AERIAL SPRAY TRIALS FOR PEAR THRIPS MANAGEMENT FALL 1988

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The defoliation from pear thrips, *Taeniothrips inconsequens* (Uzel), in 1988 caused a great deal of public concern throughout the entire State of Vermont and the New England region (Parker et al. 1988). People demanded answers to very basic practical questions and requested that immediate action be taken. The state offices and the University of Vermont Entomology Research Laboratory were literally flooded with phone calls and requests for information. One of the major questions that foresters and sugarmakers asked was "what management strategies are available for use in a sugarbush and how can they protect their trees from another season's pear thrips feeding?" It was difficult to answer these questions because much of the information needed to develop management strategies was unknown. The urgency of the situation was typified by the fact that by January 1989 the Vermont Department of Agriculture had already received hundreds of requests for approval of aerial insecticide applications for thrips control in individual sugarbushes in the spring of 1989.

In the fall following the 1988 thrips defoliation, forest managers and sugarmakers were urged to spend time scouting their sugarbushes and evaluating individual maple trees for visual impact from this pest. It was stressed that conservative tapping should be the rule because no one knew what future populations of pear thrips would do.

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In response to this pest problem the Vermont Governor's Task Force on Pear Thrips decided it was essential to investigate the use of insecticides for protection of sugar maple trees from thrips damage. This was done realizing that it was not a total solution but merely a short-term strategy that would give researchers more time to develop other appropriate management techniques. Plans were made to conduct a large-scale insecticide efficacy trial in the spring of 1989 as thrips were emerging from the soil. Preliminary testing was done in the fall (1988) because the trees were dormant and our target was closed buds. We also felt that weather conditions in the fall would approximate those in the early spring and would be an accurate test of probable conditions we might encounter in our efficacy trial in 1989.

In sugar maple stands where syrup is made, federal and state regulations limit the use of many agricultural chemicals because a food crop for human consumption is produced there. It should be kept in mind that thrips defoliation was not confined to merely sugarbushes but was also very common in hardwood forests, urban backyards and along the roadsides. Each of these situations represents a unique management problem and ultimately needs to be addressed separately. To meet immediate management needs however, we first decided to evaluate the use of agricultural chemicals in the sugarbush environment.

Two materials have been approved for general use in the sugarbush. One is carbaryl (Sevin), a carbamate (Table 1) and the other is *Bacillus thuringiensis* (B.t.), a naturally occurring, commercially produced bacterium. The latter is used mainly for the control of lepidopterous forest defoliators and its use against Thysanoptera has not been tested. Carbaryl has broad spectrum use and has label approval for use against other thrips species and at the time of these trials was registered for aerial use in sugarbushes in Vermont (Rhone-Poulenc 1989).

Table 1. Agricultural chemicals registered for use against thrips on trees. Information from Vermont Department of Agriculture, Pesticide Registration Division, 30 June 1988

Target	Common Name	Composition
Ornamentals	Dursban	*O,O*-Diethyl *O*-(3,5,6-trichloro-2-pyridinyl)-phosphorothioate
	Orthene	*O,S*-Dimethyl acetylphosphoramidothioate
	Cythion	*O,O*-dimethyl phosphorodithioate
	Mavrik	(α-*RS*,2*R*)-fluvalinate[(*RS*)-α-cyano-3-phenoxybenzyl (*R*)-2-[2-chloro-4-(trifluromethyl)anilino]-3-methyl-butanoate]
Fruit	Lorsban	*O,O*-Diethyl *O*-(3,5,6-trichloro-2-pyridinyl)-phosphorothioate
Sugarbush	Carbaryl	1-Naphthyl *N*-methylcarbamate
Forest	Cythion	*O,O*-dimethylphosphorodithioate
	Carbaryl	1-Naphthyl *N*-methylcarbamate

Objectives

Our research was designed to address the following questions:

1. Using aerial application techniques would carbaryl droplets impinge on sugar maple buds?

2. What droplet size would maximize coverage on sugar maple buds and minimize drift to adjacent environments?

Materials and Methods

A Cessna Ag Wagon equipped with six Micronair AU 4000 atomizers was used for aerial application. The plane was flown at 160 km/h (100 mph) approximately 15 m above the trees. Swath width was estimated at 30 m. Application rate was 2.2 liters/ha (32 oz/acre) of Sevin 4-Oil mixed with No. 2 diesel oil applied as 3.4 or 4.6 liters/ha (48 or 64 oz/acre) total volume. One percent Rhodamine WT dye, which fluoresced under ultraviolet light, was added to the tank mix to facilitate droplet identification on twigs and buds.

Twelve 4-hectare plots were set up at the U.S. Government Test Firing Range in Underhill, Vt. These plots were at least 1000 m apart and had a stand composition of mainly mature dominant or codominant sugar maple trees. We randomly selected nine plots for application (five to receive the 4.6 liter [64 oz] rate and four the 3.4 liter [48 oz] rate) and three plots for controls. Within each plot ten trees equidistant along a transect perpendicular to the flight of the spray plane were chosen for sampling. From each tree, at least 4 hours post-application, a professional tree climber cut two branches 45 cm long from the upper, middle and lower canopy. From each branch we randomly cut five twigs each having a primary bud. Twigs were cut 6-10 cm long and only the basal portion was handled. Twigs were bagged separately in zip lock bags.

In the laboratory, the number of droplets were counted on the terminal 2.5 cm portion of each twig (as measured from the tip of the primary bud towards the base of the twig). Droplets were recorded as either on the bud or on the stem portion. Counts were made under an ultra violet light which made the Rhodamine dye easy to see. Droplet dimensions were not taken because the relative spread factor on sugar maple buds and stems has not been calculated for this formulation.

Results

The aerial application was made on 27 October 1988. Spraying started at dawn (approximately 6:30 AM) and was stopped at 4:00 PM. Winds during application were less than 3.2 km/h (2.0 mph) and ambient temperatures were approximately 2-5°C.

Equipment problems plagued the entire operation and in general it was felt that coverage was poor. The cold weather made the formulation very viscous and the Micronair atomizers plugged frequently. Several of the Micronair propellers broke causing delays for repairs. Branch samples were taken and data from plots sprayed at the 4.6 liter (64 oz) rate are given in Table 2. Aerial application of the 3.4 liter (48 oz) rate was not possible due to mechanical problems with the aircraft.

The data show that with the parameters of this aerial application we were able to get spray droplets on the stems and buds at three levels of the canopy of sugar maple trees. There were significantly more droplets on twigs taken from branches in the upper canopy than on twigs taken at the middle or lower canopy ($P < 0.0001$). However, as mentioned previously, equipment failures confounded the experiment and reinforced the need for additional work. Our observations of the difficulties encountered during this aerial application, when the weather was cold and unpredictable, strengthened our recommendation to not use insecticides for management of this pest until some of these factors could be studied in more detail. We were not satisfied with the use of Micronair atomizers. We believe that drift spraying, as is the technique used with Micronairs, has limited use in Vermont because sugarbushes commonly are located on hillsides, have small acreages and are surrounded by homes. Adjacent landowners will not tolerate agricultural chemicals drifting onto their property. In addition, Vermont geography is such that most sugarbushes have small streams or ponds associated with them thus making it even more difficult to have environmentally sound aerial applications of insecticides.

Table 2. The mean number of spray droplets on sugar maple buds and stems from branches taken from the upper, middle and lower canopy of trees receiving an aerial application of Sevin 4-Oil at 4.6 liters/ha (64 oz/acre) with Micronair atomizers

Plot	Canopy Level	Number of Droplets[a]	
		Bud	Stem
A	Upper	4.8 ± 4.3	8.3 ± 9.8
	Middle	4.4 ± 7.0	3.0 ± 4.9
	Lower	3.3 ± 6.1	2.9 ± 5.2
B	Upper	61.6 ± 38.7	72.9 ± 34.9
	Middle	42.6 ± 20.2	48.4 ± 28.2
	Lower	27.9 ± 21.9	31.6 ± 14.7
C	Upper	99.2 ± 60.4	81.2 ± 53.8
	Middle	51.6 ± 44.4	39.0 ± 32.1
	Lower	32.3 ± 26.9	22.6 ± 21.8
Control	Upper	00.0 ± 00.0	00.0 ± 00.0
	Middle	00.0 ± 00.0	00.0 ± 00.0
	Lower	00.0 ± 00.0	00.0 ± 00.0

[a] Mean ± standard deviation.

Our future research and management plan includes a comparison of droplet deposition from pressure nozzles and rotary atomizers. This work will be done on rangelands in New Mexico in March 1989. Data will be taken from kromekote cards; mylar sheets; and horizontal, 45 degree and vertical plastic straws. The straws will be used to simulate twigs. These data will be used as the basis for a large-scale trial scheduled for April 1989 to determine the efficacy of carbaryl for management of pear thrips.

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Calibration of Aircraft for 1988 Spray Trials in Vermont