



Oregon  
Department  
of Agriculture

July 26, 1995

Dr. William Metterhouse  
Interstate Pest Control Compact  
National Association of State Departments  
of Agriculture  
1158 15th Street NW, Suite 1020  
WASHINGTON DC 20005

Dear Bill:

Enclosed is a preliminary report from Dr. Ernest Bay. The marked copies indicate that some editing is in progress. The data tables presented indicate that a successful procedure has been developed for a regulatory treatment of Malus nursery stock to eliminate apple ermine moth life stages.

The overlapping hibernaculae present an experimental observation not seen when egg laying females are not confined as in the experimental procedure used by Dr. Bay (many females confined in cages).

Dr. H. S. Gerber of Crop Protection, 17720 57th Avenue, Surrey, B.C., V3S-49P, coordinated with Dr. Bay in these trials. I understand that his results with the cherry ermine moth were similar to those obtained with the apple ermine moth. It seems we may have taken care of two ermine moths with these efforts.

We will send Dr. Bay's completed report along with the financial statement expected immediately.

A letter to Glen Lee is enclosed for your review. The letter affirms acceptance by Ag Canada of a regulatory treatment based on Dr. Bay's research.

Sincerely,

Robert Obermire  
Nursery Programs Supervisor  
Plant Division  
503/986-4635  
FAX: 503/986-4735

Enclosures

John A. Kitzhaber  
Governor



635 Capitol Street NE  
Salem, OR 97310-0110

AN OVERWINTERING TREATMENT OF APPLE ERMINE MOTH  
HIBERNACULA USING HORTICULTURAL OIL BASED  
INSECTICIDES

Ernest C. Bay

Washington State University  
Puyallup Research and Extension Center

In 1992, apple ermine moth neonates were 100 percent controlled in three commercial hibernacula trials of horticultural oil based esfenvalerate (Asana<sup>®</sup>) sprays, and in 1993, 100 percent control was repeated with fenvalerate (Belmark<sup>®</sup>).

This success culminated nearly six years of research that had begun shortly after the apple ermine moth *Yponomeuta malinellus*. Zeller, a *Malus* defoliator, first appeared in the United States near the border from British Columbia (fig. 1). By 1991, it had begun to seem that for all practical purposes aem hibernacula were impregnable. Prior to 1991, hibernacula-protected aem neonates had survived a wide attempt of experimental treatments which ranged from a variety of insecticidal dips including oils, to 104°C temperature exposures, vacuum and normal atmosphere methyl bromide fumigation (Antennal *et al* 1986, Bay and Barstow 1989). In 1991, treatments with various horticultural oils and selected oil insecticide combinations were revisited using extended post-treatment evaluation times up to and beyond thirty days.

Upon the suggestion of Dr. Stan Hot of the Washington State Tree Fruit Research and Extension Center in Wenatchee, increased attention was given to the synthetic pyrethroid esfenvalerate, Asana. A series of screening trials led to the Asana/oil formulation which gave 100 percent control of aem neonates in three commercial spray trials in 1992 (Bay, unpublished).

Asana is not registered in Canada. In November, 1993, in order to satisfy Agriculture Canada, commercial trials were repeated at Carlton Nursery, Dayton Oregon, commercial trials were repeated at Carlton Nursery Dayton Oregon, with the fenvalerate formulation, Belmark. Other treatments included horticultural oil based chlorpyrifos (Dursban), and four percent horticultural formulation alone.

**Procedure:** Cuttings of crabapple nursery stock from artificially caged apple trees infested with apple ermine moth hibernacula at Puyallup, Washington, were color coded in lots of 100 for each treatment. These were then transported to Dayton, Oregon, on November 18, 1993. Cuttings were wired to row planted apple nursery stock at varying heights and intervals along 1000 feet of row. Hibernacula ranged between 1 and 21 per cutting. Sprays were applied with a vertical boom hydraulic sprayer at a speed of 2.5 mph and a delivery rate of 100 gallons per acre. Each treatment was removed immediately following spraying and placed in plastic bag-enclosed buckets for return to Puyallup. In Puyallup, cuttings were wired to holding trees until respray or evaluation.

On December 17th, fifty cuttings from each treatment were returned to Oregon for a second spray and later replaced on holding trees at Puyallup. Additionally, on December 17th, prior to each spray, several hibernacula were held back from spraying and were instead individually swabbed with insecticide from the tank mixes

using a cotton cue tip to assure mix reliability.

The weather on both spray dates was calm, near 10°C and mildly overcast to sunny. Leaf drop on November 18th was delayed near 90 percent.

Horticultural oil was applied as a four percent formulation, and Belmark and Dursban Turf at 2 oz. and 8 oz. formulation respectively per 100 gallons. Single and double spray treatments were evaluated after 40 and 72 days respectively; December 29, 1993, and January 19, 1994. Evaluations were made by dissecting hibernacula and examining for living and dead larvae. Moribund larvae were counted as dead. Dead larvae were either desiccated, or compacted and immobile. Healthy larvae separated from one another and writhed actively (fig. 2).

**Results:** Not all cuttings contained hibernacula at the time of evaluation. Hibernacula in some instances had sloughed away or had otherwise disappeared. Single spray oil treatment resulted in only 15.8 mortality among 171 hibernacula recovered from 47 cuttings (Table 1), and 27.2 percent mortality among 162 repeat sprayed hibernacula (Table 2). All individual single swab treatments, including horticultural oil along, gave 100 percent control (Table 3). Discarding one aberrant Dursban datum, both Belmark and Dursban Turf oil combinations gave nearly 98 percent spray control among 183 and 111 hibernacula respectively. The deleted Dursban Turf datum contained a total of 21 closely spaced and often overlapping hibernacula, eleven of which contained living neonates, and ten of which contained dead. Repeat sprays resulted in 100 and 96.7 percent control of neonates in Belmark and Dursban Turf treatments respectively. Dursban Turf failed attaining 100 percent control because of a single cutting with three closed spaced hibernacula.

**Discussion:** Four percent horticultural oil combinations of esfenvalerated and fenvalerate formulated and registered as Asana and Belmark (DuPont), and also Chlorpyrifos formulated as Dursban Turf (DowElanco), can be considered to give 100 percent control of apple ermine moth neonates at recommended rates of spray formulation. This, of course, presumes 100 percent spray coverage which can best be assured by one or more repeat sprays. Although topical swab applications four percent horticultural oil tank mix were 100 percent effective, commercial spraying of the same mix was not. Adequate volume in addition to complete coverage is believed to be critical. Complete control with four percent oil was achieved in a single 1992 hydraulic mist blower trial, and also in 1993 drench hand sprays and branch dip experiments (Bay, unpublished).

The need for complete spray coverage and adequate volume when applying any aem spray cannot be overemphasized.

Table 1. Mortality of apple ermine moth neonates in overwintering hibernacula single sprayed with horticultural oil based insecticides, November 18, 1993. Dayton, Oregon

Treatment	Rate/100g	No. hibernacula	% 40 day mortality
Hort. oil 4%		171	15.8
Belmark/oil (esfenvalerate)	2 oz	183	97.8
Dursban Turf/oil (chlorpyrifos)	8 oz	111	88.3 <sup>1/</sup>
Check		100	1.0

<sup>1/</sup> A single cutting accounted for eleven of thirteen hibernacula with live larvae and ten with dead larvae. Discarding this cutting elevates Dursban mortality to 97.7%.

Table 2. Mortality of apple ermine moth neonates in overwintering hibernacula single twice sprayed with horticultural oil based insecticides, November 18, 1993, and December 17, 1993. Dayton, Oregon

Treatment	Rate/100g	No. hibernacula	January 19, 1994 % 72-day mortality
Hort. oil 4%		162	27.2%
Belmark/oil (esfenvalerate)	2 oz	145	100%
Dursban Turf/oil (chlorpyrifos)	8 oz	92	96.7% <sup>1/</sup>
Check		30	0.0

<sup>1/</sup> Survival involved three closely spaced, presumably unsprayed, hibernacula on single cutting.

Table 3. Mortality of apple ermine moth neonates within hibernacula topically treated with tank spray mixes, December 17, 1993. Dayton, Oregon

Treatment	Rate/100g	No. hibernacula	January 19, 1994 % 33 day mortality
Hort. oil 4%		20	100%
Belmark/oil (esfenvalerate)	2 oz	16	100%
Dursban Turf/oil (chlorpyrifos)	8 oz	12	100%
Check		30	0.0%

#### REFERENCES CITED

Antennal, A., E. LaGasa and S. Brown. 1986. Preliminary screening of materials for apple ermine moth dips. Entomol. Newsletter Co. Ag. WSU Dept. Entomol. 1 (4):1-43.

Bay, E.C. and D.A. Barstow. 1989. Research Report: Apple ermine moth controls. Balls and Burlaps. July: 1-16.

INTERSTATE PEST CONTROL COMPACT  
 REQUEST FOR FINANCIAL ASSISTANCE FROM THE  
 PEST CONTROL INSURANCE FUND

PART I

1. Requesting state: Oregon Department of Agriculture  
 Compact administrator: Bruce Andrews  
635 Capitol St. N.E.  
Salem OR (Address) 97310-0110 (503) 378-4152  
 (City) (Zip Code) (Telephone)

2. Responding state(s): Washington Department of Agriculture

State	Program Administrator or Responsible Official	Compact Member Yes or No	Is State In Agreement with Application? Yes or No
1. Washington		No	Yes
2.			
3.			
4.			

3. Pest involved:

- A. Common and scientific names: Apple Ermine Moth (*Yponomeuta malinellus* Zeller)
- B. Is pest native or introduced from outside the continental U.S.? Introduced, European
- C. Major means of dispersal or transmission: Adult flight is the known means of dispersal.  
Concern for potential movement of larvae on Malus nursery stock.
- D. Known geographical range in U.S.: State of Washington and the Oregon counties of  
Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco,  
Washington and Yamhill
- E. Potential geographical range in U.S.: All apple production areas and all areas using  
ornamental Malus throughout the United States
- F. Type of damage caused by pest: Larval stage feeds on leaves, produces unsightly  
tents from which prolonged feeding by larvae causes defoliation.

4. Economic importance:

Crops Affected (List)	Acreage & Value					
	Requesting State		Responding States			
	(Name)		State #1 (Name)		State #2 (Name)	
	Oregon		Washington			
	Acres	Value	Acres	Value	Acres	Value
1. <u>Malus (fruit)</u>	9513	\$22.3 million	161,000	\$995 million		
2. <u>Malus (nursery)</u>	620	\$9.5 million	1,500	\$22 million		
3.						
4.						
5.						
6.						

B. Value of crop(s) to United States: Apple fruit, \$1.7 billion; Apple Nsystock, \$60 million

C. Estimated potential damage to crop(s) in requesting state if compact in not invoked: Nursery stock market losses and increased production-certification treatment costs approach \$4 million annually.

D. Other states which may be adversely impacted: Washington state Malus nursery stock losses would be similar to Oregon's. The negative impact of Apple Ermine Moth on apple pest IPM programs could be substantial.

5. Type of program (i.e., quarantine, eradication, suppression, delimiting survey, etc.): The proposed experimental program is designed to develop safe, effective, regulatory treatments which will eliminate any viable apple ermine moth larvae which may be present on Malus nursery stock subject to infestation.

6. Will compact implementation result in an increase or decrease in normal plant pest control activity in the requesting state?: Perhaps eliminate need for multiple guthion treatments.  
 If a Decrease Results, Explain How and Why: Potential use of horticultural oils as a regulatory treatment would eliminate or greatly reduce the use of synthetic insecticides now required to eradicate apple ermine moth larvae from apple nursery stocks.

7. Amount of funds requested: \$8,000

A. Will state funds supplement this?: Yes

If yes, how much?: Washington - \$6,000; Oregon - \$8,126.05

B. Will federal funds also be used?: Yes

If yes, how much?: Indirect support WSU Puyallup Research and Extension Center

8. To the best of your knowledge, can the conditions which initiated this application for funds be abated, by a program undertaken with these funds, in one year or less?: Yes

- (10) A research proposal from Ernest C. Bay, WSU Research and Extension Center, Puyallup, WA is attached. The purpose of this proposed research:
- (a) To repeat work done in 1992 with horticultural oil and Asana to further establish the efficacy of this treatment to eradicate AEM from infested nursery stock. (Ag Canada continues to question such treatment; letter attached, directed to Glenn Lee)
  - (b) To expand the inquiry regarding the potential for horticultural oil alone to achieve the required eradivative effect.
  - (c) To expand the search for an alternative pyrethroid to Asana. Asana is not registered for use in Canada; B.C. growers still have no alternatives to the use of multiple applications of Guthion or fumigation for movement of stock to uninfested provinces of Canada. Similarly, Ag Canada requires such treatment of Oregon and Washington apple nursery stock.
  - (d) To qualify an efficacious treatment for use on budwood harvested during August for current year budding in September.

Successful completion of the proposed research will provide:

- (a) Additional trials and data to further substantiate the efficacy of the oil and Asana treatments to eradicate AEM from infested nursery stock.
- (b) The question regarding the potential efficacy of horticultural oil used alone to function as an eradicator for AEM on nursery stock will be answered.
- (c) An oil and alternative pyrethroid treatment registered for Canadian and U.S. use should be defined with this research.
- (d) Most importantly, this research should provide alternative treatments which are far safer for nursery workers and handlers. The use of multiple growing season applications of Guthion is not desirable because of frequent handling and potential worker exposure during cultural activities. The fumigation alternative is logistically difficult in marketing and shipping since only dormant nursery stock can be safely fumigated. Environmental concerns make use of MB for this purpose undesirable. The oil or Asana plus oil treatments are practical and efficient to apply. The improved economics of such treatments alone assure grower compliance and will provide AEM free Malus nursery stocks for all U.S. and foreign markets.

- (11) Since apple ermine moth Yponomeuta malinellus was detected on Vancouver Island, B.C. in 1981 it has spread from B.C. across Washington and was first detected in Oregon in 1991. By 1992 it spread to seven northern Oregon counties. It is expected to continue spreading south and east. Its natural spread could be slowed by the Cascade Mountains in Oregon. However, escaped seedling apple trees are found widely throughout the state, even across mountain passes.

Apple ermine moth is host specific to Malus species which makes apple nursery stock a target for oviposition and potentially a means of spreading the pest. The larvae are easily controlled with insecticides used to treat for codling moths, including the biological insecticide, Bacillus thuringiensis. Effective eradication treatments targeting AEM egg masses which are protected by a hybernaculum were initially limited to methyl bromide fumigation of dormant stocks or multiple treatments of Guthion applied throughout the flight period of the adult stage (ca. 4th wk. of June through mid September). Washington nurseries began using the multiple Guthion application treatment to prevent infestation of their Malus nursery stock several years ago. Oregon growers began using the multiple Guthion treatment in 1992. Additionally, Oregon growers are required to treat all Malus nursery stock (protocol attached) produced in countries where apple ermine moth has been detected. Such treatments provide protection against the spread of the pest to other states; 95% of all Malus nursery stock produced in Oregon is shipped outside the state. The same is true for Washington produced apple nursery stock.

USDA-APHIS has not imposed an apple ermine moth quarantine on Washington, Oregon or the Province of British Columbia. Ag Canada, however, now requires that Malus nursery stock grown in Oregon and Washington be treated according to the Guthion regimen or fumigated with MBr to qualify for entry into Canadian provinces not infested with the pest.

- (13) The non-party state, Washington, has been seriously impacted economically by the loss of aerospace related employment in the past 24 months. In that time period the state had to carry out an extensive Asian gypsy moth eradication program (ca. 120,000 acres, 1992) and AGM detection programs in 1992 and 1993. Additionally, the detection of the exotic pea-cyst nematode in several western Washington counties in 1993 has stretched the Washington Department of Agriculture plant pest and disease program to its limits. It is expected that the Washington nursery research program will contribute \$6,000 to the 1993-94 research activity.

While Ag Canada has not indicated so directly, I believe that any failure on the part of Oregon and Washington to provide an eradicated treatment on Malus stock sent to other states in the U.S. would place all U.S. produced Malus stock at risk for quarantine by Ag Canada. It is in the best interest of all U.S. apple production nurseries that a safe effective regulatory treatment be found for Malus stock produced in the AEM infested states of Oregon and Washington. Further, the benefit of preventing the spread of AEM to other states will protect apple fruit IPM programs from the burden of this pest and will obviate the need for control actions which would become necessary in public and private ornamental plantings of Malus.

The eradicated treatments being researched are aimed at dormant applications, and look to identify a least threatening treatment of horticultural oil only, with the alternative of an oil plus insecticide. Such treatments could be appropriately used wherever AEM may establish in the future.

- (14) The Oregon Department of Agriculture Nursery research program has already contracted \$8,126.05 to the 1993-94 research to initiate the technical field activities during July of 1993. The 1992 research activities were subsidized by more than \$17,000 from the same ODA research program. The ODA is authorized in statute (ORS 561.240) to cooperate with other state, federal, and private entities to accomplish the goals of pest and disease eradication and control activities. Further the ODA is authorized in statute (ORS 570.650 ) to participate in the Interstate Pest Control Compact.

If not, is this request for an installment in a program which is likely to continue for a longer period of time?: \_\_\_\_\_

9. Target date for program implementation: June 1, 1993

Target date for program completion: May 1, 1994

PART II

10. Detail exactly what work will be performed and what will be accomplished with the funding request from the Insurance Fund.
11. Attach a detailed statement of the circumstances which occasion this request for the invoking of the compact. Include information on how and why the situation is serious, whether or not an emergency exists, and the reasons why financial assistance is needed.
12. Attach an itemized budget page showing how the requested money will be spent as well as any state or federal funds as listed in item 7 above.
13. If the requested insurance fund money is to be used by a non-party (non-member) state, attach a statement justifying why conditions in the non-party state warrant financial assistance, and explain the value of such expenditures to the party (member) states as a whole.
14. Attach a statement of the extent of the present and projected program of the requesting state, including full information as to legal authority for the conduct of such program and the expenditures being made or budgeted therefore, in connection with the eradication, control, or prevention of introduction of the pest concerned.
15. Application submitted by:

Lorna Youngs

*Lorna Youngs*  
(Name)

Assistant Director, Oregon Department of Agriculture

(Title)

635 Capitol St. N.E.

Salem

(Address)

(City)

Oregon 97310-0110

(503) 378-4667

(State)

(Zip Code)

(Telephone)

The following person in the requesting state can be contacted for further program details:

Name: B.D. Wright, Ph.D.

Title: Administrator

Address: Oregon Department of Agriculture

635 Capitol St. N.E., Salem OR 97310-0110

Phone: (503) 378-3776

COOPERATIVE AGREEMENT  
BETWEEN  
THE PEST CONTROL COMPACT  
AND

Oregon Department of Agriculture  
(Responding State)

The principal parties to this Cooperative Agreement are the Interstate Pest Control Compact, hereinafter called the Compact, and the Oregon Department of Agr., hereinafter called the Responding State.

The purpose of this Cooperative Agreement is to stipulate the general conditions under which the Compact will provide funds to the Responding State to finance other than normal pest control operations, hereinafter called Project, as approved by the Compact Governing Board. Such Project will be provided to the Responding State as an approved "Request for Financial Assistance from the Pest Control Insurance Fund," hereinafter called Request.

The cooperation shall be conducted consistent with the Compact enabling legislation, as adopted by member states, and the Bylaws of the Compact Insurance Fund and with all applicable statutes and regulations of the Responding State.

**A. The Compact Agrees:**

1. To provide funds in the amount of \$ 8,000 to the Responding State upon timely and satisfactory completion of the Project as outlined in the Request, or upon satisfactory evidence that expenses have been incurred on account of measures taken toward Project completion.
2. To furnish the services of the Compact Executive Director whose duties shall include coordinating activities relative to this Cooperative Agreement.
3. To furnish the services of the Compact Technical Committee for advisory purposes, as mutually agreed, or for Project evaluation and monitoring.

**B. The Responding State Agrees:**

1. To provide necessary resources to perform Project activities as outlined in the Request in an expeditious and efficient manner.
2. To submit a progress report on Project activities to the Compact Executive Director by 12/1/94 (date).
3. To submit a final report, to include evidence of satisfactory and timely completion of the Project and including a detailed financial statement of funds expended, to the Compact Executive Director by 7/1/95 (date).
4. To cooperate fully with the Compact Technical Committee in any evaluation or monitoring of the Project, either during progress or after completion.
5. To maintain pest control and eradication activities of interstate significance at a level that would be reasonable in the absence of the Project.
6. To meet emergency outbreaks or infestations of interstate significance to no less an extent than would have been done in the absence of this Project.

**C. It is Mutually Understood and Agreed:**

1. That the cooperating parties may mutually agree to minor adjustments in Project details as outlined in the Request, consistent with Project objectives.
2. This agreement shall become effective upon date of final signature and shall continue until 6/1/95 (date), unless amended by mutual agreement of both parties.

Signature Responding State Lana Young  
Date June 1, 1994