

Title: Use of Physical Barriers to Prevent Borer Infestation of Apple Burrknots

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Abstract:

Dogwood borer (DWB) infestation of burrknot tissue on apple dwarfing rootstocks is an increasing problem throughout the northeast. One insecticide, Lorsban, is currently the only efficient and effective chemical control available for DWB. Because of scrutiny of Lorsban under the EPA's FQPA policy, and the desire to increase options available to growers, a search for chemical alternatives to Lorsban has been ongoing. However, barriers to egg-laying by DWB may offer an effective, efficient, non-chemical control that may also serve as a deterrent to rodents. We tested four types of barriers including white latex paint, trunk wraps of Tyvek and veterinary gauze, and a sprayable, non-woven ethylene vinyl acetate (EVA). These were compared with the Lorsban standard and an untreated check. All barriers were effective in preventing DWB infestation, and remained intact throughout the growing season. However, paint and the EVA treatments held up better going into the winter. We also discuss economic considerations.

Background and Justification:

Apple growers are increasingly concerned about the impacts of borers on dwarf apple trees. In a statewide survey of dwarf apple orchards in NY, approximately 60% of dwarf apple trees had suffered damage by borers and approx 32% of trees were actively infested. While we have not yet determined the effect of borer feeding on dwarf apple trees, we have observed decreased vigor and even death in affected trees. The lifespan of tart cherry trees is estimated to be reduced by one third by borer infestation. Borer feeding may also increase the tree's susceptibility to diseases such as rootstock fireblight. Most insecticides we've tested provide control only of the summer brood and require multiple applications. Only one, Lorsban, will provide season-long control. It also requires only one application. However, Lorsban is under increasing scrutiny by regulatory authorities, prompting an ongoing search for alternatives. In addition, growers are reluctant to apply sprays to control borers because, to be effective, sprays must be applied with a handgun applicator which entails considerable labor and potential for worker exposure. Some growers may also prefer to use non-chemical methods of control. Insect barriers may offer an effective, long-lasting alternative to insecticides. In addition, these barriers may be helpful in reducing winter injury and rodent injury. Results of the proposed research will aid growers in

the management of borers if the EPA(FQPA) revokes postbloom usage of Lorsban. Growers are likely to adopt the use of barriers if they are effective and efficient to apply because they already are accustomed to applying barriers to prevent rodent feeding and to painting trunks to prevent winter injury. In the past, growers have been eager to learn of advances in borer management and have actively participated in their development by providing monetary support (through the NYS Apple Research and Development Program) and orchards to work in.

Objectives:

- 1) Evaluate barrier materials for efficacy against dogwood borer infestation.
- 2) Determine fastness and longevity of barrier materials (as an indication of value in prevention of winter injury and rodent injury)
- 3) Project evaluation

Procedures:

This study was conducted in a high-density, dwarf apple planting at Wafler Farms, in Huron, NY. This orchard has a high proportion of trees expressing burrknots and is heavily infested by dogwood borers (average of 23-77% infested trees in checks over 4 years). Each treatment was replicated 3 times. Each replicate included 40 trees (2 rows x 20 trees/row).

1) Evaluate barrier materials for efficacy against dogwood borer infestation: Barriers were applied between 25 May and 6 June, prior to the beginning of the dogwood borer flight (12 June), to the rootstock portion of apple trees. The non-woven EVA treatment was applied using specialized equipment developed specifically for that purpose. The equipment consists of a hot melt adhesive supply unit fitted with a hand-held spray head (ITW Dynatec, Henderson TN). The unit is powered in the field by a generator and a compressor so that fluid EVA is extruded as filaments that are then carried to the target by a jet of air. EVA was applied to 10 additional trees, and barriers were subsequently removed and weighed, to determine the average amount of material applied to each tree. Undiluted white latex paint (Exterior Flat White 8-2000, Yencin-Majestic Paint Corp., Columbus, OH) was applied with a paintbrush. The amount of time required to apply paint to each replicate was recorded. The total amount of paint used was recorded and divided by the total number of trees painted to determine the average amount applied to each tree. 3 inch wide x 3 ft. long strips of Tyvek cloth were precut in the laboratory, then wrapped in a spiral around the lower (rootstock) portion of each trunk and affixed to the trunks with duct tape. The amount of time required to apply the Tyvek strips to each replicate was recorded. A cohesive flexible gauze bandage (SyrVet, Waukegan, IA), which comes in 4 inch wide x 15 ft. rolls, also was wrapped around the rootstock portion of trunks. There was also an untreated check and a Lorsban standard. Lorsban 4E was applied at a rate of 1.5 qt. per 100 gallons of finished spray using a Nifty-Pul-Tank sprayer (Rears Manufacturing Co., Eugene, OR) operating at 150 psi. Barriers were removed from twenty trees in each plot and burrknots were counted and examined for freshly produced frass (as an indication of infestation) on 16 October. The percentage of burrknots infested per tree was determined. Percentage data were transformed by arcsin squareroot and subjected to analysis of variance. (SuperANOVA version 1.11, Abacus Concepts 1991) Trees were examined for apparent phytotoxic effects.

2) Determine longevity of barrier materials: Barriers on 20 trees in each plot were left undisturbed and were examined monthly beginning one month after application, to determine

whether they will last a sufficient amount of time to be of value in prevention of winter injury and rodent injury. Percentage of each material remaining was estimated at each monthly inspection. Percentage data were transformed by arcsin squareroot and subjected to analysis of variance.

3) Project Evaluation: Barrier costs (materials and cost of application) were compared to a standard treatment of one trunk application of Lorsban using a handgun applicator. The time required to apply each treatment was noted and the average amount and cost, per tree, of each material was calculated from the total used.

Results and Discussion

In terms of preventing DWB infestation, all barrier treatments were significantly better (less infested) than the untreated check and statistically equivalent to Lorsban. (Table 1)

Table 1. Efficacy of barriers compared with Lorsban and an untreated check

Treatment	n	Proportion of burrknots infested
EVA	59	0.000 a
Lorsban	60	0.008 a
Tyvek	60	0.014 a
Gauze	60	0.031 a
Paint	57	0.051 a
Check	60	0.207 b

Tyvek was chosen as a control treatment because it was assumed to be impenetrable. It was also chosen, in part, because it is breathable. However, presumably due to higher humidity under the barrier, the root initials that form burrknots grew out into roots under this barrier, while they did not under any of the others. Leskey and Bergh (2005) noted this growth of rooting tissue on trees on which the lower portion of the trunk had been mounded with soil. They stated that >50% of trees that had been mounded later became infested by DWB and that "rooting tissue seemed to provide an ideal habitat for developing larvae."

The gauze treatment was chosen because it has an open weave and is, therefore, presumably breathable, and because it is impregnated with an adhesive that allows it to adhere to itself when wrapped around the trunk. This seemed to be a practical consideration for its eventual adoption because it is quick and easy to apply. However, after a month or two the adhesive began to deteriorate and the gauze began to fall away from the trunk. (Table 2)

In a previous study, we had applied a 50:50 mixture of water and white latex paint using a sprayer. While spraying paint on was efficient, it was not effective at the 50:50 rate in preventing DWB infestation. (Kain, et al 2004) In this study we applied the paint at full strength with a paint brush. While this took considerably more time than spraying, it was effective and long-lasting. However, in a few instances, burrknot tissue grew through the paint layer and became unprotected. Paint was the most expensive treatment. If paint was applied with a sprayer, it would be more economical but material cost is still the highest of materials tested.

EVA was chosen because it is breathable, easy and efficient to apply, and because it had previously been shown to be an effective barrier to insect pests in other crops. This barrier completely excluded DWB and has held up better than the other treatments. The biggest impediment to its adoption is that it must be applied with specialized equipment that is expensive (\approx \$8000–\$9000) and not readily available in a configuration suitable to field use. However, it can be adapted to field use and, if demand for this type of borer control was great enough, it could be cost-effective for a grower group or custom applicator to own.

Table 2. Longevity of barrier materials affixed to tree trunks

Treatment	n	Percentage remaining per trunk					
		June	July	Aug.	Sept.	Oct.	Nov.
Gauze	60	97 a	93 a	92 a	86 a	85 a	86 a
Tyvek	60	100 a	99 b	98 b	97 b	94 b	91 b
Paint	60	100 a	100 b	99 b	99 b	98 b	98 bc
EVA	60	100 a	99 b	99 b	98 b	98 b	98 c

Table 3 contrasts the cost of treatments on a per tree basis and, to give a more easily relatable illustration, cost of each treatment per acre, using 1200 trees/A and \$8.00/hr as a basis. To further evaluate the cost of these treatments it would be well to assume that, if they last throughout the winter, they would be effective as rodent barriers and should be compared to the cost of applying another type of mouseguard, namely the plastic spiral type. At a cost of \$0.50 each, and assuming a labor cost equal to the cost of applying the gauze treatment, the cost of applying plastic spiral mouseguards would be \$742.40/A. In addition, this type of mouseguard does not prevent, and may actually lead to, DWB infestation so that Lorsban would need to be applied as well, increasing the cost to \$779.92/A.

Table 3. Cost of application of barriers and Lorsban 4E

Treatment	Cost per tree		Cost per acre
	Labor (mins)	Material (\$)	Total (\$)
Gauze	0.89	0.247	438.80
Tyvek	1.33	0.108	342.40
Paint	0.96	0.292	504.00
EVA	0.61	0.035	139.60
Lorsban	0.167	0.009	37.52

Lorsban material cost based on a price of \$30.00/gallon.

EVA material cost is based on a price of \$1.27/lb.

Project location:

Wayne County, NY. Dogwood borer problems occur throughout the northeastern U.S. and Michigan in apple trees on size-controlling rootstocks.

References

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