

US EPA ARCHIVE DOCUMENT

1.0 Introduction

1.1 Chemical Name and Type Pesticide

1.1.1 - Dichlobenil; 2,6-dichlorobenzonitrile; Casoron G-4 and Carson W-50, herbicide.

1.1.2 Diquat; 6/7-dihydrodipyrido (1,2-2:2', 1'-C) pyrazinedium dibromide, herbicide.

1.1.3 Bromacil; 5-bromo-3-sec-butyl-6-methylurcil; herbicide.

1.1.4 Picloram; 4-aminocyclohex-3,5,6-trichloropicolinic acid; Tordon; herbicide.

1.1.5 Endothall; di(N, N-dimethyl-tridecylamine) salt 7-Oxabicyclo (2.2.1) heptane-2,3-dicarboxylic acid; herbicide.

1.2 This is a freedom of information request for degradation in soil and water of the herbicides Dichlobenil, Diquat, Bromacil, Picloram, and Endothall.

2.0 Discussion of Data

2.1 Dichlobenil

The 'half-life' of dichlobenil is in the range of 2 to 20 weeks under wet conditions in different soil types, 2 weeks in clay, medium loam, and 3 to 20 weeks in peat for different applications.

In Beltsville experiment residues of dichlobenil persisted from one season to the next but did not buildup in soil sprayed annually for 3 or 8 lbs/A.

Dichlobenil disappeared from soils with average half-life of about four weeks and with a range of 1 to 12 weeks depending on both the kinds of soil and weather conditions.

Persistence and rate of loss by volatilization are drastically modified by mechanical incorporation with the soil and rainfall after spraying. Loss by volatilization is accentuated by high temperatures.

Dichlobenil was added at 2 ppm to a sandy soil containing 4% organic matter. After 8 months more than half the added herbicide had been metabolized. The major conversion product was 2,6-dichlorobenzamide (95% of total metabolites).

The hydrolysis to 2,6-dichlorobenzamide appears to be a microbiological process since very little conversion to degradation products took place after 6 months in sterilized soil.

90% of dichlorobenzamide applied at 2 ppm to sterilized and unsterilized soils was recovered after 6 months.

Dichlobenil is degraded to 2,6-dichlorobenzamide (2,6-BAM) in the soil. This compound is in general only 1/50 as herbicidally active as dichlobenil. At 8 weeks (2,6-BAM) residues in the soil were generally greater than those of dichlobenil except in peat.

Degradation is probably by non-biological hydrolysis. Analysis of soil extracts by both thin layer and gas chromatography indicated that the amide rather than the benzoic acid derivative accumulated as herbicide disappeared.

Rates of loss from both non-sterile and azide-treated soils were very similar indicating a non-biological process.

Soils containing 5% organic matter or more will completely absorb dichlobenil and restrict leaching.

At 32 weeks after treatment of clay with dichlobenil the benzamide residues at 0-4 in., 4-8 in., and 8-12 in depth all exceeded those of the corresponding total nitrile or dichlobenil residues in the 0-4 in. layer.

Benzamide residues in clay loam at 32 weeks after treatment were equivalent to 0.07-0.4 lb/acre and in these terms were 3-20 times greater than the total nitrile or dichlobenil residues at the same time although the depth profile of the residues of the compounds was different.

Dichlobenil was not detected in the 6 to 12 in. depth of plots sprayed annually for 3 years with 4 lb/A. Although the herbicide was present in the 6 to 12 in. depth the second and third years in the plots sprayed each year with 8 lb/A; it did not appear to buildup excessively.

Dichlobenil is not readily leached from soils with a high organic content.

Dichlobenil is quite persistent in cranberry bogs. The chemical was not readily leached downward in the soil or carried from the bog by flood water but was recovered primarily in the upper 4 in. of the soil.

Chemical residue analysis demonstrated a greater quantity of herbicides was present than indicated by a bioassay test. Most of the herbicide is believed to be held ineffective by the organic matter in the soil.

2.2 Diquat

Diquat seems to be tightly bound to hydrolysis and does not desorb readily.

Detectable residue of diquat persisted in water for 14 to 30 days (treated at 2.5 ppm).

The concentration of diquat increases in hydrosols due to diquat release from decomposing plants.

Diquat soil residues are persistent and are biologically unavailable once adsorption occurs.

Half-life of diquat in water is less than two days.

Rapid loss from water due to:

- (a) uptake by weeds
- (b) adsorption to hydrosol
- (c) photochemical degradation

The chief photodegradation product is 1,2,3,4-tetrahydro-1-oxo-pyrido [1,2-a]-5-pyrazidinium bromide.

2.3 Bromacil

A humic acid surface adsorbs considerably more bromacil than other surfaces.

Half-life in soil is about 7 months.

Two degradates found: 5-bromo-6-hydroxymethyl-3-sec-butyluracil and another unidentified product.

2.4 Picloram

Picloram is considered persistent and reports of carryover (from one season to the next growing season) phytotoxicity do occur. The persistence appears to be related to dosage and climate. Low moisture climates have shown carryover from 1 oz/acre up to 1/2 lb.; carryover almost always occurs at higher dosages, the estimated half-life runs into "years" rather than "months".

The mode of dissipation involves microbial degradation, photo-degradation, leaching and runoff followed by dilution (in water and in soil including adsorption). Microbial and non-biological degradation processes in soil appear to proceed too slowly to account for observed picloram loss. Photo-degradation is minimal in soil but may be important in non-turbid water. The data seems to support dilutions and the mode of dissipation most frequently involved as a major mechanism of loss, though other mechanisms apparently contribute.

2.5 Endothall

The overall trend, as seen in several studies, is such that microbial degradation may be considered a major mode of loss for endothall in soil.

Studies indicate that endothall is lost from pond water rapidly (1-2 week half-life) initially. There may be a temporary decrease in rate of loss due to release of endothall by decomposing target plants, but the rapid loss is likely to resume until no detectable residues occur in about 1 month. Hydrosol does adsorb endothall, but decomposition does seem to take place so that loss from both water and hydrosol is seen to resume after about 3 weeks. Autoclaved pond water and hydrosol treated with endothall do not lose residual ¹⁴C, but exchange the residue between the two phases. This reinforces the apparent microbial nature of endothall loss.

The studies which show degradation in hydrosol, along with the field studies on lakes and ponds suggest that under the conditions expected in rice fields, endothall probably will degrade rapidly and not be present for subsequent crops. This conclusion that endothall will not persist is based on the fact that depleted or even anaerobic conditions do exist early in the flooding period of rice culture. Values of 1/4 the saturation value at a given temperature are expected as the minimal concentration under normal conditions, but the values may vary with temperature, depth of water, and organic content of soils and surface before flooding. Recovery of oxygen levels occurs within 3-4 days usually, due to algal blooms and photosynthetic oxygen and also elimination of decomposable carbon sources. Thus, the period of anaerobic conditions is short and aerobic metabolism is liable to dominate. The only concern would be for the production of some identifiable metabolite of endothall which occurs only anaerobically and which would be of concern if taken up by subsequent crops. Such a hypothetical metabolite would have to be resistant to aerobic degradation and form very quickly from parent endothall. No such metabolite has been reported and the necessary characteristics to cause concern are improbable if the metabolite occurred. It was concluded that such a hazard is minimal.

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