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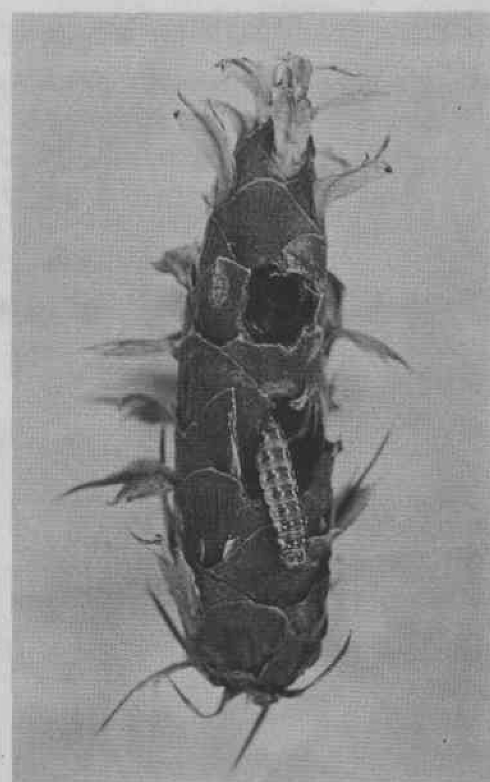

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GROUND APPLICATION OF DIMETHOATE (CYGON) FOR THE CONTROL OF CONE AND SEED DESTROYING INSECTS OF DOUGLAS-FIR AND GRAND FIR[1/]

by

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ABSTRACT

Two concentrations of dimethoate were applied with a hydraulic ground sprayer to cone-bearing Douglas-fir and grand fir trees. Single application (mid-June) and a double application (mid-June and mid-July) were compared. Three of the four treatments applied to Douglas-fir resulted in a significantly higher number of sound seeds produced per cone compared to untreated cones. No seed protection was exhibited in the grand fir treatments.

INTRODUCTION

Insects that damage or destroy the seeds of forest trees have a detrimental effect on reforestation. In a 3-year study of insects attacking Douglas-fir cones, Dewey (1972) found that over 54 percent of the cones collected were visibly damaged by insects. Entire cone crops can be lost due to insects in years of light cone crops. As the forests of the Northern Region become more intensively managed, losses to seed-destroying insects will become less tolerable. Currently seed production areas are being identified in the Region. Without a sound method of insect management these areas will not realize their potential as sources of large volumes of high quality seed.

1/ This paper reports work involving a chemical insecticide. It does not include recommendations for its operational use nor does it imply that the discussed uses have been registered. All uses of pesticides must be registered by appropriate State and Federal agencies or both before they can be recommended.

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This project was designed to evaluate effectiveness of two concentrations of dimethoate[6] insecticide in protecting Douglas-fir and grand fir from insect depredations. Study sites were on the Selway District, Nezperce National Forest, Idaho.

METHODS AND MATERIALS

The project was designed to evaluate four dimethoate treatments and a control, each on Douglas-fir and grand fir. Treatments were:

Treatment 1 = 0.25 percent concentration applied in mid-June.
Treatment 2 = 0.25 percent concentration applied in mid-June and mid-July.
Treatment 3 = 0.5 percent concentration applied in mid-June.
Treatment 4 = 0.5 percent concentration applied in mid-June and mid-July.
Treatment 5 = untreated control.

Water was the carrier for each concentration. No additives were used.

Five clusters of 10 Douglas-fir and five clusters of five grand fir were located and randomly assigned treatment. All trees included were less than 60 feet tall because of spraying height limitations. Trees were somewhat full crowned and contained over 100 cones. The cone crop was relatively light in the area with many barren trees.

Because cones were sprayed later in their development than was desired, a prespray sample of 50 cones from each of five Douglas-fir trees and two grand fir trees located in the study area, was taken to determine the prespray insect infestation level. For this measurement trees were felled, cones collected (not more than five cones per branch) and dissected in search of insects.

Spraying of selected clusters was with a pickup-mounted John Bean hydraulic sprayer operated at a pump pressure of approximately 7,000 kilopascals (500 p.s.i.). Hose was fitted with a trigger-type spray gun allowing spray stream regulation from a fine mist to a well-defined stream. Spraying took place in the early morning hours to minimize spray drift. The same process was repeated about a month later for those clusters designated to receive dual treatments.

6/ 0.0 - Dimethyl S - (N - Methylcarbamoylmethyl) phosphorodithioate registered trademark - American Cyanamid Co., Princeton, New Jersey. (Mention of commercial products in this report is for convenience only and does not imply endorsement by the U.S. Department of Agriculture.

A total of 100 mature cones per tree were collected in September by climbing the trees. These were taken to the laboratory for determination of quality. The following measurements were taken in determining cone quality:

1. Weight of cones.
2. Percent of cones showing visible injury.
3. Number of sound seed per face of axial sliced cone.

Cone weight was determined by weighing to the nearest gram all 100 cones per tree at the same time. Percent of cones showing visible injury was measured by examining each cone individually and recording those displaying deformities or other evidences of insect feeding. The number of sound seeds per face of axial sliced cones was obtained by dissecting the cone lengthwise with a cone cutter described by Winjun and Johnson (1960), and recording number of sound seed on one sliced surface (figure 1).

Figure 1. Dissecting cones to determine number of sound seed.

Data were analyzed using students "t" test to detect significantly different control and treatment population means.

RESULTS AND DISCUSSION

The target time for spraying was just after the cones were pollinated and beginning to turn down. This was expected to occur about the first week in June. Due to time delays in getting the project proposal approved, spraying did not begin until about a week or 10 days later than desired. By this time cones were pendant and about three-fourths to 1 inch in length, and many were already infested with budworm and other insects.

A prespray damage evaluation conducted on June 12 revealed an average of 22 percent of the Douglas-fir and 18 percent of the grand fir cones already insect infested. Western spruce budworm *Choristoneura occidentalis* Freeman, was the most common insect found feeding on cones of both species.

Spraying began on June 13. After two clusters were treated the pressure regulator valve ruptured making the sprayer inoperable and spraying was not completed until June 16. Spray was applied to the point of runoff, making certain all foliage was wet. An average of about 4.5 gallons of spray mix was applied per tree. Clusters scheduled for two applications were sprayed again on July 16.

Cones were collected for quality determination the first week in September. Results of the cone quality determinations are shown in table 1.

Table 1.--Measures of cone quality

Treatment	Weight of cone: Weight (grams)	Weight of cone: Level of significance[1/]	Percent of cones visibly deformed: Percent	Percent of cones visibly deformed: Level of significance[1/]	No. of sound seed per sliced surface: Sound seed	No. of sound seed per sliced surface: Level of significance[1/]
			Douglas-fir			
Control	8.33	--	15.8	--	3.0	--
.25% - 1	10.29	NS	21.4	NS	5.0	**
.25% - 2	8.87	NS	17.0	NS	5.7	***
.50% - 1	11.66	***	14.7	NS	6.2	***
.50% - 2	10.81	*	15.8	NS	3.2	NS
			Grand fir			
Control	49.13	--	8.4	--	10.7	--
.25% - 1	52.78	NS	4.6	NS	14.7	*
.25% - 2	61.10	NS	4.2	NS	12.9	NS
.50% - 1	47.72	NS	6.0	NS	11.0	NS
.50% - 2	50.41	NS	4.4	NS	11.9	NS

NS = No statistical significant difference.
* = Statistically different at the 90% level.
** = Statistically different at the 95% level.
*** = Statistically different at the 99% level.

1/ Level of significance as determined by comparing difference of treatment and untreated control values.

Application of dimethoate was partially successful in protecting the cones and seeds of Douglas-fir and grand fir under the conditions of this study. Unfortunately first treatment was applied about 7 to 10 days later than optimum. By this time many cones had already been attacked. Dimethoate is reported to be absorbed into the tree and translocated to the cones (Johnson and Rediske, 1964). It was hoped that insects already inside the cones would be killed by this action and that insects attacking after treatment would be killed by residual insecticide. However, once the insect is inside the cone it is apparently protected from contact of the spray.

The most meaningful measurement taken in this study was number of sound seed per sliced surface. The average cone weight is a less meaningful measure because it can be influenced significantly by such things as amount of time between harvesting and weighing, the number of cones on the tree, the size of the tree, and suitability of site on which the tree is located. The percent of the cones visibily deformed is an arbitrary measurement that can be misleading because cones can be insect infested yet show no external deformities. Also, cones that were damaged sufficiently to be visibly deformed could be shed prior to harvest.

Three of the four treatments significantly increased the sound seed produced by Douglas-fir. Unexplainably, the heaviest treatment, 0.5 percent concentration applied twice, was the only treatment not resulting in a significantly higher seed yield.

The only treatment resulting in significantly higher seed yield for grand fir was the lightest one (0.25 percent concentration applied once).

Despite the treatments, insects were still very damaging to the 1974 cone crop in the study area. Proportion of visibly deformed cones collected in September is a conservative estimate of the percent of cones damaged by insects. For example, only 5.5 percent of the grand fir cones collected in September were visibly deformed whereas 18 percent of the grand fir cones collected in mid-June were insect infested. Most cones that are budworm infested early in the year wither, die, and fall off the tree prior to maturity.

Hence, the percentage of deformed cones in September is not a percentage of the initial cone crop, but merely of those reaching maturity. Cones can be infested by such insects as midges, seed chalcids, and maggots and not show visible external deformities.

Noticeable phytotoxicity resulted in clusters sprayed with the 0.5 percent concentration. Needle burn was conspicuous on the new growth of both tree species sprayed. Leaf margins of some broadleaf shrubs were also affected by the treatment.

SUMMARY AND RECOMMENDATIONS

Seed production areas are becoming more important in the Northern Region as a result of more intensive management. Management systems for cone and seed destroying insects are mandatory in order for seed orchards or seed production areas to reach their potential. Numerous insecticides have been partially tested against cone and seed insects and some have shown very promising results. Several insecticides are currently registered for cone and seed protection of pines in the southeastern United States. Dimethoate is the only registered insecticide for Douglas-fir cone and seed insects (midges). Materials are available that should be effective against other cone-attacking insects in the Northern Region. What is needed is an evaluation of the best candidate materials, looking at concentrations and timing, so that one or more chemicals can be registered for use in seed-production areas.

Though phytotoxicity was apparent to new growth at the 0.5 percent concentration, it did not appear to be unacceptably damaging. If treatments were to be repeated several consecutive years on the same trees, as could be the situation in seed orchards or seed production areas, then intolerable chemical damage could result. For this reason, perhaps the 0.25 percent concentration is the best treatment.

The 1974 dimethoate project was encouraging, but not definitive regarding expected maximum benefit of an optimumly applied treatment. This effort should be repeated to see if better results can be achieved with earlier applications.

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