Integrating Approaches to Meet Insect Management Challenges in Michigan Vineyards

Progress report to The Michigan Grape and Wine Industry Council

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This project aims to address the following objectives. Methods and procedures are detailed in the original and continuation proposals.

Objective 1. Determine the effectiveness of reduced-risk insecticides on grape pests and their impact on biocontrol agents in vineyard-scale trials.

Objective 2. Optimize sprayer technology to improve coverage of grape clusters.

Objective 3. Characterize relationship between cluster coverage and control of grape pests.

RESULTS

1. Determine the effectiveness of reduced-risk insecticides on grape pests and their impact on biocontrol agents in vineyard-scale trials. In 2003, significantly fewer moths were caught in pheromone traps in the reduced-risk treatment than in the conventional treatment ($F_{(1,26)}$=6.65, P=0.02). In 2004, there was no significant difference in the total number of moths trapped in each treatment. In 2003 and 2004, cluster infestation by GBM did not differ significantly between treatments (Figure 1), indicating that the reduced-risk insecticide program is as effective as the grower's standard program.

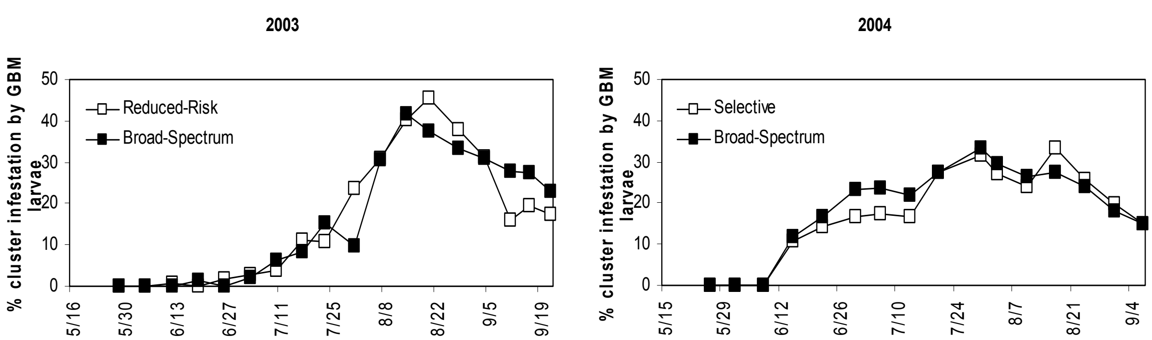

Figure 1. Comparison of cluster infestation by GBM larvae in vineyards managed under two different insecticide programs in 2003 and 2004.

In 2003, berries collected in the reduced-risk insecticide treated vineyards has significantly lower survival of GBM than berries from the grower standard vineyard on all collection dates (14 Aug, 2 Sept and 13 Sept) (Z=3.68, P<0.05; Z=4.02, P<0.05; Z=3.56, P<0.05 respectively). In 2004, significantly fewer adult GBM emerged from berries in the reduced-risk treatment on two of the three collection dates (12 and 26 Aug; $F_{(1,35)}$=31.0, P<0.05 and $F_{(1,44)}$=12.10, P<0.05 respectively).

On all three sample dates in 2003 and 2004 (same GBM infested berry samples as above), the parasitism rate of GBM was numerically greater in the reduced-risk vineyards than the grower standard vineyards (Figure 2). However, these differences were not significant.

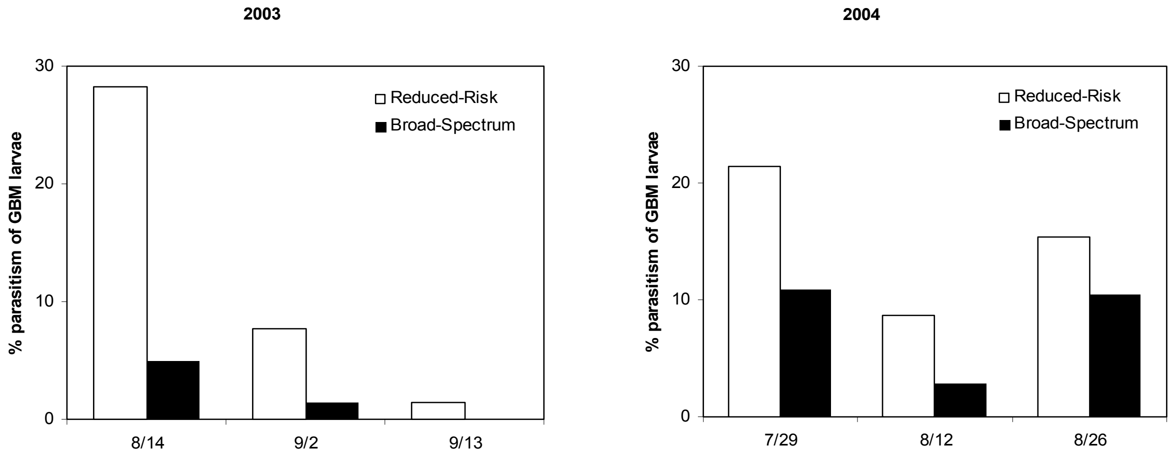

Figure 2. Comparison of percent parasitism of GBM larvae in vineyards managed under two different insecticide programs in 2003 and 2004.

Unbaited yellow sticky traps were deployed in all vineyards, providing an overview of the natural enemy complex. The number of natural enemies at each vineyard interior, vineyard border, and adjacent wood border within the following groups were recorded: Chrysopidae, Hemerobiidae, Coccinellidae, parasitic wasps (Ichneumonidae, Braconidae, etc), Syrphidae, Vespidae, Lampyridae, Carabidae, Cantharidae, Staphylinidae, Reduviidae, Pentatomidae, Asilidae, Mecoptera, Dermaptera, spiders, and harvestmen. In 2003 and 2004 there was no significant difference in the number or community of natural enemies between treatments (Figure 3), suggesting no improvement in the abundance of the general natural enemy community in vineyards receiving a selective insecticide program.

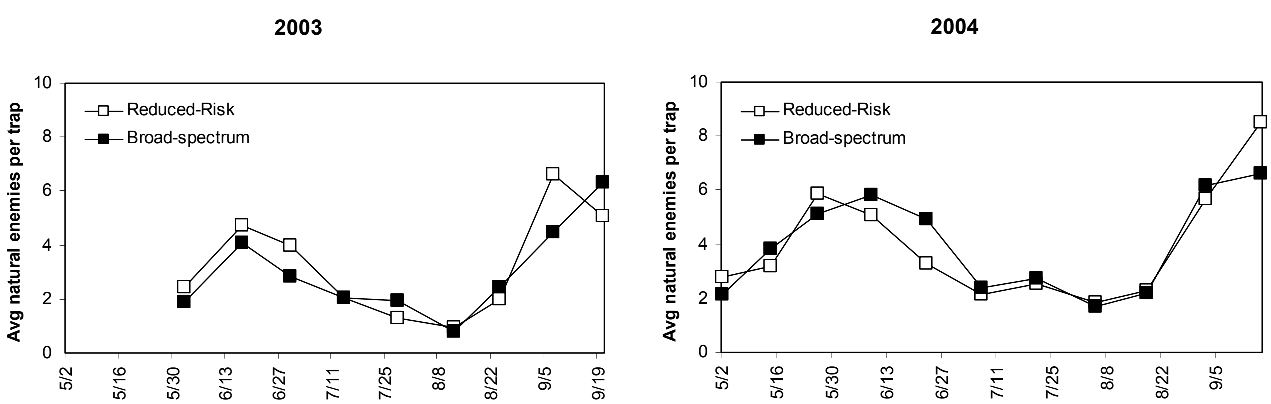

Figure 3. Comparison of natural enemies trapped in vineyards managed under two different insecticide programs in 2003 and 2004.

Objective 2. Optimize sprayer technology to improve coverage of grape clusters. Three different sprayers (Figure 4), representing the main types used for spraying grapevines in Michigan were compared for their ability to deposit spray material on grape clusters within a juice grape canopy. We have also conducted this project in a wine grape canopy, but data from that experiment are still being analyzed. Once that is complete, a supplemental report will be provided to the Council.

Each sprayer was run at three different gallonages appropriate to the sprayer, such that the Proptec was run at 5, 10, and 20 gpa, the Agtec was run at 10, 20, and 50 gpa, and the Airblast was run at 20, 50, and 100 gpa. For each sprayer-gallonage combination, the sprayer was loaded with a consistent concentration of kaolin clay (SURROUND WP) as a tracer and was run along the same 7 vine section of a Concord grape row (Figure 4). Before each spray, ten Concord grape clusters of similar shape and size (pre-veraison stage) were hung into the canopy at typical cluster positions under the leaves. After each spray had dried, these clusters were removed and carefully transported to the nearby laboratory where five of the clusters were washed to extract the kaolin for analysis of total deposition, and the other five were used to create digital images of spray deposits for analysis.

Figure 4. Sprayers used to apply spray to Concord grape canopy in August 2004. A: airblast, B: Proptec, and C: AgTec.

Amount of kaolin deposited

Chemical analysis of the kaolin deposits is ongoing this winter, but preliminary results are available for some of the treatments.

Analysis of the amount of kaolin deposited on the clusters revealed some interesting patterns in deposition. For example, comparison of the 50 and 100 gpa applications using the airblast sprayer (Figure 5) indicate only a modest increase in the amount of kaolin deposited on clusters with the higher gallonage. Observations made just after the spraying indicate that this was caused by run-off from the clusters, such that product was lost. Spraying alternate row vs. every row led to an almost 50% reduction in the amount deposited, as expected. However, the pattern of deposition was observed to be very uneven when alternate row spraying was done (Figure 5), and this would be expected to have significant consequences for product efficacy, particularly if the insect had to eat the residue and there was no vapor or contact activity.

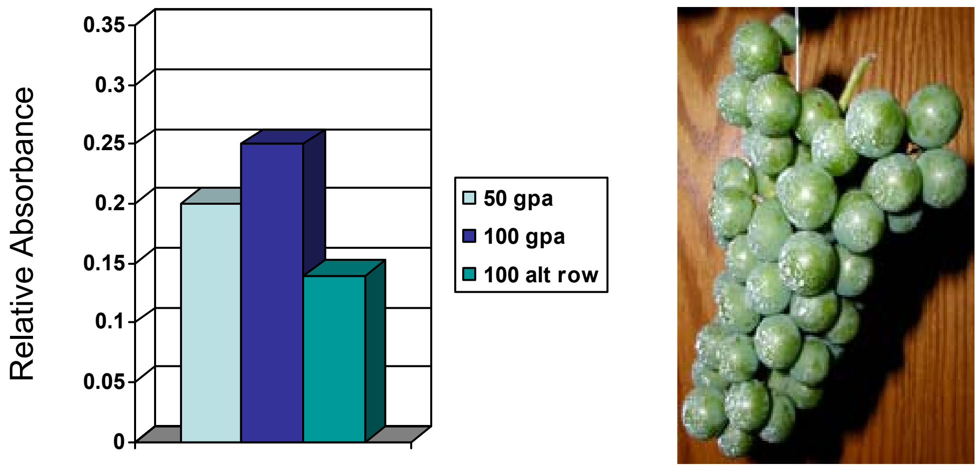

Figure 5. Effect of different sprayer-gallonage and driving patterns on total amount of kaolin deposited on Concord grape clusters by an airblast sprayer (measured as absorbance), and an image of a grape cluster sprayed with kaolin from one side.

Increasing gallonage in the Proptec sprayer led to increased amount of product deposited (Figure 6), but this was found not to be a linear increase. Doubling from 5 to 10 gpa caused a doubling of deposition, whereas the increase from 10 to 20 gpa had only a small effect on deposition measured as absorbance, and this may also have been due to run-off. It is also interesting to compare data presented in Figures 5 and 6, indicating that equivalent amounts of product can be deposited on the clusters using the Proptec sprayer with much lower use of water than is required with the airblast sprayer.

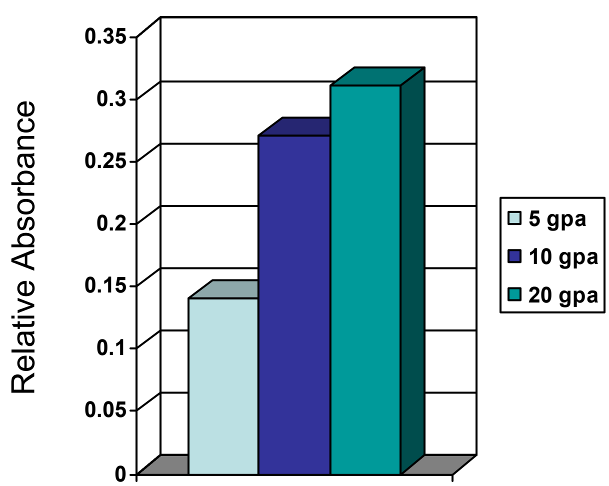

Figure 6. Amount of kaolin deposited onto grape clusters as a function of gallonage applied using a Proptec sprayer

During the winter of 2004-5, we are analyzing the remainder of the kaolin samples from experiments in 2004 and will then be able to make statistical comparisons among the different treatments. This information will be collated in a technical report that will be presented to growers and industry leaders.

Pattern of deposition

Digital images of spray deposits on part of berries (Figure 6) have been created from all treatments to enable analysis of spray deposits. We have photographed a small area of the grape to allow high resolution images to be taken and to reduce problems associated with the curved surface. Figure 7 provides three examples of berries differing in the spray droplet size, with droplet size decreasing from left to right. The distribution of droplet size and % coverage of berry surfaces is being quantified from these images.

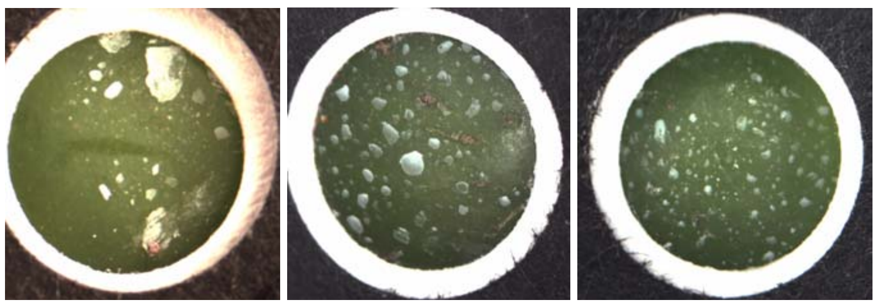

Figure 7. Three images of Concord grape berries treated with kaolin, showing the range of spray deposits achieved using different sprayers

Objective 3. Characterize relationship between cluster coverage and control of grape pests.

This objective will be addressed in 2005.

Outreach activities

During the 2003 and 2004 growing seasons, this project provided data on pest phenology for Michigan grape IPM meetings, it helped to improve pest management recommendations for the grape industry, provided information for MSU Crop Advisory Team Alert publications, and provided data in support of the Fruit Pest Management Guide publication by MSU Extension (E-154). In addition, results from this project have been presented at the 2004 Southwest Horticulture Days, the 2004 Southwest MI Research and Extension Center Viticulture Days, the 2004 Great Lakes Expo, and other scientific meetings.