The Great Lakes Entomologist

Volume 4
Number 3 -- Fall 1971 *Number 3 -- Fall 1971*

Article 3

July 2017

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EVALUATION OF THREE ALDRIN APPLICATION METHODS FOR WHITE GRUB, *PHYLLOPHAGA* SPP., CONTROL (COLEOPTERA: SCARABAEIDAE)[1]

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White grubs, the larvae of May beetles (*Phyllophaga* spp.), feed on the roots of newly planted red pine (*Pinus resinosa* Ait.) seedlings in the Lake States region. A 1/2 or 1% solution of aldrin insecticide is recommended to control these grubs (Shenefelt and Benjamin 1955; Speers and Schmiege 1961). Treatments of white grubs in Michigan using a 1% solution dispersed from the planting machine (standard method) have given erratic control and therefore reevaluation appeared necessary. We decided to retest the standard application method and to test two new methods.

METHODS

Five plantable areas with high white grub populations were selected for the tests in the Hiawatha National Forest in Upper Michigan. These areas were machine-planted in the spring of 1967. Planting stock was run-of-the-nursery red pine 3-0 seedlings and 2-1 transplants.

A randomized complete block design replicated 5 times in each test planting was used to evaluate the aldrin treatments. Each of the four treatments in a block involved 15 trees in 6 adjacent rows. The treatments were as follows:

Treatment 1 – aldrin solution applied with a dispenser attached to the planting machine, the standard method of application
Treatment 2 – Aldrin solution applied with a backpack pump and wand designed for the purpose
Treatment 3 – granular aldrin applied with a dispenser attached to the planting machine
Treatment 4 – check plots (no aldrin application)

In Treatment 1, the dispenser used is a modification of the one described by Shenefelt *et al.* (1954, 1955). It consists of a pressurized tank for the insecticide, a system of hoses containing a foot- or knee-operated valve, and a nozzle located at the planting shoe. The soil immediately around the tree is sprayed with insecticide as the tree is placed in the ground and before trench closing.

In Treatment 2, aldrin solution was applied with a backpack pump fitted with a long rod for insertion into the ground. Three nozzle holes dispensed the insecticide into the soil near the tree roots.

In Treatment 3, aldrin granules were applied with a dispenser consisting of a non-pressurized hopper and system of tubes with a value. Two tubes with flattened ends terminated in the vicinity of the shoe, depositing the granules continuously in two 18-inch bands, one on each side of the seedling.

[1]This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

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The standard liquid application is a 0.5 to 1.0% solution of technical aldrin in water at a dosage of about 8.5 ml per seedling. Our aldrin concentrations varied from 0.3 to 1.2% and dosage rates from 8.8 to 11.3 ml per seedling. A summary is presented in Table 1 where all the dosages are converted to show the amount of aldrin appplied if a 1% solution had been used.

Table 1. Dosage rate of aldrin applied per seedling per plantation, based on 1% solutions and 20% granulars.

Test plantation	Liquid		Granular
	Machine	Backpack	
	mls	mls	gms
1, 2, 3	13.7	10.6	9.3
4	5.8	4.6	9.3
5	5.8	3.7	9.3

Mortality, root damage, and height growth of the planted red pine indicated the effectiveness of the aldrin treatments. All dead trees in each plot were dug and root scored in the fall of 1967, the spring of 1968 , and the fall of 1968 – 4, 12, and 16 months after planting. Also eight to ten living trees per plot were randomly selected, dug, and root scored in the fall of 1967 and again in the fall of 1968.

The root damage was visually scored as follows:

1 – no grub injury
2 – 1-33% of fibrous roots destroyed by grubs
3 – 34-66% of fibrous roots destroyed by grubs
4 – 67-99% of fibrous roots destroyed by grubs; also includes some seedlings completely stripped of fibrous roots but which had grown some new root tips
5 – 100% of fibrous roots destroyed or tap root severed above all fibrous roots

A Damage Index (DI), which is the average root score damage per treatment plot, was used to compare treatment and check plots. A DI of 1.00 indicates there was no damage in a treatment; a DI of 5.00 indicates maximum damage.

Terminal shoot growth was measured on all living seedlings in the fall of 1967 and 1968 in four of the test plantings as an indicator of sublethal grub injury.

RESULTS

The three aldrin treatments gave comparable protection to the seedlings from white grubs after two growing seasons (Table 2). White grubs killed less than 3% and damaged

Table 2. Mortality and damage by white grubs to red pine seedlings in aldrin test plots two growing seasons after planting.

Treatment	Percentage red pine seedlings			Damage index
	Killed by all causes	Killed by grubs	Damaged by grubs	
1. Aldrin liquid (machine)	6.8	2.8	35.3	1.97
2. Aldrin liquid (backpack)	4.7	1.4	36.2	1.78
3. Aldrin granules (machine)	6.4	1.8	32.4	1.71
4. Check (no aldrin)	14.5	10.4	57.3	3.03

https://scholar.valpo.edu/tgle/vol4/iss3/3
DOI: 10.22543/0090-0222.1150

no more than 36% of the seedlings in all three treatments. However, they killed over 10% of the unprotected (check) seedlings, and damaged 57% more. Significantly more damage occurred to the check seedlings ($P > .01$). The degree of larval feeding on the living seedlings (Damage Indices) was about the same for all aldrin treatments but considerably more for the checks. Damage Indices of about 2.00 and 3.00 signify average grub populations of 0.2 and 1.0 grubs per cubic foot respectively (Fowler and Wilson 1971).

Significant differences in height growth between the living treated and living check trees were found after two growing seasons in all but one planting ($P > .05$). Average 2-year leader lengths for all seedlings combined were 3.8, 3.8, and 3.7 inches for aldrin treated trees and 3.3 inches for the check trees.

CONCLUSIONS

The backpack method of dispensing aldrin solution and the machine-dispensing of granular aldrin were not significantly better than the standard method.

Damage from white grubs in all three control treatments was significantly less than in the untreated check seedlings.

Since some of the damaged seedlings are likely to die by the third year, a practical estimate of mortality would be to assume death of score 4 and 5 seedlings (67 to 100% of roots destroyed by grubs) plus mortality due to other causes. Under this assumption, a maximum of 13% of the aldrin-treated seedlings would die by the third season, compared to a maximum of 38% of untreated seedlings.

If one accepts up to 15% seedling mortality by the start of the third growing season and gambles on some—but probably little—additional mortality later, than the three aldrin treatments and mean dosages tested in this study are adequate suppression techniques.

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