Title of Report

Interim Progress Report for CDFA Agreement Number 12-0468-SA

Title of Project

Continuation of the Field Evaluation of New Strategies
for the Management of Pierce's Disease of Grapevine.

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Time Period Covered by the Report

07/01/2014 to present

Introduction

Xylella fastidiosa (*Xf*) is a Gram negative, xylem-limited, insect-vectored bacterium and is the causal agent of Pierce's Disease (PD) of grapevine (Hopkins and Purcell, 2002). Current PD management strategies primarily involve vector management through the use of insecticides. Several alternative strategies are currently being evaluated in field trials. One of the field trial is located at the Department of Agricultural Operations (AgOps) at UC Riverside. The experimental grapevines grown at UCR are subjected to natural *Xf* insect vector populations (the glassy-winged sharpshooter, GWSS). The strategies developed by principal investigators Dandekar, Lindow, Gilchrist, Powell and Kirkpatrick/Hopkins that are currently being evaluated include various transgenic grape and grape rootstocks expressing genes from different constructs as well as the use of non-virulent *Xf* strain as a biocontrol agent (see PIs reports for more information). Our goal is to maintain the vines growing at AgOps and record data on insect vector and disease pressure, and PD incidence and severity in order to identify the most effective control strategy moving forward.

List of Objectives

1. Maintain grapevines and research plots.
2. Monitor sharpshooter populations and disease pressure.
3. Record Pierce's Disease severity.

Description of Activities Conducted to Accomplish each Objective, and Summary of Accomplishments and Results for each Objective.

Objective 1: Maintain grapevines and research plots.

The experimental grapevines are currently being maintained by a qualified and experienced working crew based at AgOps in Riverside. In each block, weeding was done in January, and pruning in February of 2014. All vines were sprayed for powdery mildew control with Rally and Stylet oil in July of 2014. Vines are on a drip irrigation system and are water adequately. Water analysis was also conducted and showed no obvious water quality problems (data not shown). Grapevine tissue analysis was done in July of 2014 (**Table 1**) and showed nitrogen deficiency and boron toxicity in all three blocks. In addition, vines in the Kirkpatrick-Hopkins block showed low levels of phosphorous, potassium and zinc. Soil nutrient analyses and nematode counts will be done later this year. Vine tissue analyses will be repeated in the spring next year and vines will be fertilized accordingly to mitigate the deficiencies and toxicities observed.

Table 1: Leaf blades and petioles nutrient analyses from grapevines located at the 3 experimental blocks at AgOps, UCR. Samples were collected in July of 2014 and sent to the Fruit Growers Lab, CA. Values highlighted in yellow and red represent deficient and toxic levels, respectively.

Sample	Test Description	Block		
		Dandekar	Kirkpatrick Hopkins	Lindow Gilchrist Powell
Leaf blades	**Macronutrients**			
	Total Nitrogen (%)	3.3	2.62	2.88
	Phosphorus (%)	0.46	0.17	0.38
	Potassium (%)	1.37	0.47	1.78
	Calcium (%)	2.19	2.88	2.38
	Magnesium (%)	0.35	0.36	0.38
	Micronutrients			
	Zinc (ppm)	38.4	23.2	32.1
	Manganese (ppm)	111	100	121
	Iron (ppm)	251	290	187
	Copper (ppm)	15	8	14
	Boron (ppm)	91.3	69	102
	Sodium (%)	0.024	0.014	0.022
Petioles	**Macronutrients**			
	Total Nitrogen (%)	--	0.83	0.77
	Nitrate-Nitrogen (ppm)	--	840	710
	Phosphorus (%)	--	0.12	0.68
	Potassium (%)	--	0.98	4.30
	Calcium (%)	--	2.46	1.54
	Magnesium (%)	--	0.76	0.62
	Micronutrients			
	Zinc (ppm)	--	58.8	42.7
	Manganese (ppm)	--	223	218
	Iron (ppm)	--	47	72
	Copper (ppm)	--	7	7
	Boron (ppm)	--	34.2	42.9
	Sodium (%)	--	0.075	0.166

Objective 2: Monitor sharpshooter populations and disease pressure.

Sharpshooters were monitored at the experimental site in all three blocks (Dandekar, Gilchrist/Lindow/Powell, and Kirkpatrick/Hopkins). For each block, six 6" x 9" double-sided yellow sticky traps were placed randomly throughout the plots. Traps were mounted on wooden stakes slightly above the vine canopy. These traps were collected every month and returned to the laboratory to identify under the microscope the number of glassy-winged sharpshooters (*Homalodisca vitripennis*). Results in **Figure 1** showed that a low insect vector population was recorded early in the season (March to May 2014) but that that population drastically increased in the last couple months (June-July 2014). In addition to monitoring sharpshooter populations, we will monitor their natural infectivity. The *H. vitripennis* insect collected from the sticky traps will be subjected to qPCR (Yang et al., In Preparation) to determine the fraction testing positive for *Xf* (Fig 1). This information, together with sharpshooter seasonal counts will allow for estimates of disease pressure in the plot.

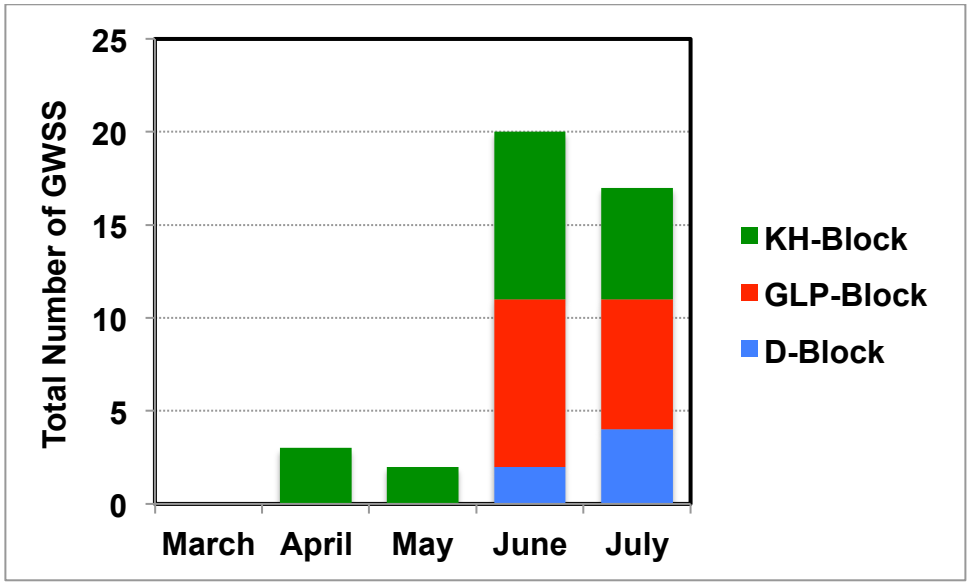

Fig. 1: Total number of glassy-winged sharpshooter (GWSS) insect vectors captured on yellow sticky traps from all 3 experimental blocks (D: Dandekar; KH: Kirkpatrick/Hopkins; GLP: Gilchrist/Lindow/Powell). Results are based on a total of 18 traps (6 traps per block).

Objective 3: Record Pierce's Disease severity.

PD severity will be recorded in late August when PD symptoms are expressed, using the rating system (0-5 scale) developed by B. Kirkpatrick and S. Lindow.

Publications Produced and Pending, and Presentations Made that Relate to the Funded Project

Yang, J-I., Rapicavoli, J., Roper, M.C., and Rolshausen. P.E. A quantitative molecular detection method for *Xylella fastidiosa* in grapevine and insect vector. Journal of Microbiological Methods. In Preparation.

Research Relevance Statement

Several strategies developed by project investigators and funded by the California Department of Food and Agriculture–PD/GWSS Board have showed promising results in controlled environment but those strategies must be evaluated and validated in field settings under natural conditions. Those experimental vines are currently grown next to each pother at the Department of Agricultural Operations at the University of California, Riverside, where natural PD insect vector populations reside. A standard protocol for evaluating disease pressure as well as rating of the disease incidence and severity has been established and is being implemented so one can compare those management strategies to each other.

Layperson Summary of Project Accomplishments

Five control strategies developed by Principal Investigators Dandekar, Lindow, Gilchrist, Powell and Kirkpatrick/Hopkins are currently being evaluated in the field at the Department of Agricultural Operations at the University of California, Riverside. Vines are subjected to natural disease pressure because of the presence of insect vector populations, the glassy-winged sharpshooter (GWSS). Thus far, we recorded an increased GWSS population incidence at the experimental sites as the year progressed. In addition we have performed water, and plant tissue analyses and showed that vines suffered mainly from nitrogen deficiency and boron toxicity. This vine nutrient unbalance will be corrected in the near future.

Status of Funds

As of July 2014, $500 was spent for plant tissue analyses and field operation costs.

Summary and Status of Intellectual Property Associated with the Project

Nothing to report.

Literature Cited

Hopkins, D. L., and A. H. Purcell. 2002. *Xylella fastidiosa*: Cause of Pierce's disease of grapevine and other emergent diseases. *Plant Disease*, 86 (10):1056-1066.