

CONTROL OF HEMLOCK WOOLLY ADELGID USING SOIL INJECTIONS OF SYSTEMIC INSECTICIDES

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The hemlock woolly adelgid (*Adelges tsugae*) is a severe pest on eastern hemlocks (*Tsuga canadensis*) in the eastern United States. Alternatives to foliar sprays, implants, and trunk injections to manage this pest are needed. Soil injection of pesticides can eliminate the problems associated with foliar applications of pesticides, such as drift and dermal exposure, and does not wound the tree as implants or trunk injections can. Thus, a study was initiated to evaluate soil injections of Merit 2F (imidacloprid) for control of hemlock woolly adelgids on eastern hemlocks. Merit 2F is a systemic and contact insecticide exhibiting low mammalian toxicity which is from a new class of insecticides known as the Chloronicotinyls.

The experiment was conducted at Longwood Gardens, Inc., Kennett Square, Pennsylvania, and all trees used for the study were heavily infested and showed signs of damage and decline, indicated by discolored foliage and dead branches. Soil injections 15 to 23 cm deep were made around the drip line of hemlocks between 18 to 21 May, 1993, from 6:00 a.m. to 9:00 a.m. A Hypro Corp diaphragm sprayer operating at 100 psi with a Deep Root Feeding Gun was used to perform the injections. For each 2.5 cm (1 inch) of tree

diameter at breast height (dbh), 3.8 liters (1 gallon) of water and either 7.4 ml of Merit 2F or 44.4 ml of Metasystox-R2, respectively, were injected around each tree. Two injections per 2.5 cm of dbh were made for each tree. For each treatment, 11 trees were used and tree dbh ranged from 8 to 99 cm.

Treatments were evaluated from 18 to 26 Oct., 1993, by randomly sampling five branches from the bottom half and five from the top half of each tree. The first 100 adelgids on the new growth of each branch were examined microscopically and recorded as dead or alive; 11,000 adelgids were examined for each treatment.

Merit 2F significantly reduced the adelgid population, with 95.9% mortality resulting (Table 1). Mortality was not significantly different from sample location on the trees. Metasystox-R2 also provided effective control (84.9%), but resulted in significantly lower mortality than supplied by Merit 2F. Uniform control was not achieved throughout the tree with Metasystox-R2; adelgid mortality was significantly higher on the top half of the tree. A high level of adelgid mortality (56.5%) occurred on the untreated trees; however, McClure (1,2,3), reported that 37.3 to 68.7 % natural mortality

Table 1. Percent mortality of hemlock woolly adelgid 5 months after soil injections were made around hemlocks using Merit 2F and Metasystox-R2.

Treatment	% Mean mortality (\pm SD)		
	Total	Sample location ^b	
		Top	Bottom
Merit 2F	95.9 \pm 12.5a ^a	96.2 \pm 11.9a	95.6 \pm 13.0a
Metasystox-R2	84.9 \pm 13.4b	87.0 \pm 12.7a	82.8 \pm 13.8b
Control	56.5 \pm 19.5c	58.8 \pm 22.0a	54.3 \pm 16.3a

a Means within column sharing the same letter are not significantly different, (P<0.05; ANOVA/Fisher's protected LSD).

b Pairs in row sharing the same letter are not significantly different, (P<0.05; ANOVA).

occurred in his studies [Insect & Acaricide Tests 14: 346-347; J. Arboric. 17: 227-229; J. Econ. Entomol. 85: 468-472].

Soil injections of Merit 2F were more effective than Metasystox-R2 in controlling adelgids. The oral and dermal LD50 for Merit 2F are >4000 and >2000 mg/kg, respectively, while those of other systemic insecticides such as Cygon 2E and Metasystox-R2 are <215 and <610 mg/kg, respectively. Merit 2F is considerably safer than other presently available systemic insecticides and could prove useful in managing the hemlock woolly adelgid without the potential drawbacks that can result from foliar sprays, implants, or trunk injections.

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