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Technical Report A-98-1, US Army Corps of Engineers, Waterways Experiment Station
May 1998

Aquatic Plant Control Research Program

"Aquatic Dissipation of the Herbicide Triclopyr in Lake Minnetonka, Minnesota"

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ABSTRACT

A study of the aquatic fate of the triethylamine (TEA) salt formulation of triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid) was conducted in small bays (Phelps, Carsons, and Carman) of Lake Minnetonka, Minnesota. The primary purpose of this study was to determine dissipation rates of the parent active ingredient, triclopyr, and its major metabolites, TCP (3,5,6-trichloropyridinol) and TMP (3,5,6-trichloro-2-methoxypyridine) in selected matrices including water, sediment, plants, finfish and shellfish.

Two 6.5-ha plots containing Eurasian watermilfoil (*Myriophyllum spicatum* L.) dominated submersed plant communities were treated at a nominal aqueous rate of 2.5 mg/L triclopyr on 21-23 June 1994 using variable-depth subsurface injection and surface broadcast techniques. The inert fluorescent dye, rhodamine WT (RWT), was tank mixed and applied at approximately 10 mg/L with the herbicide to provide a real-time indication of water-exchange and hydraulic mixing processes during and following treatment. A third 6.5-ha plot was established as an untreated reference.

Water and sediment residue samples were collected from within the plots and at selected locations up to 1600 m outside of the plots. Residue samples were collected for the target plant, Eurasian watermilfoil, and a representative non-target plant, flatstem pondweed (*Potamogeton zosteriformis* Fernald), both within and outside of the plots. Other non-target matrices included various game and rough fish, as well as clams and crayfish. All non-target animals were sequestered in cages located in the center of each plot. Water and sediment samples were collected pretreatment through 6 weeks posttreatment, while non-target organisms were collected pretreatment through 4 weeks posttreatment. Residues were analyzed using various methods developed by DowElanco, primarily employing gas chromatography and mass spectrometry.

Supplemental parameters measured during the study included water quality (dissolved oxygen, temperature, pH, conductivity), light (300-700 nm), and meteorologic data (wind, temperature, precipitation, solar radiation). An assessment of the submersed plant community (biomass and species diversity) in each plot was also conducted using SCUBA divers at pretreatment, and 6 and 52 weeks posttreatment.

Calculated half-lives for dissipation of triclopyr and TCP in water ranged from 3.7 to 4.7 days, and from 4.2 to 7.9 days, respectively. Although TMP has not been reported in other triclopyr aquatic dissipation field studies, small amounts (< 5 ng/ml) were measured in the water column in both treated plots. Peak triclopyr sediment values ranged from 257 to 335 ng/g, with an average sediment half-life of 5.4 days. Peak TCP sediment levels ranged from 27 to 65 ng/g, with an average half-life of 11.0 days. The TMP metabolite was found in the sediment at trace levels or less. The reference plot tested ND for triclopyr, TCP, and TMP in water and sediment throughout the study period. The RWT dye proved to be an efficient indicator of bulk water exchange and movement, and tracer for triclopyr and TCP. The correlation between the dye and triclopyr ranged from 0.98 to 0.99, and between dye and TCP from 0.86 to 0.91.

Triclopyr and TCP accumulated and cleared from fish and shellfish tissues in relation to concentrations found in the water column, with triclopyr half-lives < 11 days and TCP < 14 days. Residues of these compounds were generally higher in inedible viscera portions of animals, and were usually higher in bottom-feeding fish species, than in game fish. Unexpectedly, TMP levels were measured at 2 to 3 times higher than those of triclopyr and/or TCP, particularly in the viscera tissue.

Eurasian watermilfoil was effectively controlled in the treatment areas, as evidenced by biomass and frequency transect data. Many native plant species survived, although some were injured by this high-dose triclopyr treatment. By one year posttreatment, native submersed plant communities were recovering in a substantial manner in both treated plots. No adverse effects on water quality were found following the triclopyr applications. Once Eurasian watermilfoil was removed from the water column, water quality conditions generally improved, particularly with respect to pH and oxygen levels. Results from this study will be used to support a US Environmental Protection Agency aquatic registration for the TEA salt of triclopyr.

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