Effect of Phenoxy Herbicides on Riparian Vegetation and Water Quality

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CHEMICAL CONTROL of vegetation along streambanks and reservoir shores has become an acceptable procedure on many municipal watersheds. Such vegetation has long been undesirable because in addition to the use of large quantities of water its leaves often accumulate in the stream channels and reservoirs. As a result they may clog intake screens and impart acids and color to the water by their decomposition.

The phenoxy herbicides, such as 2,4-D and 2,4,5-T, although widely used in forest management have not been used on municipal watersheds because of possible contamination of the water supply. Phenols when chlorinated form chlorophenols which are said to have very low odor and taste thresholds and may be detected in concentrations as low as 0.3 parts per billion (ppb). The U.S. Public Health Service has recommended a limit of one part per billion (1 ppb) of phenol for drinking water. This recommendation is based upon taste and odor considerations and not toxicological limits.

Although considerable literature is available concerning the taste and odor thresholds of chlorophenols, little factual information is available concerning the contaminating effects of the use of phenoxy herbicides on municipal watersheds.

Therefore, the School of Forestry, The Pennsylvania State University, along with the Northeastern Forest Experiment Station and Amchem Products, Inc., conducted a cooperative study to determine the extent of streamflow contamination following the spraying of riparian vegetation with phenoxy herbicides.

The experiments were carried out on two small headwater streams of the Newark, New Jersey, watershed and two similar streams on the Stone Valley Experimental Forest in Huntingdon County, Pennsylvania.

A portable mistblower was used to spray riparian vegetation growing within 20 feet of each stream bank for a distance of 1000 feet. Thus, each plot was approximately an acre in size. The operator walked in the middle of the stream, spraying on one side only (Figure 1). Vegetation on the other side was sprayed on returning in the other direction. No extra precautions were taken and, hence, some spray settled directly on the water in the stream channel.

Two chemicals were tested. One, an ester of 2,4,5-T, was considered a representative formulation of the commercially available herbicides. The other was

Table 1. Formulations and amounts of herbicides applied to test plots.

Herbicide	Amount	Oil Carrier	Water Carrier
	gallons	gallons	gallons
2,4,5-T butoxy ethanol ester	0.5 (2 lbs. ae)	1	8.5
2,4,5-T emulsifiable acid	1.0 (2 lbs. ae)	0	9

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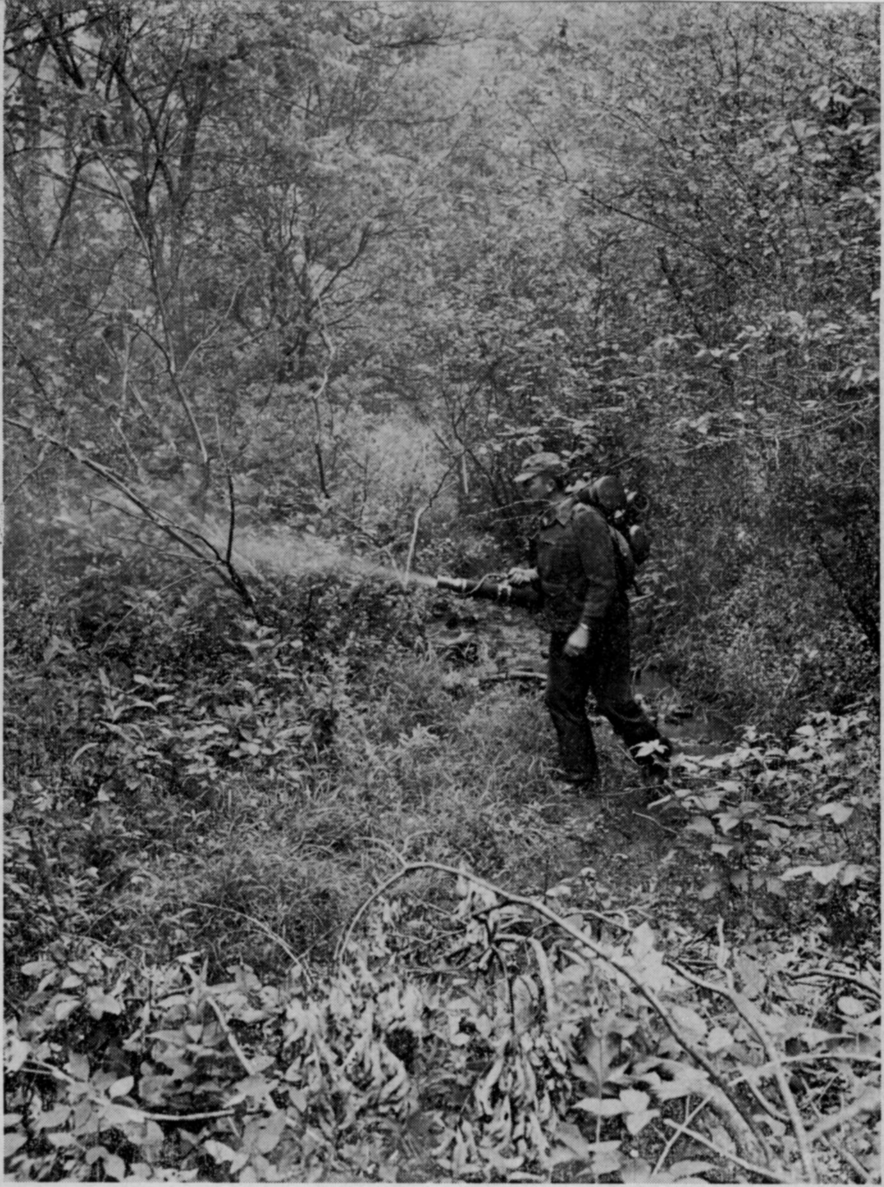

Fig. 1. A portable mistblower was used to apply herbicides to riparian vegetation. (Mr. R. R. Johnson is operator.) Note low streamflow. This is the Pennsylvania stream being sprayed with the 2,4,5-T emulsifiable-acid formulation.

2,4,5-T in the form of an emulsifiable acid. Formulations and amounts applied to the test plots are shown in Table 1.

Herbicides were applied to all streams by the same operator. Since we were interested in detecting maximum contamination, the herbicides were applied during a low streamflow period. Flow in all streams was less than 0.1 cubic foot per second (45 gpm).

Water samples were taken periodically after treatment at various locations up and down stream. The first samples were collected immediately after spraying followed by a second group of samples 4 hours later. Thereafter, samples were collected daily during the first week and twice a week during the next 3 weeks. Additional samples were collected after each rainstorm.

Streamflow samples collected were tested for contamination by a calibrated three-member odor panel (Figure 2). The testing procedure used was that approved by the American Society for Testing and Materials. Results of the panel tests are shown in Table 2.

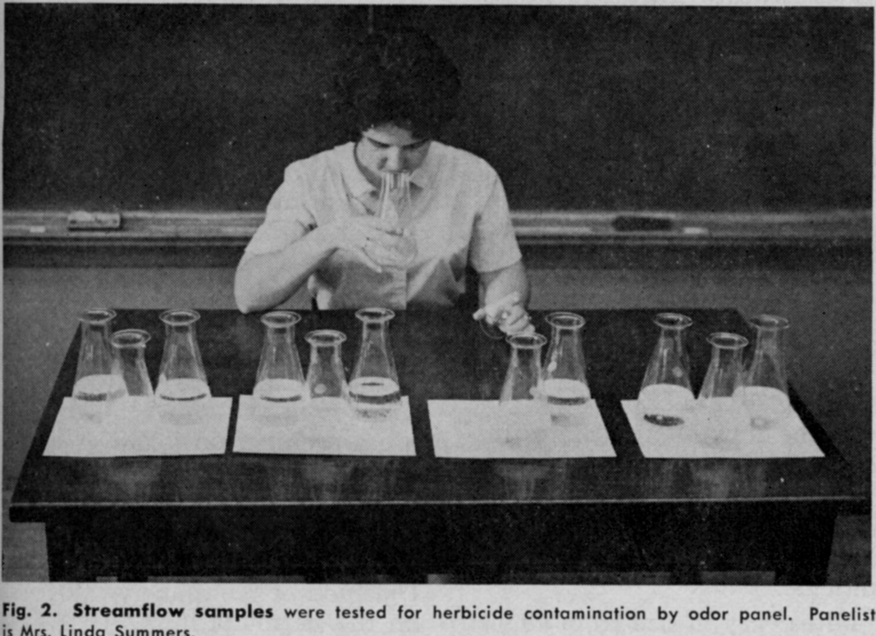

Fig. 2. Streamflow samples were tested for herbicide contamination by odor panel. Panelist is Mrs. Linda Summers.

Results indicate that during the three weeks following treatment contamination of streamflow occurred only immediately after spraying and after the first large storm. In addition, contamination was detectable only within the treated reach of stream and no contamination was ever found in a downstream sample. Downstream samples were collected approximately one mile away from the treated areas and in both locations below the junction of the two treated streams.

All areas were examined one year after treatment to deter-

Fig. 3. A tally of vegetation kill was made one year following treatment. Seventy to eighty percent of the stems were completely killed by the ester formulation. Note invasion by grasses and herbaceous vegetation. This is Pennsylvania stream treated with the 2,4,5-T ester formulation.

mine the effect of the herbicides on the riparian vegetation (Figure 3). Streamside vegetation was very brushy. The number of stems under 4 inches in diameter breast high ranged from 5,600 to 11,520 per acre. Results indicate that the ester formulation had completely killed 70 to 81% of the stems and the emulsifiable acid killed 58 to 78%. In addition, from 17 to 32% of the remaining stems were partially killed. A subsequent treatment in 3 to 5 years should eliminate the remaining stems. New streambank vegetation consists primarily of grasses and herbaceous species and should eventually predominate.

On the basis of this study it appears that phenoxy herbicides can be used to control riparian vegetation on municipal watersheds, if properly applied with the normal precautions, without constituting a water pollution hazard.

Table 2. Results of streamflow samples collected by panel in Pennsylvania and New Jersey to determine contamination.

Herbicide and Time of Sample	Herbicide Concentration in Penna. Streams	Streamflow Sample N. J. Streams
	ppb	ppb
2,4,5-T ester		
After spraying	40	40
4 hours later	20	20
Next 9 samples	neg.	neg.
After first large storm	10	neg.
2,4,5-T acid		
After spraying	40	20
4 hours later	10	neg.
Next 9 samples	neg.	neg.
After first large storm	20	neg.
Both herbicides		
All downstream samples	neg.	neg.

Mites Can Be Controlled

Mites which attack ornamental shrubs, fruit trees and bermudagrass lawns can be controlled with Tedion or Kelthane, two specific miticides, according to Stanley Coppock, entomologist with the New Mexico State University Cooperative Extension Service, University Park, N. M. Malathion is also effective although it is not a specific miticide.

Mites vary in size from almost microscopic to as big as the head of a pin. The European red mite, two-spotted mite, and McDaniel mite are troublesome on deciduous and fruit trees and shrubs. Red mites, prevalent in early spring and summer, experience a population decrease in early August. Two-spotted mites and McDaniel mites are in greatest number at the end of July and are a problem until fall.

The bermuda mite is specific on bermudagrass. Symptoms are shortening of the plant stems and browning of the vegetation. Diazinon or Kelthane work best on the bermuda mite.

Dutch Elm Disease Control Should Continue in Winter

Dutch elm disease doesn't attract much attention during the winter, but this is the time to put into effect measures to help keep it from spreading next spring, the National Arborist Assn. recommends. Sanitation and spraying are still the most effective means known to control this fatal disease of elm trees.

The overwintering habits of the tiny bark beetle makes sanitation an entirely practical control measure. Destroy weakened elm wood in which the beetles may live. By eliminating their habitat the beetle population is reduced, thus lessening the chances of the disease being spread.

Destruction of beetle-infested, diseased elm trees is of greatest importance; no elm material that can serve as living quarters for the beetles should be neglected. The National Arborist Association warns that diseased elm trees should be felled and the wood destroyed, preferably by burning, well before the spring emergence of the beetles.

Equally important in the disease control program is the application of an insecticidal spray to protect healthy elm trees against the feeding beetles. Spraying should be done annually, either in the fall after leaves have dropped and before freezing weather arrives, or in early spring before the new leaves appear.