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

Picloram

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TRADE OR OTHER NAMES

Commercial products containing the compound have trade names including Grazon and Tordon. It may be used in formulations with other herbicides such as bromoxynil, atropine, diuron, 2,4-D, MCPA, triclorpyr, and atrazine among others. It is also compatible with fertilizers.

INTRODUCTION

Picloram, in the pyridine family of compounds, is a systemic herbicide used for general woody plant control. It also controls a wide range of broad- leaved weeds excepting mustards (crucifers). Most grasses are resistant to picloram so it is used in range management programs.

Picloram is formulated either as an acid (technical product) or as a potassium salt. The materials in this document refer to the acid form unless otherwise indicated.

All uses of the pesticide except for the formulations in Tordon 101R and Tordon RTU, are restricted by the EPA. Restricted Use Pesticides (RUP) may be purchased and used only by certified applicators.

TOXICOLOGICAL EFFECTS

ACUTE TOXICITY

Picloram is a slightly toxic herbicide and therefore requires the signal word CAUTION on its label. It is of moderate toxicity to the eyes and only mildly toxic on the skin (9). There is no documented history of human intoxication by picloram so symptoms of acute exposure are difficult to characterize. A possible symptom from massive amounts would be nausea.

The oral LD50 for picloram is 8,200 mg/kg in rats, between 1,061-4,000 mg/kg for mice, between 1,922-3,000 mg/kg for guinea pigs, and between 2,000- 3,500 mg/kg for rabbits. The rabbit dermal LD50 is greater than 4,000 mg/kg, a level which produced no mortality or toxic signs. Inhalation by a rat of a formulated product failed to achieve an LC50 and no adverse effects were observed for two weeks following the administration of the compound (7).

CHRONIC TOXICITY

Mice fed large quantities (1,000 to 2,000 mg/kg/day) of picloram for 13 weeks experienced no clinical or blood changes. Females did show decreased body weight and increased liver weights. Over a wide range of doses (30-1,000 mg/kg/day) for 32 days, no effects were seen in rat livers. Dogs, sheep and beef cattle fed low levels of picloram for a month experienced no toxic effects.

Reproductive Effects

Multi-generation studies with pregnant rats exposed from gestation through reproductive cycles to moderate levels (about 180 mg/kg) of picloram produced no adverse effects on fertility. Pregnant mice fed small amounts of the herbicide (15 mg/kg) for four days before and 14 days after mating showed no adverse effect on fertility. While the evidence is limited, it does not appear likely that the compound would have a significant adverse effect on human reproduction at low levels of exposure.

Teratogenic Effects

No teratogenic effects were seen in the offspring of pregnant rats exposed to high doses (1,000 mg/kg) during gestation. At even higher doses (2,000 mg/kg), maternal toxicity was noted but did not induce malformation in the pups (5). It is unlikely that the compound would pose a significant birth defect threat in humans.

Mutagenic Effects

One test has shown that picloram is mutagenic (for the bacteria Saccharomyces cerevisiae) and another test has shown that it is not mutagenic (Ames test) (4). The results from these two experiments make any conclusion about the mutagenic risks to humans impossible.

Carcinogenic Effects

Mice fed average doses of 150 mg/kg or 250 mg/kg for 80 weeks and observed for another ten weeks did not display any carcinogenic effects. Rats fed 350 or 750 mg/kg for 80 weeks and observed for 33 weeks had no carcinogenicity in the males. Females developed benign liver tumor nodules (4). Several other tests have indicated an increased incidence of cancer among animals treated with picloram. The EPA has determined that these studies are inadequate based on two criteria. First they concluded that the tests were not designed properly to fully assess the carcinogenicity of the compound and second that all of the tests were conducted with picloram that contained minor contaminants of HCB, a probable human carcinogen, that might have skewed the results (10). The EPA has stated that the compound is not classifiable as to its cancer effects in humans.

Organ Toxicity

Mice and rats both had liver changes when fed high doses. Such changes occurred at doses above 1,000 mg/kg for 13 weeks or 3,000 mg/kg for 32 days and in rats at doses above 225 mg/kg for 90 days.

Fate in Humans and Animals

Low oral doses of 0.5 and 5 mg/kg were absorbed rapidly from the GI tract of humans and excreted unchanged in the urine. Half of the product had been excreted within a day or so. Skin absorbed only a very small amount of the applied product (1).

Rats had a pattern much like the studies listed above for humans with doses excreted virtually unchanged in urine and feces within 48 hours. Picloram does not accumulate in fat and thus would tend not to significantly accumulate in organisms.

An additive effect is seen when sheep are given moderate amounts of picloram mixed with slightly larger amounts of 2,4-D over a five day period. The combination was fatal even when picloram alone did not produce overt signs of toxicity (4).

No measurable residues were found in milk from cows fed small amounts of the herbicide in their diets. At higher levels of exposure, milk levels of picloram were low (0.05 to 0.29 ppm) and declined rapidly upon withdrawal of picloram from the diet.

ECOLOGICAL EFFECTS

Ducks, pheasant, and quail had picloram related LD50 values of greater than 2,000-5,000 mg/kg, with no mortality seen at even the highest levels. This indicates that the compound is practically non-toxic to wildfowl (7).

Picloram is moderately to slightly toxic to fish. Rainbow trout had a picloram related 96-hour LC50 of 19.3 mg/l, while it was 6.3 mg/l for the technical material in channel catfish (10). The isooctylester was more toxic. The LD50 for the isooctylester in rainbow trout is 4 mg/l, and in channel catfish is 1.4 mg/l (5). With LC50 values ranging from 10 to 68 mg/l, picloram is only slightly toxic to aquatic invertebrates The compound is non- toxic to bees (9).

The U.S. Fish and Wildlife service has determined that the compound, because of its persistence, mobility and toxicity to plants, may pose a threat to endangered plant species. The EPA is developing guidelines to reduce the potential of affecting these plants (10).

ENVIRONMENTAL FATE

In heavy clay soil, picloram has a half life of slightly over two months. However, when more organic material is present, the half life of the compound nearly doubles. Breakdown by soil microorganisms occurs slowly, resulting in the formation of carbon dioxide (CO_2) and the release of a chloride ion (5). The compound is mobile and relatively persistent in soil and can therefore leach to groundwater. Picloram has been detected in the groundwater of seven states (10).

In water, the action of sunlight is an important mechanism leading to the breakdown of the product. Herbicide levels in farm ponds which were 1 ppm at the time of spraying reached 10 ppb in 100 days primarily due to dilution and the action of sunlight. The movement of picloram in runoff after heavy rainfall may occur.

Picloram is readily absorbed by plant roots, less so by the foliage, and is readily translocated throughout plants. It remains stable and intact in plants.

PHYSICAL PROPERTIES AND GUIDELINES

Exposure Guidelines:

NOEL:	(dog) 7 mg/kg/day animal: 150 mg/kg/day, based on multiple effects
DWEL:	2 mg/l
HA:	0.5 mg/l (lifetime)
TLV-TWA:	10 mg/m3
ADI:	0.07 mg/kg/day (10)
RfD:	0.07 mg/kg/day (EPA)
LEL:	35 mg/kg/day (dog)

Physical Properties:

CAS #:	1918-02-1
Chemical name:	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid
Chemical class/use:	chlorobenzoic acid herbicide
Solubility in water:	430 mg/l (salt. 200,000 mg/l)
Solubility in other solvents:	acetone 1.98 g/100 g; ethanol 1.05 g/100 g; benzene 0.02 g/100 g
Melting Point:	218-219 degrees C
Vapor Pressure:	6.16 x 10 to the minus 7 mm Hg at 35 degrees C
pKa:	3.6

BASIC MANUFACTURER

Dow Chemical Company
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Midland, MI 48640
Telephone: 517/636-1000
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Review by Basic Manufacturer:

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