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1975 WESTERN SPRUCE BUDWORM INSECTICIDE  
TEST RESULTS AND CURRENT STATUS

October 24, 1975

Background

Zectran and Malathion are the only two insecticides currently registered for western spruce budworm control. Zectran is no longer being manufactured and Malathion has not been proven effective for large-scale forest spraying. Several insecticides are registered for eastern spruce budworm control but these registrations do not include budworm control in the West.

In an attempt to find significant effective budworm control agents that are environmentally safe, the Forest Service completed a series of tests in both the West (Washington and Montana) and East (Maine and Minnesota) during 1975. Further tests were carried out by industry in Washington State in cooperation with a private research group from New York.

Region 6 carried out two spray programs on Federal lands in Washington State. The first was a cooperative pilot control project with Washington State Department of Natural Resources using Sumithion<sup>®</sup> (fenitrothion) and the second was a cooperative field experiment with the PSW Station using Orthene<sup>®</sup> and Matacil<sup>®</sup>. The pilot tests completed by Region 1 in Montana included the use of Dylox, Sevin-4-Oil, and *Bacillus thuringiensis* (B.t.). The Forest Service conducted two cooperative pilot control projects in the East, one in Maine and the other in Minnesota. The project in Maine included Matacil, Dylox and Sumithion. Sevin-4-Oil was used in Minnesota. In addition, there was a cooperative State and Federal control project in Maine using Sevin-4-Oil, Sumithion, and the last remaining supplies of Zectran. The University of Maine also field tested Orthene in 1975. Environmental Research Associates (ERA) from Oswego, New York in cooperation with the Pack River Lumber Company conducted a series of field tests on private and Federal lands in Washington State using Dimilin, FMC 33297, a synthetic pyrethrin, and Imidan. The PNW Station's Aerial Application Unit selected the western spruce budworm as a target insect for field testing aerial application equipment and methods of Orthene, Dylox, Sevin-4-Oil, and Dimilin as a part of the Expanded Douglas-fir Tussock Moth Research and Development Program. Results of these tests can be later applied to Douglas-fir tussock moth control projects.

### 1975 Insecticide Test Results

Region 6 - The Sumithion pilot control program was carried out on six 1,200 to 1,500 acre plots and three additional pre-selected untreated plots. All plots were located on National Forest land; three selected on the Wenatchee National Forest near Cle Elum and six on the Okanogan National Forest near Twisp. The objectives were to determine if the insecticide would significantly reduce the budworm population and save foliage.

Two Sumithion application rates were used and applied at different periods. The first treatment included three plots that were sprayed only once with 3 ounces of actual Sumithion in 17 ounces of fuel oil per acre. Three plots comprising the second treatment were sprayed twice, 7 days apart, with 2 ounces of actual material in 18 ounces of fuel oil per acre. The results are summarized below. Data means have been adjusted to the common prespray population density means by analysis of covariance.

#### Average Larvae Per 100 Buds

<u>Treatment</u>	<u>Prespray</u>	<u>Postspray</u> <u>20 days</u>	<u>Mortality</u> <u>Percent</u>	<u>Defoliation</u> <u>(loss)Percent</u>
One spray 3 oz AI	41.6	9.4	77.4	67.7
Two sprays 2 oz AI	41.6	10.9	73.8	84.8
Untreated	41.6	13.2	68.3	94.8

The above control results were disappointing. Spruce budworm mortality rates were insufficient to save this season's foliage and to prevent future tree damage.

In conjunction with this pilot project, a monitoring program was conducted under contract by the Washington State Departments of Game and Ecology. The Game Department studies various species of songbirds while the Ecology Department concentrated on fish and aquatic insects. No significant adverse effects were observed or recorded on the treated areas.

Region 6 and PSW Station - The objectives of the Matacil<sup>®</sup> and Orthene<sup>®</sup> field tests were as follows:

1. Determine and compare the efficacy of these chemicals for reducing western spruce budworm populations and tree foliage damage.

2. Determine the systematic properties of an early Orthene application.
3. Determine the effects of various treatments on survival of the primary insect parasites, *Apanteles* and *Glypta*.

Fifteen 20 acre plots were selected on the Winthrop Ranger District, Okanogan National Forest, near Bankers Pass and they were treated as follows:

- 3 plots with 1 pound actual Orthene in 1 gallon of water per acre applied early (at 50 percent bud break).
- 3 plots with 1 pound actual Orthene in 1 gallon of water per acre applied late when most insects were out of the buds (50 percent of the larvae in the 5th instar).
- 3 plots of .15 pounds actual Matacil in 1 gallon of fuel oil per acre applied late when most insects were out of the buds. (50 percent of the larvae in the 5th instar).
- 3 plots of .30 pounds actual Matacil in 1 gallon of fuel oil per acre applied late when most insects were out of the buds (50 percent of the larvae in the 5th instar).
- 3 plots as untreated checks (except for the sample trees, the same 3 plots were used for the early Orthene treatments and the late treatments of Orthene and Matacil).

The following results have not been adjusted by using analysis of covariance.

Average Larvae Per 100 Buds

<u>Treatment</u>	<u>Prespray</u>	<u>Postspray 14 days</u>	<u>Mortality Percent</u>	<u>Defoliation (loss)Percent</u>
Early Orthene 1 lb/ac	37.0	17.1	53.8	21.6 <sup>1/</sup>
Early Untreated	42.0	38.0	10.0	64.0 <sup>1/</sup>
Late Orthene 1 lb/ac	27.2	0.1	99.6	96.9 <sup>2/</sup>
Matacil .15 lb/ac	29.7	0.9	97.0	89.0 <sup>2/</sup>
Matacil .30 lb/ac	20.8	0.2	99.0	71.1 <sup>2/</sup>
Late Untreated	43.0	20.2	53.0	100.2 <sup>2/</sup>

<sup>1/</sup>The amount of defoliation present at the 14-day post-sample taken during first week of July.

<sup>2/</sup>The amount of defoliation present at the 14-day post-sample taken during last week of July.

The early Orthene applications saved some current season's foliage but there were too many spruce budworm survivors after treatment which continued to seriously defoliate the trees throughout the month of July. Late treatments with Orthene and Matacil failed to save foliage. However, these late treatments did significantly reduced larvae populations to low enough levels to prevent future damage.

Except for monitoring the effects of these insecticides on the two primary hymenopterous primary parasites, no additional non-target or environmental studies were made. Registration of either insecticide for operational use in 1976 is doubtful. Based on results of these field tests, additional large-scale pilot tests using both materials should be conducted somewhere in the West during 1976 to improve application timing.

Region 1 - A series of large-scale plots were established on the Gallatin and Beaverhead National Forests and treated with Dylox at 1 pound actual per acre, Sevin-4-Oil at 1 pound actual per acre, and *Bacillus thuringiensis* (B.t.) at 1 pound of powder in 2 gallons of water per acre.

Covariance analysis was used to determine effects of the three treatments and to determine if foliage was saved because of treatment. The following table shows results of the analysis:

<u>Treatment</u>	<u>Average Larvae Per 100 Shoots</u>			
	<u>Prespray</u>	<u>Postspray 14 days</u>	<u>Mortality* Percent</u>	<u>Defoliation (loss)Percent</u>
Dylox 1 lb/ac	18.8	3.7	76.8	57.9
Sevin 1 lb/ac	19.2	3.0	81.8	47.5
Untreated	19.4	16.5	-	81.6
B.t.	42.2	15.8	50.4	89.4
Untreated	44.1	32.4	-	95.1

\*Data corrected for natural mortality.

The B.t. plots were also evaluated 21 days after spraying and the average larval count at that time was 9.2 for the treated areas and 19.7 for the untreated. Larval mortality increased to 52.6 percent. This microbial agent failed to save as much foliage as the two chemical insecticides.

Monitoring was conducted on the effects of Sevin-4-Oil on bees and the effects of Dylox on cholinesterase depression of birds. The Sevin study proved that this insecticide can be used for spruce budworm control without seriously effecting bee pollinators. Dylox caused no serious adverse effects on birds.

Region 1 reports that about 5 million acres of fir type in Idaho and Montana are infested with western spruce budworm.

State of Maine - A total of 2.5 million acres were treated operationally with Zectran, Sevin-4-Oil and Sumithion.

This project used up the last remaining supplies of Zectran. Both the Zectran and Sevin-4-Oil gave excellent control with about 95 percent insect mortality and good foliage protection. Sumithion gave "good" control with about 90 percent insect mortality but much less foliage protection. The State of Maine is satisfied with all results and is currently planning to treat 3.5 to 4 million acres with Sumithion and Sevin-4-Oil in 1976. They believe they can justify fairly frequent retreatments just as long as they keep the trees green.

Pilot projects using Matacil, Sumithion and Dylox were also carried out in Maine. Insect mortality was about 88 percent with Sumithion, 96 percent with Dylox and 80 percent with Matacil. Foliage protection showed 20 percent was saved with Sumithion, 42 percent with Dylox and 16 percent with Matacil.

The University of Maine field tested Orthene. The results showed insect mortality varied from 87 to 98 percent and 30 to 52 percent of the foliage was saved.

State of Minnesota - Sevin-4-Oil was tested at the 1 pound and 1/2 pound rate on a total of six plots, each about 200 acres in size. The average percent reduction of the budworm population 10 days after spraying was 96 percent with the 1 pound rate and 90 percent with the 1/2 pound application. No evaluation was made to determine if any foliage was saved.

ERA - Environmental Research Associates established a series of test plots on both Pack River Lumber Company and National Forest lands in Washington State. Preliminary results are as follows:

<u>Material</u>	<u>Rate Pounds/Acre</u>	<u>Results</u>
Dimilin	1/4, 1/8, 1/16	Larval mortality reached 60% only with 1/4 rate.
FMC 33297	0.05, 0.02, 0.01, 0.005	95% mortality with 0.05 rate - ranged down to 60% with lowest rate.
Imidan	1.0, 0.75, 0.5	95%+ mortality at all rates.

No additional data have been received.

PNW Station - The Aerial Application Unit established a series of plots within the Swauk Pass Area, Wenatchee National Forest. As part of the Expanded Douglas-fir Tussock Moth Program, their objectives were to field test application equipment and techniques. Because tussock moth populations are at low levels throughout the Region this season, the western spruce budworm infested areas on the Wenatchee were used for these tests. The insecticides used in these tests have shown promise for tussock moth control in the past. These materials included Orthene, Dylox, Sevin-4-Oil, and Dimilin.

The preliminary data indicates that all the above materials gave excellent results in reducing budworm populations depending on application techniques used.

#### Current Situation

The 1975 Cooperative aerial detection survey delineated over 560,470 acres that supported various visible defoliation intensities caused by the western spruce budworm and a closely related species the Modoc budworm. Defoliation by States are as follows:

#### Oregon

Warm Springs Indian Reservation	10,560
Wallowa-Whitman National Forest (Northeast of Enterprise)	8,430
Fremont National Forest (Modoc budworm)	<u>28,450</u>
OREGON TOTAL	47,440 Acres

Washington

Okanogan National Forest	168,450
Wenatchee National Forest	250,070
State and private land	59,460
North Cascades National Park	<u>35,050</u>
WASHINGTON TOTAL	513,030
GRAND TOTAL OREGON AND WASHINGTON	673,550 Acres

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Biological evaluation data for Oregon and Washington are now being finalized by Insect and Disease Management. Tentative results so far indicate western spruce budworm populations will again be at high levels in 1976. Direct control measures are being recommended for areas in north central Washington and the Warm Springs Indian Reservation.

A Spruce Budworm Steering Committee was formed during early 1975 to coordinate all budworm field tests in Region 6 and to provide the public with information about the various projects. Representatives from Washington State Department of Natural Resources, Pack River Lumber Company, Burlington Northern, Boise Cascade, Region 6, and Okanogan and Wenatchee National Forests formed the original committee. The decision was made to retain this committee and to expand its membership to include the Bureau of Indian Affairs, National Park Service, and the Northwest Forest Pest Action Council. Key environmental groups will also be asked to participate in an advisory or consultant capacity.