

E X T O X N E T

Extension Toxicology Network

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

Pesticide
Information
Profile

Metsulfuron-methyl

Publication Date: 9/93

TRADE OR OTHER NAMES

Product names include Ally, Allie, Gropper, and Escort.

REGULATORY STATUS

Metsulfuron-methyl is classified by EPA in acute Toxicity Category III, and must bear the signal word "Caution" on commercial products ([1](#)). There are tolerances for residues of metsulfuron-methyl in or on raw commodities ranging from 0.05 ppm for sugar cane and milk, to 20.0 ppm for barley hay.

INTRODUCTION

Metsulfuron-methyl is a residual sulfonylurea compound used as a selective pre- and postemergence herbicide for broadleaf weeds and some annual grasses. It is a systemic compound with foliar and soil activity, and it works rapidly after it is taken up by the plant. Its mode of action is by inhibiting cell division in the shoots and roots of the plant, and it is biologically active at low use rates. The most common uses of metsulfuron-methyl include wheat, barley, rye, and pastures. It can be used with other foliar herbicides, and is typically applied on cereals at 0.004 - 0.007 pounds active ingredient/acre, and on non-crop areas at 0.005-0.160 pounds active ingredient/acre. It is commercially available in the form of dry flowable formulations. Because it has residual activity in soils, it is necessary to allow ample time for the chemical to break down before planting certain crops (22 months for sunflowers, flax, corn, or safflower, and 10 months before planting sorghum). It should not be used on ryegrass or on pastures containing alfalfa or clovers ([2](#)).

TOXICOLOGICAL EFFECTS

ACUTE TOXICITY

This chemical has very low toxicity in mammals. Based on laboratory tests, the oral dose of metsulfuron-methyl that causes mortality in half of the test animals (LD50) is > 5,000 mg/kg in rats. It has low dermal toxicity in tests with rabbits, with an LD50 > 2,000 mg/kg, and low inhalation toxicity in rats, with a median lethal concentration in air of greater than 5 mg/liter air.

Moderate but reversible eye irritation has been seen in rabbits, and mild skin irritation has been observed in guinea pigs. No skin sensitization has been observed in guinea pigs ([3](#)).

Signs and Symptoms of Poisoning

Systemic poisoning by sulfonylurea based compounds is unlikely, unless large quantities have been ingested. No accounts of poisoning by metsulfuron- methyl are currently available. ([4](#)).

CHRONIC TOXICITY

A 2-year feeding study in rats resulted in a No Observable Effects Level (NOEL) of 25.0 mg/kg/day (or 500 ppm in feed), based on decreased body weights seen at 250 mg/kg/day (5,000 ppm) which was the highest dose tested. EPA has based its reference dose (0.25 mg/kg/day) on this study ([5](#)).

Reproductive Effects

Multigeneration studies in rats did not result in any reproductive effects at the highest doses tested of 250 mg/kg/day ([5](#)).

Teratogenic Effects

Metsulfuron-methyl did not cause developmental abnormalities to offspring of rats and rabbits fed 1000 mg/kg/day and 700 mg/kg/day respectively during gestation. These doses represent the highest dose tested for each experiment ([5](#)).

Mutagenic Effects

The weight of evidence presented by a battery of tests to measure mutagenicity and other adverse effects on DNA indicates that metsulfuron- methyl is neither mutagenic nor genotoxic ([6](#)).

Carcinogenic Effects

Negative for rats and mice in laboratory tests, but studies may not have been at maximum tolerated dose ([6](#)).

Organ Toxicity

Metsulfuron-methyl is a moderate eye irritant ([6](#)).

Fate in Humans and Other Animals

The chemical is broken down quickly and eliminated from the body. In tests with radiolabeled metsulfuron-methyl in rats, the excretion half-lives ranged from 9 to 16 hours and 23 to 29 hours for rats administered low and high doses, respectively. It did not bioaccumulate in fish ([6](#)).

ECOLOGICAL EFFECTS

Effects on Birds

Metsulfuron-methyl has very low avian toxicity. The oral LD50 value for mallard ducks is greater than 2510 mg/kg, and dietary LC50 values for mallard ducks and bobwhite quail are greater than 5620 ppm (6).

Effects on Aquatic Organisms

The chemical has very low toxicity to aquatic organisms. 96-hour LC50 values are greater than 150 mg/l in rainbow trout and bluegill. Forty-eight hour toxicity tests with the freshwater invertebrate *Daphnia magna* resulted in a LC50 of greater than 150 mg/l (6). A 21-day life-cycle test with *Daphnia magna* also exhibited very low toxicity. The NOEL for survival and reproduction was >150 mg/l.

Effects on Other Animals (Nontarget species)

Metsulfuron-methyl has low acute toxicity to honey bees with a topical LD50 of greater than 25 ug/bee (6). The LC50 for earthworms is greater than 1,000 mg/kg soil.

ENVIRONMENTAL FATE

Breakdown of Chemical in Soil and Groundwater

The breakdown of metsulfuron-methyl in soils is largely dependant on soil temperature, moisture content, and pH. The chemical will degrade faster under acidic conditions, and in soils with higher moisture content and higher temperature (7). The chemical has a higher mobility potential in alkaline soils than in acidic soils, as it is more soluble under alkaline conditions. Metsulfuron-methyl is stable to photolysis, but will break down in ultraviolet light. Half-life estimates for metsulfuron-methyl in soil are wide ranging from 14 - 180 days, with an overall average of reported values of 30 days (8). Reported half-life values (in days) for soil include: clay - 178 (7); sandy loam - 102 (7); clay loam - 70 (7), 14-28 (8), 14-105 (8); silty loam - 120- 180 (9).

Breakdown of Chemical in Surface Water

The dissipation time for metsulfuron-methyl was investigated in a mixed wood/boreal forest lake. The DT50 or length of time required for half of the material to dissipate in water was >84 days when high concentrations of metsulfuron-methyl were applied, and 29.1 days at concentrations that might be expected if the chemical is applied for forestry uses (9). The chemical is stable to hydrolysis at neutral and alkaline pHs, and has a half-life of 3 weeks at pH 5.0, 25 degrees C and >30 days at 15 degrees C (10).

Breakdown of Chemical in Vegetation

Metsulfuron-methyl is rapidly taken up by plants at the roots and on foliage. The chemical is translocated throughout the plant, but is not persistent. It is broken down to non-herbicidal products in tolerant plants (6).

Analytical Methods

Methods for the detection of metsulfuron-methyl exist for soil and water. Liquid chromatography/mass spectroscopy and bioassay methods are used for soils, and gas chromatography/electron capture detection is used for measuring trace levels of the chemical in water ([11](#)).

PHYSICAL PROPERTIES AND GUIDELINES

Exposure Guidelines:

RfD: 0.25 mg/kg/day

NOEL: 25.00 mg/kg/day (500 ppm) (2 year rat feeding study)

LEL: 250.00 mg/kg/day (5,000 ppm) (2 year rat feeding study)

Physical Properties:

CAS #: 74223-64-6

Molecular Formula: C₁₄H₁₅N₅O₆S

Chemical Names: Methyl 2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoate (CA)
Methyl 2-[3-(4-methoxy-6-methyl-1,3,5-triazin-2-yl)ureidosulphonyl]benzoate (IUPAC)

Molecular Weight: 381.4

Form: faint, sweet ester-like white to pale yellow solid

Melting Point: 158 degrees C

Vapor Pressure: 2.5 X 10 to the minus 12 mm Hg @ 25 degrees C

Solubility: Acetone @ 20 degrees C 36,000 mg/l;
n-Hexane @ 20 degrees C 0.79 mg/l;
Methanol @ 20 degrees C 7,300 mg/l;
Methylene chloride @ 20 degrees C 121,000 mg/l;
Water @ 25 degrees C, pH 4.6 270 mg/l;
Water @ 25 degrees C, pH 5.4 1,750 mg/l;
Water @ 25 degrees C, pH 7.0 2,790 mg/l;
Water @ 25 degrees C, pH 9.0 213,000 mg/l

pKa: 3.3 in water @ 25 degrees C

Kd: 1.4 (Flanagan silt loam, pH 6.5, 4.02% organic matter)

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