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Your file Votre référence
22 July 1987
Our file Notre référence

Charles Lewis
Ecological Effects Branch
Hazard Evaluation Division
Office of Pesticides & Toxic Substances
US Environmental Protection Agency
Washington, D.C. 20460

Dear Charles,

Re: DuPont Ally Herbicide (Metsulfuron-methyl)

Enclosed is a copy of our evaluation of the use of Ally to control or suppress certain broadleaf weeds in wheat (spring and durum) and barley in the black and gray-wooded soil zones (pH 7.5 or less) of the Prairie Provinces and the Peace River region of British Columbia. I have attached a copy of the covering letter to Agriculture Canada because it refers to our conversation on Ally in response to statements on its U.S. registration.

A Discussion Document (equivalent to your Registration Standard) is being prepared for the use of Ally on wheat and barley because Agriculture Canada granted a temporary registration for 1987, against the recommendations from Environment Canada. I have enclosed a draft copy of the Environment Canada section for your information. The final document will also summarize the evaluations by Health & Welfare Canada and Fisheries & Oceans Canada, and the regulatory position and rationale by Agriculture Canada.

We are currently determining which acute toxicity tests and plant species should be used to generate the data we need to evaluate potential hazards to wildlife habitats in areas where Ally will be used. At present only the agricultural use pattern is registered but DuPont is also conducting research in Canada on the use of Ally on roadsides, pipelines, utility and railroad rights-of-way, and in reforestation areas. I would appreciate any comments you might have in this regard.

For your information, I have assumed the responsibility in CWS for the development of guidelines for testing of pesticide toxicity to nontarget plants.

If I can be of further assistance, please don't hesitate to call me at (819) 997-6073.

Yours sincerely,

Kathy Freemark

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AGRICULTURE CANADA :

ALLY DISCUSSION DOCUMENT

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6. ENVIRONMENT CANADA INPUT: (ENVIRONMENTAL ASPECTS)

6.1 Summary

The prominent modes of degradation of metsulfuron-methyl in soil, water and sediment are by microbial action under aerobic and anaerobic conditions and by chemical hydrolysis, the latter being significant only under acidic conditions. Photodegradation is insignificant. Residues degrade faster in warm, moist soils of low pH. In prairie soils herbicidally-active residues persist for at least two growing seasons. High water solubility, poor soil adsorption and results of laboratory leaching experiments suggest metsulfuron-methyl has a significant potential for movement through leaching and run-off. Field studies in

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the prairies with technical material have provided variable results but in general indicate that leaching was limited and was related to amount of rainfall and soil type. Field studies with formulated material to assess movement through leaching and runoff are pending.

The requested use of metsulfuron-methyl is not expected to pose a hazard to wildlife from acute or dietary exposure or from food removal from acute toxicity to invertebrates. However, the impact on wildlife habitat and associated food resources cannot be evaluated because minimal-effect-levels for nontarget plants have not been determined. The data submitted indicate that metsulfuron-methyl is likely to be toxic to aquatic plants at initial concentrations expected in prairie sloughs in the intended area of use. Algal toxicity tests and toxicity tests with plant species commonly associated with prairie sloughs are pending in order to evaluate potential impacts of metsulfuron-methyl on wildlife habitat and associated food resources in the intended area of use, and to determine if the current detection limits for metsulfuron methyl in water and soil are adequate. In the interim a 15-m buffer zone is suggested around sloughs and other wetlands to minimize possible off-site movement of metsulfuron-methyl and exposure of nontarget plants.

6.2 Environmental Chemistry and Fate

Metsulfuron-methyl is a weak acid (pKa = 3.5), the non-ionic form predominating at low pH.

Metsulfuron-methyl is highly soluble (109 mg/L in distilled water at 25°C), particularly under buffered conditions and higher pH (270 mg/L at pH 5, 9500 mg/L at pH 7). Its higher water solubility is also reflected in its low octanol-water partition coefficient (Kow = 0.018).

Metsulfuron-methyl is moderately volatile with a vapour pressure of 5.8×10^{-5} mm Hg at 25°C.

The prominent modes of degradation of metsulfuron-methyl in soil, water and sediment are by microbial action under aerobic and anaerobic conditions. Chemical hydrolysis is also significant under acidic conditions. Photodegradation in soil or water is insignificant. In soil, the parent compound is degraded to saccharin and CO_2 by way of intermediate transformation products.

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Metsulfuron-methyl is very persistent in cool, dry, alkaline soils. In a laboratory study with Canadian prairie soils, the half-life was 70 days in clay loam (pH 5.2), 102 days in sandy loam (pH 6.8) and 178 days in clay soil (pH 7.5). Field studies using radio-labelled metsulfuron-methyl in silt loam, silty clay loam and sandy loam soils (pH 6.1 to 8.2) in the northern U.S. and Canada (Alberta, Saskatchewan and Manitoba) indicated an average DT_{50} (50% decline time) of 2.5 months (range of 1 to 7 months). However, the parent compound persisted in the soils for at last two growing seasons. No data were available on the fate of transformation products. Differences in persistence between laboratory and field studies were a result of some combination of factors related to soil pH, moisture and temperature.

In prairie soils, herbicidally active residues persist for at least two growing seasons. A recropping interval of 22 months or more depending on the results of a preliminary field bioassay, may be necessary for crop rotation. Some tolerant crops may be grown after 10 months. Regular annual use of the product may lead to accumulation or buildup of residues although no data were available.

A laboratory anaerobic water/sediment study conducted at 25°C indicated that the approximate DT_{50} in natural water ranged from 5 weeks at pH 5.8 to 25 to 30 weeks at pH 6.9. Because the water in prairie sloughs is mainly alkaline (pH up to 9.7) and well buffered, metsulfuron-methyl is expected to persist in the water column for more than 30 weeks and thus potentially accumulate from regular annual use. Studies on persistence on metsulfuron-methyl in water and sediment have been suggested to address this concern.

Studies with acid soils (pH 5.6-6.5) indicate that metsulfuron-methyl absorbs poorly in soils. Soil column experiments with freshly treated acid soils (pH 5.6-6.7) showed that 85% to 100% of the applied radioactivity leached through the columns. A soil TLC study also indicated that metsulfuron-methyl was mobile in sandy loams and silt loam soils. In soils with a higher pH, the mobility of metsulfuron-methyl is expected to increase because of increased solubility, increased ionization of the chemical and decreased adsorption. Results from field

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studies in the prairies with radiolabelled technical material were variable, but in general indicate that leaching was limited and was related to amount of rainfall and soil type. There was very little leaching (>1%) below 22 cm in the dark brown soil at Swift Current (silt loam, pH 6.1) and Saskatoon (silty clay loam, pH 6.2). However, in the black soil at Stettler, Alberta (sandy loam, pH 6.9), 12% of the applied activity had leached down to 22-35 cm soil depth after 1 month with no indication that leaching had stopped at 35 cm as soil from a greater depth had not been sampled. Field studies with formulated material to assess leaching in black and gray-wooded soils are pending.

Based on its high solubility and poor soil adsorption characteristics, metsulfuron-methyl has a potential for movement in runoff water if there is rainfall soon after application of the herbicide. This could result in contamination of adjacent wetlands and subsequent damage to nontarget plants. Field runoff studies based on the use of indicator plants are pending. In the interim, a 15-meter buffer zone is suggested around sloughs and other wetlands to minimize contamination of nontarget habitats adjacent to use areas.

6.3 Environmental Toxicology

Wild Birds Wild birds may be exposed to metsulfuron-methyl by direct overspray, spray drift, or by consumption of vegetation or prey sprayed with this herbicide. Exposure through these routes is not expected to result in adverse toxicological effects because of low application rates and residues, and the extremely low acute oral and dietary toxicity of the technical and formulated product to bird species tested. Technical metsulfuron-methyl is practically non-toxic to 6-month old mallards (LD50 greater than 2510 mg/kg). Technical metsulfuron-methyl was not toxic to 14 day-old Mallard or Bobwhite Quail when administered in the diet for 5 days (both LC_{50}'s greater than 5620 ppm).

Wild Mammals Wild mammals may be exposed to metsulfuron-methyl by direct overspray, spray drift or by consumption of vegetation or prey sprayed with this herbicide. Exposure through these routes is not expected to result in adverse effects because of low application rates and residues, and the extremely low toxicity of the technical and formulated product to laboratory mammals exposed by oral, dermal or respiratory routes.

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No mortalities were observed in rats administered single oral doses of 5000 mg/kg of the active as technical grade or formulated product. Acute oral tests on single rats indicated 25000 mg/kg of technical material was not lethal. The approximate lethal oral dose in dogs was greater than 2500 mg/kg.

Orally administered metsulfuron-methyl is very rapidly cleared by rats and ruminants, predominantly in the urine.

When metsulfuron-methyl was administered orally to rats as ten repeated doses up to 3400 mg/kg over a two week period, only slight weight losses were observed. Mice exposed to dietary doses as high as 5000 ppm for 90 days showed only decreases in body weight gain associated with decreased food consumption. Dietary concentrations as high as 5000 ppm were not toxic to rats fed continuously for two years. Dogs consuming a diet containing 5000 ppm for one year were also not affected.

In rabbits, the acute lethal dermal dose was greater than 2000 mg/kg of the active as technical grade or formulated product. Rabbits exposed dermally up to 2000 mg/kg of the technical material for 21 days showed no compound related effects. Rats inhaling doses up to 5.3 mg/L of technical material were not adversly affected.

Metsulfuron-methyl had no embryopathic or teratogenic potential when orally administered to rats at concentrations as high as 1000 mg/kg or to rabbits at 700 mg/kg.

Amphibians and Reptiles No data are available, however a hazard is not expected given the plant specific mode of action of metsulfuron-methyl and its low acute toxicity to aquatic invertebrates and fish (LC_{50} > 150mg/L).

Terrestrial Invertebrates Metsulfuron-methyl is nontoxic to honey bees, *Apis mellifera* (contact LD_{50} > 25 ug/bee), and earthworms (LC_{50} >1000 mg/kg). The requested use of metsulfuron-methyl is not expected to pose a hazard to terrestrial invertebrates from acute toxicity. However, terrestrial invertebrates may be at risk from plant removal in non-target habitats as a result of contamination by metsulfuron-methyl.

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Aquatic Invertebrates Metsulfuron-methyl was not acutely toxic to *Daphnia magna* at concentrations as high as 150 mg/L (v/v). Aquatic invertebrates should not be at risk from acute toxicity as a result of contamination by metsulfuron-methyl. However, aquatic invertebrates may be at risk from the loss of plants commonly associated with sloughs.

Soil Microbial Systems Little information was available on the effect of metsulfuron-methyl on soil ^{14}C microorganisms. A laboratory study on ^{14}C-cellulose digestion showed that there was limited effect on anaerobic microorganisms in sediment.

Wildlife Habitat Considerations The use of metsulfuron-methyl is not expected to pose a hazard to wildlife from food removal associated with acute toxicity to terrestrial or aquatic invertebrates (although data ~~was~~ were limited). The impact on wildlife habitat and associated food resources from the use of metsulfuron-methyl cannot be evaluated because the minimal-effect-level for nontarget plants has not been determined.

Metsulfuron-methyl is absorbed by foliage and roots and is translocated. Metsulfuron-methyl inhibits cell division in the shoots or roots by blocking synthesis of the amino acids valine and isoleucine. Sensitivity of plant species is related to the rate of metabolic inactivation of metsulfuron-methyl.

No data were available for algae or other nontarget plants to determine minimal-effect-levels of metsulfuron-methyl. Some data on the effects of this herbicide on aquatic macrophytes were available for efficacy studies in the laboratory and in rice paddies in southeast Asia. Although these studies were not designed to determine minimal-effect-concentrations, they do indicate that this herbicide is phytotoxic to aquatic plants at very low concentrations in water.

The most senstive aquatic plants reported were the submerged species, *Potamogeton nodosus* and *P. pectinatus*. Growth in shoot length was inhibited by 77-90% relative to the control 4 weeks after treatment at a nominal rate of 1 ug/L prior to plant emergence from the soil. As 1 ug/L was

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the lowest rate tested, the minimum-effective-concentration for growth inhibition is unknown, but a concentration of 0.05 ug/L or less is not unreasonable to assume based on the dose-growth response of submersed aquatic plants to other sulfonyl ureas or other herbicides.

Efficacy studies in rice paddies in southeast Asia indicated that metsulfuron-methyl provided 90-100% growth inhibition of submersed, floating and emergent broadleaf plants at treatment rates of 2-3 gm a.i. per ha. Little or no control of emergent grasses was reported at rates as high as 8 gm a.i. per ha.

Since the minimal-effect-level for nontarget plants has not been determined, the impact on wildlife habitat and associated food resources from the use of metsulfuron-methyl cannot be evaluated. However, the data submitted indicate that metsulfuron-methyl is likely to be toxic to aquatic macrophytes at initial concentrations expected in slough water from runoff. Exposure of floating, emergent and slough-margin vegetation to overspraying from ground application and spray drift into nontarget habitats adjacent to use areas is also potentially hazardous. In addition, as metsulfuron-methyl has a high degree of residual phytotoxicity in soil and in water/sediment, repeated use of metsulfuron-methyl could pose an additional hazard to plants in nontarget habitats from residue accumulation in soil or water.

Sloughs in the prairie pothole region of Canada support a substantial portion of North American waterfowl populations during the breeding season. Their reproductive and recruitment success depend on continued access to a variety of sloughs (e.g. temporary, semi-permanent, permanent). These sloughs provide a balance of protective cover and appropriate nesting vegetation as well as plant and aquatic invertebrate food resources for laying hens and young ducklings from mid-April to late September.

Algal toxicity tests and toxicity tests with plant species commonly associated with prairie sloughs are pending in order to evaluate potential impacts of metsulfuron-methyl on wildlife habitat and associated food resources in the intended area of use, and to determine if the current detection limits for metsulfuron methyl of 0.1 ug/L in water and 0.2 ug/L in soil are adequate.

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