IMPACT OF LAYERING CONTROL TACTICS ON THE SPREAD OF PIERCE'S DISEASE BY THE GLASSY-WINGED SHARPSHOOTER

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INTRODUCTION

Solutions to managing and controlling Pierce's disease of grapes are often conceptualized as ways of breaking at least one two-way interaction among the insect, plant, and bacteria components that are required for successful disease spread and propagation. Hypothetical solutions may also involve altering the abiotic and biotic environment within which these interactions take place. On the basis of our understanding of Pierce's disease epidemics, as well as other insect transmitted plant pathogen systems, one single control tactic (especially focused upon the insect) will not be sufficient to substantially reduce vector populations such that the incidence of disease is below an economically acceptable level. One management and control strategy that potentially may be utilized to limit the damage brought about by Pierce's disease involves layering separate vector and disease management tactics together such that vector population densities are reduced, their interactions with grapevines are inhibited or disrupted, and the interface between grapevines and the disease organism, *X. fastidiosa*, is disrupted. Here we report on our efforts to simultaneously implement (i.e. "layer") various control strategies currently available to limit the spread of Pierce's disease transmitted by the glassy-winged sharpshooter, *Homalodisca coagulata*. Specifically we are investigating the efficacy in controlling Pierce's disease by simultaneously (1) applying systemic insecticides aimed at reducing the number of sharpshooters invading vineyards (functioning as deterrents and inducing mortality prior to feeding); (2) applying foliar barriers (application of kaolin) such that sharpshooter landing and feeding behavior on grapevines is disrupted; (4) rapidly killing sharpshooters that actually initiate feeding on grapevines; and (5) using chemotherapy (application of metalosate) on grapevines as a prophylactic to reduce establishment of *X. fastidiosa*. All of these control tactics are to be employed against a "backdrop" of region-wide biological control of glassy-winged sharpshooters.

OBJECTIVES

Our specific objectives are to determine the ability of a variety of treatment and treatment combinations on 1) their ability to reduce glassy-winged sharpshooter density and feeding and 2) their ability to reduce the rate of spread of Pierce's disease in newly planted vineyards. Treatment and treatment combinations to be evaluated are applied 1) imidacloprid at full rate, 2) imidacloprid at 1/2 rate, 3) a combination of imidacloprid (in the Spring) plus acetamiprid (in the Fall), 4) metalosate, 5) kaolin, 6) imidacloprid-acetamiprid combination PLUS kaolin, 7) imidacloprid-acetamiprid combination PLUS metalosate, 8) metalosate + kaolin, 9) imidacloprid-acetamiprid combination PLUS kaolin PLUS metalosate, and 10) control (water only).

RESULTS AND CONCLUSIONS (to date October 1, 2001)

Project Status

In April of 2001, a research site was selected at the Agricultural Operations facility located on the campus of the University of California, Riverside. The dimensions of this site are approximately 800 ft X 150 ft. During April and early May the site was cultivated, and prepared for planting. Drip irrigation was installed. One thousand grape vines were acquired from SunRidge Nursery in early May and planted on May 16, 2001. The variety utilized in this study is Chardonnay 04 on S04 rootstock. Vines were planted with 6 ft spacing between plants and 12 ft spacing between rows. A total of 10 rows of 100 vines per row was planted. Experimental treatments were initiated in August of 2001.

Treatments were applied using a randomized complete block design utilizing 10 experimental blocks. A block consists of 10 sections of vine-rows comprised of 10 plants per row. Treatments are applied individually to each plant within an entire row section. As rows will receive the treatment, rows will be considered as the replicate and plants nested within row. The following treatments will be applied 1) imidacloprid at full label rate, 2) imidacloprid at one-half label rate, 3) a combination of imidacloprid (applied in August) plus acetamiprid (in the Spring), 4) metalosate, 5) kaolin, 6) imidacloprid-acetamiprid combination PLUS kaolin, 7) imidacloprid-acetamiprid combination PLUS metalosate, 8) metalosate + kaolin, 9) imidacloprid-

acetamiprid combination PLUS kaolin PLUS metalosate, and 10) control (water only). One month following initial treatment application and every 2 weeks thereafter, the total number of sharpshooters found on each treated row will be determined. The impact of treatment on sharpshooter numbers is subsequently determined by repeated measures analysis of variance; the preliminary results showing the impact of treatment on sharpshooter numbers for the first six weeks following treatment application are presented below.

Additionally, for each treatment combination, sharpshooter feeding and behavior trials are conducted to evaluate the impact of treatments on feeding biology and host acceptance of the sharpshooter. The first set of these trials is currently underway and we hope to have preliminary results by December 2001. Similar trials will be conducted for each treatment every six months for the duration of the experiment (2.5 years).

Finally, in the fall of each year (beginning in 2002) of the experiment, an evaluation as to the efficacy of treatments to prevent the development of Pierce's disease will be made based on visual observations and sampling for *X. fastidiosa* within selected plants within each treated row.

Results from the repeated measures ANOVA indicated that there was a significant difference among treatments with respect to the number of sharpshooters found on experimental plants ($\mathbf{F}_{5,52}$=6.93, $\boldsymbol{P}$<0.0001). As replicates involving acetamiprid have not as of yet (Oct. 2001) received these treatments, these treatments have not been included in this analysis. As expected plants treated with metalosate (a potential prophylactic treatment for Pierce's disease) supported similar numbers of sharpshooters as untreated control plants (see figure below). The efficacy of metalosate for the prevention of Pierce's disease will be evaluated during the annual estimate of Pierce's disease incidence in test plants. Overall plants treated with kaolin demonstrated reduced numbers of sharpshooters relative to the untreated controls, and plants treated with imidacloprid exhibited the lowest numbers of sharpshooters. There were no significant differences in the numbers of sharpshooters found on plants treated with kaolin as compared to the numbers found on insecticide treated plants. No experimental treatment resulted in complete protection from sharpshooters; consequently, all treated plants are at risk of exposure to *X. fastidiosa*.