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PROJECTED RED PINE YIELDS FROM ALDRIN-TREATED AND UNTREATED STANDS DAMAGED BY WHITE GRUBS AND OTHER AGENTS

Richard F. Fowler[1] and Louis F. Wilson[2]

ANNOTATION

Growth and yield projections were made for the surviving red pines in aldrin-treated and in untreated plots. Greater financial returns were projected for untreated plots in three of four plantations. Grubs lowered the stocking levels to near optimum in three, and below optimum in the fourth plantation.

INTRODUCTION

Young red pines, *Pinus resinosa* Ait., during the first few years after planting in the Lake States, are vulnerable to several injurious agents, including white grubs, the larvae of May beetles, *Phyllophaga* spp. (Kittredge, 1929; Craighead, 1950).

The pesticide aldrin[3] has frequently been applied at planting time to protect seedlings from white grubs. More than 12,000 acres of national forest land were treated with aldrin from 1960 to 1967 in the Lake States; almost 10,000 of these were on the Hiawatha National Forest (Fowler, 1973).

Definitive studies were begun in 1967 on the Hiawatha National Forest to assess white grub injury and to determine the effectiveness of three different aldrin treatments on white grub populations. The studies revealed that white grubs killed many trees and reduced vigor, but that improper planting practices, diseases, and other agents combined, accounted for more than half of the total mortality during the first five years after planting (Fowler and Wilson, 1971a, 1974).

Because of restrictions on the use of hard pesticides, such as aldrin, in 1974 we set out to determine what degree of damage was tolerable before a pesticide should be used for grub control. To do this we assessed the overall impact of grubs and other agents by projecting the growth and yield of the remaining trees in the affected plantations used in the previous studies.

STUDY AREA AND TREATMENTS

Four white-grub-infested research areas on the Hiawatha National Forest were machine planted with 3-0 and 2-1 nursery stock in 1967. A randomized complete block design replicated five times in each planting was used to evaluate three aldrin treatments. As all aldrin treatments were equally effective, the treatment results are pooled for analysis in these studies. Further detail of the methods and results of the tests are found in Fowler and Wilson (1971b, 1974).

The four study plantations, designated Bird, Raco, Townhall, and Townline Lake, were planted at various stockings from 450 to 1037 trees/acre because of variability in

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[3]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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terrain and obstacles. The Townline Lake area, converted from a poorly stocked hardwood stand, had the lowest stocking.

White grubs, improper planting, and diseases and other agents reduced the stock considerably in the first three years after planting. Thereafter, most such "juvenile" problems diminished and mortality nearly ceased by the fifth year after planting (Fowler and Wilson, 1974). We thus considered the plantations stable at that time, and disregarding uncertain future problems from other agents, we began the growth and yield projections based on the trees remaining at plantation age 5.

GROWTH AND YIELD PROGRAM

Projected values for the study plantings were determined using the "red pine growth, yield and evaluation" computer program developed by A. L. Lundgren[4]. Basic inputs include the following:

1. Nature of the stand (new plantation).
2. Site index of stand (55 and 65, Table 1).
3. Age of stand (3 years at planting).
4. Number of trees per acre (number surviving 5 years after planting, Table 1).
5. Value of expected products (cordwood at $5.00/cord, sawtimber at $20/1000 bd. ft.).

The management provisions of the program were drawn from the Timber Management Plan of the Hiawatha National Forest which basically provides for the growing of red pine for timber under relatively long rotation. In compliance with the plan, the projected stands were thinned at 10-year intervals beginning at age 30 or 35 by cutting the stand back to 90 square feet of basal area. Twenty years before harvest a shelterwood cut was made by removing half the remaining basal area. The residual stand was then projected, the last 20 years without thinning, to final harvest at 115 or 120 years depending upon the age at which thinning could begin.

At the start of the program all plantations were considered to be age zero, but the trees were actually three years old, the age of the planting stock. We programmed the computer for projections at five year intervals from age zero (three years) to rotations age (115 or 120 years).

The model assumes 67 percent of the trees are within 2 inches in diameter of each other at d.b.h. of 10 inches (i.e., 9 to 11 inches), and 95 percent of the trees are within 4 inches in diameter of each other (i.e., 8 to 12 inches). Cubic foot volume is the total stem volume, not limited by a merchantable top. Board foot volume is the volume of saw-timber in trees 9.0 inches d.b.h. and larger using the International 1/4 inch rule. A cord includes all mechantable volume in trees 5.0 to 8.9 inches d.b.h.

Interest rates expressed as internal rates of return (IRR) were also computed for each stand after each projection period, beginning at about stand age 70 years. Lundgren (1966) gives the IRR as the rate earned over an investment period on all the invested capital. It is the rate of interest that would make the sum of all compounded costs equal to the sum of all compounded incomes. The IRR is one measure frequently used to indicate the period during which the stand should be harvested to realize maximum profits.

The white grubs and other injurious agents that reduced the planted stock seldom kill randomly, which is important to the forest manager because of the resulting "clumped" distribution of living trees. Pockets of dead trees and the remaining live trees were not clumped badly enough to cause concern and we expect that the uneven distribution will be evened out during the early thinnings.

The costs of the chemical and application were not included in the basic inputs into the computer program. The chemical itself cost less than $1/acre. Except for periodic

[4]Dr. Lundgren is Principal Economist North Central Forest Experiment Station, St. Paul, Minnesota 55101. The computer program, not yet published, is based on growth and yield equations developed by Dr. Robert Buckman (1962) and Dr. Robert Wambach (1967), formerly with the North Central Station.

filling of the dispensing apparatus on the planting machine, extra time or effort was not expended when the granular form of aldrin was used. Other forms of the chemical and application methods may add to the cost.

Table 1. Total financial return from red pine cordwood and sawlogs in aldrin-treated and untreated plots for white grub research areas (in dollars).

	Cordwood value*		Sawlog value		Total value	
Research area	Treated	Untreated	Treated	Untreated	Treated	Untreated
Bird	608	566	1120	1197	1728	1762
Raco	609	638	1152	1196	1761	1834
Townhall	783	773	1589	1603	2372	2376
Townline Lake	739	681	1760	1753	2499	2434

*Values are derived from projected growth and yield analyses and are anticipated totals at time of harvest at 115-120 years rotation.

RESULTS AND DISCUSSION

The growth and yield projections indicated that the plots not treated by aldrin yielded greater financial returns than the ones treated in all plantings except Townline Lake, suggesting that the seedling mortality caused by white grubs was beneficial to most of the stands (Table 1). This apparent benefit occurs because at the higher stocking levels at the Raco, Townhall, and Bird areas (Table 2); the wood that is produced is spread over more trees, resulting in smaller diameter trees in any given year. At Townline Lake the treated plots yielded greater financial returns, presumably because there were too few trees left in the untreated plots to completely utilize the site after grub-caused mortality. The stocking level was near optimum before grub activity, and the aldrin treatment simply kept the stocking level near optimum on the treated plots by preventing grub injury. Had grubs killed more trees in the untreated Townline Lake plots, the loss in yield would have been significantly greater.

The apparent inefficiency of a "well stocked" stand can further be seen by comparing the financial returns from the Townhall and Townline Lake stands (Table 1), which are on similar sites. The Townline Lake stand earned the most money, yet it had only about one-third as many trees (Table 2) as the Townhall stand.

Sawlogs provided a slightly greater proportion of the financial return at Townline Lake (about 72 per cent) compared to Bird, Raco, and Townhall (68, 65, and 67 per cent). Pulpwood was less abundant at Townline Lake because of the lower stocking, but the pulpsticks were larger and could be harvested sooner than those in the other stands.

Site played a significantly greater role in growth and yield than white grubs in this study. The two stands with site indices of 65, Townhall and Townline Lake, yielded far greater returns than the Raco and Bird stands with site indices of 55, whether they were treated for white grubs or not.

Table 2. Number of trees per acre for aldrin-treated and untreated stands at plantation age 5 years old.

		Trees/Acre	
Research area	Site index	Treated	Untreated
Bird	55	628	459
Rado	55	737	609
Townhall	65	829	745
Townline Lake	65	346	252

The calculated internal rates of return (IRR) for the plot ranged from 2.8 to 3.6 per cent–the higher rates occuring on the site index 65 areas. Maximum IRR's were achieved between plantation ages of 75 and 85 years at the Townline Lake and Townhall plots, whereas maximum IRR's were reached at 85 and 90 years in the Bird and Raco plots. Based on an economic rotation, those stands on the best sites could be harvested up to 15 years earlier than the others.

CONCLUSION

White grubs, which are normally considered destructive, may actually be beneficial in plantations where stocking densities are far above those necessary for optimum growth and yield. Although further research is needed to determine the best stocking densities for optimum growth and yield under different grub population levels, our experience indicates that a stand planted in excess of 1000 trees/acre certainly could lose one-half or more of its trees before growth and yield losses from grubs would be significant. Thus, where trees are planted at more than 1000 trees/acre and the management plan calls for sawtimber production, chemical treatment for white grub control would be of no value (or of negative value) and should not be recommended.

LITERATURE CITED

Buckman, R. E. 1962. Growth and yield of red pine in Minnesota. U.S.D.A. Forest Service, Tech. Bull. 1272, 50 p.

Craighead, F. C. 1950. Insect enemies of eastern forests. U.S.D.A. Misc. Publ. 657, 679 p.

Fowler, R. F. 1973. Insecticide use in the National Forests of the Lake States: a history. U.S.D.A. Forest Service, Northeastern Area S&PF, St. Paul Field Office, St. Paul, Minn., Report S-72-8, 50 p.

Fowler, R. F. and L. F. Wilson. 1971a. White grub populations, *Phyllophaga* spp., in relation to damaged red pine seedlings in Michigan and Wisconsin plantations (Coleoptera: Scarabaeidae). Mich. Entomol. 4:23-28.

Fowler, R. F. and L. F. Wilson. 1971b. Evaluation of three aldrin application methods for white grub, *Phyllophaga* spp., control (Coleoptera: Scarabaeidae). Mich. Entomol. 4:89-91.

Fowler, R. F. and L. F. Wilson. 1974. Injury to aldrin-treated and untreated red pine by white grubs (Coleoptera: Scarabaeidae) and other agents during first five years after planting. Great Lakes Entomol. 7:81-88.

Kittredge, J., Jr. 1929. Forest planting in the Lake States. U.S.D.A. Bull. 1497, 88 p.

Lundgren, A. L. 1966. Estimating investiment return from growing red pine. U.S.D.A. Forest Service, Resource Paper NC-2, 48 p.

Wambach, R. R. 1967. A silvicultural and economic appraisal of initial spacing in red pine. Ph.D. Thesis, Univ. of Minnesota, 282 p.