 Onion Production in Canada

Onion production is concentrated in Ontario which accounts for 66 percent of Canadian production and Quebec which has 24 percent, based on 1983-85 average production. British Columbia, Manitoba and Alberta account for the remainder of the recorded commercial production. The area (approximately 3800 hectares) devoted to onion production has changed little over the past 10 years. Most onion production occurs on muck or organic type soil, which produces very high yields under intensive management practices. The principal areas of muck production in Quebec are south and east of Montreal; in Ontario they are north of Toronto and in the southwest near Lake Erie; and in British Columbia in the lower Fraser Valley.

The largest production area is the Bradford Marsh, north of Toronto which accounts for about half of Canada’s onion production.

Farm cash receipts for onions for 1981-84 averaged $24 million. This represents about 5 percent of total vegetable cash receipts, while in terms of total agriculture it represents about 0.1 percent. In overall terms, therefore, it is a minor crop. However it is an important crop to those regions where it is produced.

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Canada both exports and imports onions and on balance is a significant net importer of onions. Nearly half (46 percent in 1984) of the onions consumed in Canada were imported and nearly all of these imports were from the United States. Canadian onion imports are predominantly the Spanish-type onion. Canadian onion production is mostly the yellow cooking-onion type as the climate does not favour the production of Spanish type onions.

5.3 Production Impact of Herbicide Non-Availability

Commercial onion production requires intensive management practices. In a growing season a field of onions may receive over 15 applications of various herbicides, insecticides and fungicides. Onions are a very poor competitor against weeds and as many as five or six flushes of weeds occur in the production of onions on organic soils. Oxyfluorfen cannot be applied to onions until they reach the two-leaf stage and is normally used for the third and subsequent weed flushes.

In a study conducted in Ontario on the yield losses with no pest control it was found that without herbicides yield losses in each of the trial years was 100 percent. The weed population in organic soils is very high and in the tests virtually 100 percent of the plant surface was smothered by weeds each year within six weeks of onion planting. The dominant broadleaved weeds observed in the test plots included pigweed, purslane, lambs-quarters and lady’s-thumb.

The absence of an effective post-emergent herbicide (such as oxyfluorfen) would result in estimated yield losses of 70-80 percent in onions, making commercial production of onions impractical. The cost of handweeding is so high that it is not an economically viable alternative to herbicide use.

5.4 Economic Impact of Herbicide Non-Availabity

In the event that no broadleaf herbicide is registered for use in onion production, commercial production of onions in Canada would be uneconomic. Prices for onions in Canada are largely determined by the U.S. market. Without oxyfluorfen or a suitable replacement herbicide, Canadian producers could not produce onions at a price competitive with U.S. producers. U.S. onion producers, with their continued permitted use of various broadleaf herbicides, could supply all of Canada’s onion needs.

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The economic impact on Canadian producers is difficult to quantify. Current onion producers would switch to various other crops. The most likely alternative crop would be carrots, while potatoes and beets are other alternate storage crops. Some of the onion crop area may be used for production of fresh market crops such as lettuce, endive, celery and Chinese vegetables.

The area devoted to onion production represents about one-quarter of the organic soil area under cultivation in Canada. A shift to the next best alternative crop, carrots, would result in a 50 percent increase in carrot area. Such an increase would be too large for the market to absorb. Consequently, onion producers will likely switch to a variety of crops, the choice being dictated by the price and marketing situation for the various crops.

The economic impact of such a shift in production will affect not only onion producers but also other vegetable producers through a price effect. The increased area devoted to other crops will increase the production of these crops and this increased supply will depress prices. The decline in revenue will lead to a decline in land values, particularly of the organic soil type. It is possible that the total impact for vegetable producers may be larger than just the loss of onion production.

While estimating the impact on vegetable producers is difficult because it necessitates estimating shifts in production and pricing, it is possible to make an illustrative calculation. For example, if 50 percent of onion area was shifted to carrot production it would result in about a 25 percent increase in carrot production. Carrot prices are sensitive to production changes and over the period 1977-83, a 1 percent change in production resulted in a nearly 2 percent change in prices. Therefore, a 25 percent increase in carrot production could decrease prices to producers by up to 50 percent. Given an average farm value of carrots of $30 million, the decline in farm cash receipts to carrot producers could be $15 million.

Onion producers will be further affected in that their capital investment in storage facilities, machinery and equipment will be partly or mostly lost. Storage facilities, in particular, will no longer be necessary, or if to be used for other crops, would have to be modified.

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Loss of onion production will have an impact on Canada's balance of payments. It will result in a loss of $7 .5 million in export earnings (1983-85 average). About 35 percent of these exports go to countries other than the United States, mainly Caribbean countries and the United Kingdom. None of the alternative crops have any export potential in these off shore markets nor is it likely that the alternative crops will recapture the loss of onion exports to the United States.

6. Toxicology (Health and Welfare Canada Input)

6.l Acute Studies

6.1.1. Technical material

The acute oral LD_{50} in male rats varies with solvent (5.47 g/kg bw in corn oil:>7.0 g/kg bw in water); compound purity also appears to affect the oral LD_{50} in rats (3.0 g/kg bw with 72.6% purity:>l0 g/kg bw with 98.3% purity), but detailed data on these studies have not yet been received. In dogs, the oral LD_{50} is >5 g/kg bw using 91% purity test material.

6.1.2 Formulations

A 1.6EC formulation containing 27% of 72.8% purity technical material resulted in an LD_{50} (both sexes) of between 0.5 and 5.0 g/kg bw in rats. In a rabbit dermal study, the LD_{50} was >5 g/kg bw. Oxyfluorfen was severely irritating to rabbit skin and eyes.

6.2 Short Term Studies

A 90-day mouse feeding study with 72.5% purity technical material failed to indicate a no-observed effect level (NOAEL), the lowest dose (200 ppm in the diet) resulting in increased liver weight:body weight ratio and changes in liver pathology in both sexes. In males, haematological changes, splenic and bone marrow hypertrophy were also observed.

A 90-day feeding study with Charles River rats using a 72% purity technical material failed to indicate a NOAEL, the lowest dose (200 ppm in the diet) resulting in histopathological changes in the kidney of female animals

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A second 90-day rat study with Long Evans rats using a 72.5% purity technical material in which dose levels were increased after 2 and 4 weeks, also failed to indicate a NOAEL. The lowest dose (initially 400 ppm, increased to 560 ppm and then 800 ppm) induced lower body weight gain in males, haematological changes, adrenal (both sexes) and liver (males only) pathology.

A third 90-day rat study with Charles River rats using 91% purity technical material, caused body weight gain reduction and centrilobular swelling of the liver at 5000 ppm. No effects were observed at 800 ppm. However, diet analyses and compound stability data were not available to confirm the dietary levels administered.

A 90-day dog study, performed by Industrial Biotest Laboratories Inc. (IBT) could not be validated.

A 21-day repeat dermal exposure study in rabbits was of limited value given the use of a small group size and the lack of data pertaining to site occlusion or animal restraints in order to prevent oral exposure. Dermal effects were noted in the animals receiving a 2 g/kg bw/day technical material (75% pure), O.1 mL/kg bw/day EC formulation (23.7% pure) and O.4 mL/kg bw/day formulation blank. Systemic hepatic effects were demonstrated in animals receiving the 2 g/kg bw/day technical material. No NOAEL was achieved.

No NOAEL was achieved when rats were exposed to aerosol concentrations of 0.034 mg/L of Goal 2EC (23.5% pure) or formulation blank for 6 hours/day, 5 days/week for one month. Effects included salivation, discoloration of fur, haematological changes, organ weight changes and pulmonary histopathology.

6.3 Metabolism Data

Metabolic data are extremely limited, being based on administration of oxyfluorfen labelled in the trifluoromethyl group, to one male and one female rat of unknown strain. Exeretion appears to be similar in both sexes, with the exeretion being rapid and mainly via the faeces. Six faecal metabolites were isolated.

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6.4 Mutagenicity Studies

Some 16 mutagenicity studies have been performed. The results indicate that technical oxyfluorfen is mutagenic in Ames and mouse lymphoma studies, whereas purified material is not. It appears that the more polar impurities are mutagenic in some test systems, but the three isolated polar impurities tested to date in limited studies, were all negative.

6.5 Teratology

A rat teratology study utilizing 71.4% purity technical material did not indicate teratogenic activity at dose levels up to 1000 mg active ingredient (a.i.)/kg bw/day. Clinical signs of maternal toxicity, delayed ossification in foetuses and increased resorption rates were observed at 1000 mg a.i./kg bw/day, resulting in a NOAEL of 100 mg a.i./kg bw/day for the study.

A rabbit teratology study using 94% purity technical material did not show any signs of teratogenic activity in the limited number of pups available at doses up to 125 mg/kg bw/day. However, numbers of animals utilized (6-8 pregnant female/dose level) were inadequate to permit a valid evaluation and the study was rejected.

Further studies in rabbits have utilized a 25 WP formulation. Additional data are required to resolve the significance of a dose related increase in abortion rate (O, O, 7, 13 and 36% at 0, 0, 10, 30 and 90 mg/kg bw/day). Similarly, the limited number of foetuses (22) due to maternal death or abortion at 90 mg/kg bw/day renders evaluation of teratogenic potential difficult.

6.6 Reproduction studies

The dose levels utilized in a rat mutigeneration study (100 ppm maximum dietary levels) were insufficient to cause any effects. The study was rejected on the basis of inadequacy of the doses utilized.

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6.7 Long Term Studies

A two-year dog feeding study utilizing 71.4-73.8% purity technical material failed to demonstrate an NOAEL, although effects (bile pigmented hepatocytes, thyroiditis and C-cell hyperplasia, etc.) were minimal at the lowest dose tested (100 ppm a. i.).

A 20-month mouse study with 85.7% purity technical material, with dietary concentrations of 2, 20 and 200 ppm a.i. failed to demonstrate an NOAEL, due to effects on the liver and because of wide variability in clinical chemistry and haematology parameters. An increased incidence of hepatocellular nodules and carcinomas was also observed in male mice at 200 ppm.

A 24-month rat study using 82-85% purity technical material, indicated a possible NOAEL of 2 ppm although there was some decrease in female body weight at this dose level. Pathological effects were observed in the top dose level (ca 650 ppm) at 12 months in an interim kill, but at 24 months, none was reported. (The histopathology was performed by different laboratories at 12 and 24 months). The available data were not indicative of any tumor induction.

6.8 Summary of Toxicity Data

Overall, the data base is insufficient due to study limitations or the failure to demonstrate NOAELs. Concern regarding the toxic potential of impurities in the technical material, evidenced by acute studies and mutagenicity data, as well as in short-term tests remains unalleviated. Further, because of the variations in purity of test material, the relevance of specific studies are open to question. The variability of the alkylation process during manufacture of technical material is also of concern due to the potential for nitrosamine formation.

6.9 Occupational Exposure

The available exposure study is not adequate to predict dermal exposure for workers under typical Canadian use conditions as only one subject was used for one trial where the product was applied to one acre. Furthermore, only four patches were used to estimate dermal exposure and clothing was assumed to provide 100% protection.

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6.10 Dietary Exposure

Oxyfluorfen herbicide is absorbed by plants but is not readily translocated to other parts of the plant. The parent compound is the major component of any terminal residues, with several minor metabolites accounting in total for less than 5% of the terminal residue.

Analytical methods capable of determining both oxyfluorfen and its potential metabolites show that total residues in bulb onions are unlikely to exceed 0.01 ppm when onion plants are treated at 120 g/a.i./ha with a maximum of three applications per season, and an interval of 56 days or more between the last application and harvest of the onion bulbs.

7. Environmental Aspects (Environment Canada Input)

7.l Summary

More data are needed to determine the environmental acceptability of oxyfluorfen. Of special concern are the high aquatic toxicity and persistence in sediments. There are no data on the environmental fate of oxyfluorfen in muck soils on which dry bulb onions are generally grown in Canada. A mitigating factor is the smallness of the area that is planted to dry bulb onions in any year.

7.2 Environmental Chemistry and Fate

The solubility of oxyfluorfen in water is very low, and this chemical is readily adsorbed in a variety of soils, particularly those with high organic matter content. Little desorption into water occurred in test soils, indicating that leaching of oxyfluorfen from treated soil would be minimal. The vapour pressure of oxyfluorfen is low: nonetheless, measurable concentrations of the chemical were found in the air above a treated field (silt-loam soil, 2.5 percent organic matter) and this may be a significant route of dissipation. The air/water distribution ratio or Henry’s law constant is relatively high (close to that of triallate) which supports the potential for volatilisation. However, the very strong adsorption of oxyfluorfen on soil organic matter makes volatilisation an unlikely route of dissipation from muck soils. The fate of the vaporized chemical is unknown.

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Field studies of soil residue decline, not in muck soils, have shown varied half-1ives (50 percent decline times) ranging from 9 days to 95 days.

A field study found significant contamination of hydrosoil in a farm pond, on a site subject to erosion by runoff, within an area of use of oxyfluorfen (in the United States). This type of erosion is not likely to be characteristic of muck areas on which dry bulbs are generally grown in Canada. In such areas, the likelihood of movement of oxyfluorfen adsorbed on suspended organic matter in drainage water will depend on the hydraulic regime imposed and the timing of tillage in relation to application of Goal.

7.3 Environmental Toxicology

Wild birds: The acute toxicity of oxyfluorfen to 16 week Bobwhite Quail is approximately 5000 mg/kg with mortality occurring between 4 and 14 days after dosing. The 5 day dietary toxicity (followed by three days of observation on clean food) was greater than 4000 ppm for 5-7 day old mallard ducks and 390 +/- 22.7 ppm for 5-7 day old Bobwhite. Feeding depression was noted at 1000 ppm and 100 ppm respectively. Symptoms of toxicity were observed at the lowest diet concentrations tested, namely 2000 ppm in the Mallard and 100 ppm in the Bobwhite. The lowest diet concentration which caused mortality in the Bobwhite was estimated to be between 100 and 300 ppm whereas no mortality was observed in the mallard at 4000 ppm. In reproductive studies consisting of 11-12 weeks of dietary exposure pre-laying followed by 10 weeks of egg laying while still on the contaminated diet, no effects were seen up to 100 ppm in either the Mallard or Bobwhite. Information on diet stability was not included and has been requested from the manufacturer so that these studies can be properly evaluated.

If there is contamination of wetland, chronic dietary exposure is likely to result from subsequent uptake on plant and animal foods. Only limited exposure is expected from the use of oxyfluorfen on onions.

Based on these considerations, oxyfluorfen is not expected to present an acute hazard to avian species. A chronic hazard is not likely, although the reproduction studies submitted could not be evaluated fully.

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Wild mammals: No wild mammals were tested. Based on the low acute toxicity of oxyfluorfen to the rat and dog (range: 3200 mg/kg to greater than 7100 mg/kg) acute toxicity is not expected in wild mammal species. The formulated product was found to be somewhat more toxic than the technical, the rat LD_{50} being between 500 and 5000 mg/kg.

Amphibians and Reptiles: No data are available for the evaluation of risk to amphibians or reptiles. Exposure to the former is likely if there is contamination of wetlands.

Fish: (see Fish and Fish Habitat Section)

Aquatic Invertebrates: Oxyfluorfen is very toxic to some aquatic invertebrates such as crustacea and mollusks. Endpoints of toxicity studies submitted in support of registration are as follows:

Species	Endpoint	Result (in a.i.)
Daphnia magna	48 hr. LC_{50}	1.5 mg/L
Grass shrimp (P. pugio)	96 hr. LC_{50}	0.032 mg/L
Freshwater clam (E. complanata)	96 hr. LC_{50}	9.6 mg/L
Eastern Oyster (C. virginca)	48 hr. EC_{50}	greater than 0.032 mg/L

Furthermore, no data were submitted on the toxicity of formulated material. These values must, therefore, be considered to be underestimates of the toxic potential of formulated oxyfluorfen. The U.S. EPA has concluded that several species of endangered mollusks could be at risk from the use of oxyfluorfen in that country.

On the basis of the environmental chemistry of oxyfluorfen, exposure is expected to occur if there is sediment transport in runoff from treated fields. Residues are expected to be persistent and to accumulate, to some degree, in the biota.

Terrestrial Invertebrates: No data were provided on the toxicity of oxyfluorfen to earthworms or terrestrial insect species. Tests on a number of soil microorganisms showed no effect at expected field concentrations.

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Wildlife Habitat Considerations: The removal of animal food organisms from wetlands associated with areas of use is one of the potential impacts on wildlife habitat. Another is the phytotoxicity of oxyfluorfen residues to aquatic plants. Field soil residue levels below the detection limit (10 ppb) were found to be still herbicidally active. There is a possibility that the contamination of receiving wetlands by sediment in runoff will affect important food plants such as aquatic macrophytes. Oxyfluorfen is known to be phytotoxic to the green alga **Scenedesmus acutus**. The full spectrum of its activity should be investigated in order to determine its probable impact.

8. Fish and Fish Habitat (Fisheries and Oceans Canada Input)

The active ingredient (oxyfluorfen) is highly toxic to Rainbow trout (96 hr. LC_{50} at 0.41 mg a.i./L). Standard acute toxicity studies report the following: (all reported as a.i.) **Daphnia magna** 48 hr. LC_{50} = 1.5 mg/L, grass shrimp 96 hr. LC_{50} = 0.032 mg/L, freshwater clam 96 hr. LC_{50} = 9.6 mg/L and eastern oyster 48 hr. EC_{50} greater than 0.032 mg/L. The a.i. has a half-life ranging from 79 to 120 days in soils at the proposed application rates of 120 g a.i./ha. Moreover, residues are not degraded by hydrolysis, photolysis or microbial activities in soils. However, there is a very significant photolytic degradation in water (half-life of 12 hr.).

Bioconcentration factors employing channel catfish and bluegill sunfish are very high, ranging from 400x to 4000x depending upon the species and the experimental design. However, depuration rates were equally striking in that 98 percent of accumulated materials in the channel catfish disappeared in 5 days while 90-95 percent of that in the sunfish cleared within 14 days.

The a.i. is strongly sorbed to soils and its solubility in water is low so that any entry into fish habitat will occur through the sediment in runoff. Groundwater contamination is not a likely route for transportation. Soil erosion is not typical of the soils commonly used in Canadian onion growing areas, but does depend, in part, upon well-informed soil management techniques.

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The current manufacturing process produces only some 60-80 percent of the active material, the remaining "residues" being characterized as "isomers" which have varying invertebrate larvicidal activities and five of which present variable effects on plant chlorophyll systems.

It has been said that: over the long term, based on model predictions, oxyfluorfen can be expected to persist and accumulate in certain aquatic environments. The EXAMS computer simulation predicts a half-life of 127 days and that there will be an increase in the hydrosol (sediment) concentration every year the pesticide is applied. Actual field monitoring of residues (which include clear statements as to limits of detection) of oxyfluorfen and the "isomers" as well as aquatic biota deviations from normal is necessary to evaluate accurately the persistence, bioaccumulation and hazard to aquatic organisms. Of carticular concern is the question of whether the observed hydrosol concentrations of 50 ppb might have detrimental effects on the plants residing in any wetlands in the use areas. In essence, is oxyfluorfen as toxic to beneficial aquatic plants as it is to target weeds?

There is a need for more data relating to the likelihood of this product reaching Canadian aquatic environments and its impacts upon the components of these environments. Such material should include data on the formulation(s) (not just the a.i. data predominantly available to us now) and similar information on the major "isomers" to be expected in the formulation.

Please direct inquiries regarding oxyfluorfen (Goal) herbicide to Dr. F.Y. Chang (613) 993-4544.

June 24, 1987