

2014-2015 Funding Cycle

March Progress Report Submitted to: California Department of Food and Agriculture Pierce's Disease and Glassy-winged Sharpshooter Board

Project Title: A Research Proposal to Conduct PD Symptom Field Evaluation at the Solano County Research Block

Fiscal Year and Projected Duration: September 1, 2014 through June 30, 2015

Project Leader: **Dr. Deborah Golino**, Director, Foundation Plant Services, University of California, One Shields Avenue, Davis, CA 95616

Overall Research Project Objective:

The Product Development Committee (PDC) of the California Department of Food and Agriculture (CDFA) Pierce's Disease and Glassy-winged Sharpshooter Board requested research into uniform evaluation of Pierce's Disease symptoms exhibited by grapevines developed by four PIs as part of the Board's research portfolio. These vines are planted in a single research block in Solano County. The PI and a team of grape pathologists monitored these blocks and took data on disease severity in September 2014, and will again in May 2015. An analysis of the variation in the data overall and between individuals will be calculated. This research will help the PDC make future decisions about evaluating products of the research funded by the Board.

Evaluation Team:

PI Golino and 5 FPS Plant Pathologists with many years of grape disease experience made up the core evaluation team. Two Plant Pathology PhD graduate students with grape pathology thesis research were also invited to participate. A Viticulture consultant scored the vines as well. Each individual participated in training in evaluating PD symptoms according to the scoring system below. That training included 'calibration' by examining a subset of vines including healthy and PD-inoculated controls to insure that ratings are as uniform as possible. All vines were evaluated in mid-September, and will be again in spring, 2015.

Scoring Technique:

A visual rating system on a scale of 1-5 was used by each member of the team to rate every vine individually. All vines were labelled by row and vine number. Data was collected by row and vine number without any information about the particular treatment that vine has received. This is a slightly modified version of the rating system used by the Kirkpatrick lab.

GOLINO/ GILCHRIST SIMPLIFIED RATING SYSTEM –

0 – Healthy vine. All leaves green with no scorching, good cane growth, no cordon dieback or failure to push canes at bud positions. Dry or yellowing leaves may be present but do not show characteristic Xyllela symptoms.

1 – Leaves on one or two canes showing characteristic Xyllela scorched leaf symptoms. No evidence of physical damage to leaf petiole(s) or cane(s). On cane in question at least TWO leaves are symptomatic, 1 single leaf is NOT enough to warrant a rating of #1.

2 – More than 2 canes possess multiple scorched leaves. HOWEVER canes with symptomatic leaves are still confined to just one area of the vine.

3 – Canes with clearly scorched leaves are found on several canes including canes which have not been inoculated.

4 – Ends of cane(s) begin dying back; some canes failed to push in the spring. Vine is clearly symptomatic on all or nearly all surviving canes. Main point is that the vine is NOT yet dead but is clearly facing a terminal fate.

5 –Dead vine or a vine that had a few canes weakly push in the spring but those canes later died with onset of hot temps in July or August. There are NO visible signs of other potential problems such as gophers, crown gall, phytophthora, or Eutypa/Bot dieback of cordons.

If a vine appears to have died for reasons other than PD that will be entered in the comments field for that vine and no score will be entered in the rating field.

Analysis of Data:

Nine members of the evaluation team scored 616 vines in September, 2014, and the data was analyzed with the purpose of determining the extent to which the scores for any given vine agreed. Scores for a vine were counted as “in agreement” if they equaled one of the integers above or below the mean. Although mode and frequency are typically used for analyzing ordinal data, the scores in the rating system are quantitative in the sense that they follow a logical sense of order and the difference between the scores is roughly equivalent. Therefore, we felt that using the mean as a measure of central tendency was justified. The purpose of the interval was to accommodate integer data and in practice, allows scores to vary by one integer and still be counted as “in agreement”.

The percent agreement of scores for individual vines is shown in Figure 1. Cells of varying shades of green represent vines where at least five out of nine scores agreed. Table 1 shows the number and percent of vines in each agreement category. Adding columns “56%” through “100%” indicates that for 97.4% of the vines, at least five of the nine scores agreed. For 51.0% of the vines, all nine scores agreed i.e. were within one integer above or below the mean. Eight out of nine scores agreed for 26.6% of the vines (Table 1). Vines whose scores were in lower agreement did appear to be clustered in some cases, indicating that some treatments were possibly more difficult to rate. However, percent agreement on these vines was still greater than

50%. Vines with less than 50% agreement were scattered throughout the plot, indicating problems with individual vines and not entire treatments.

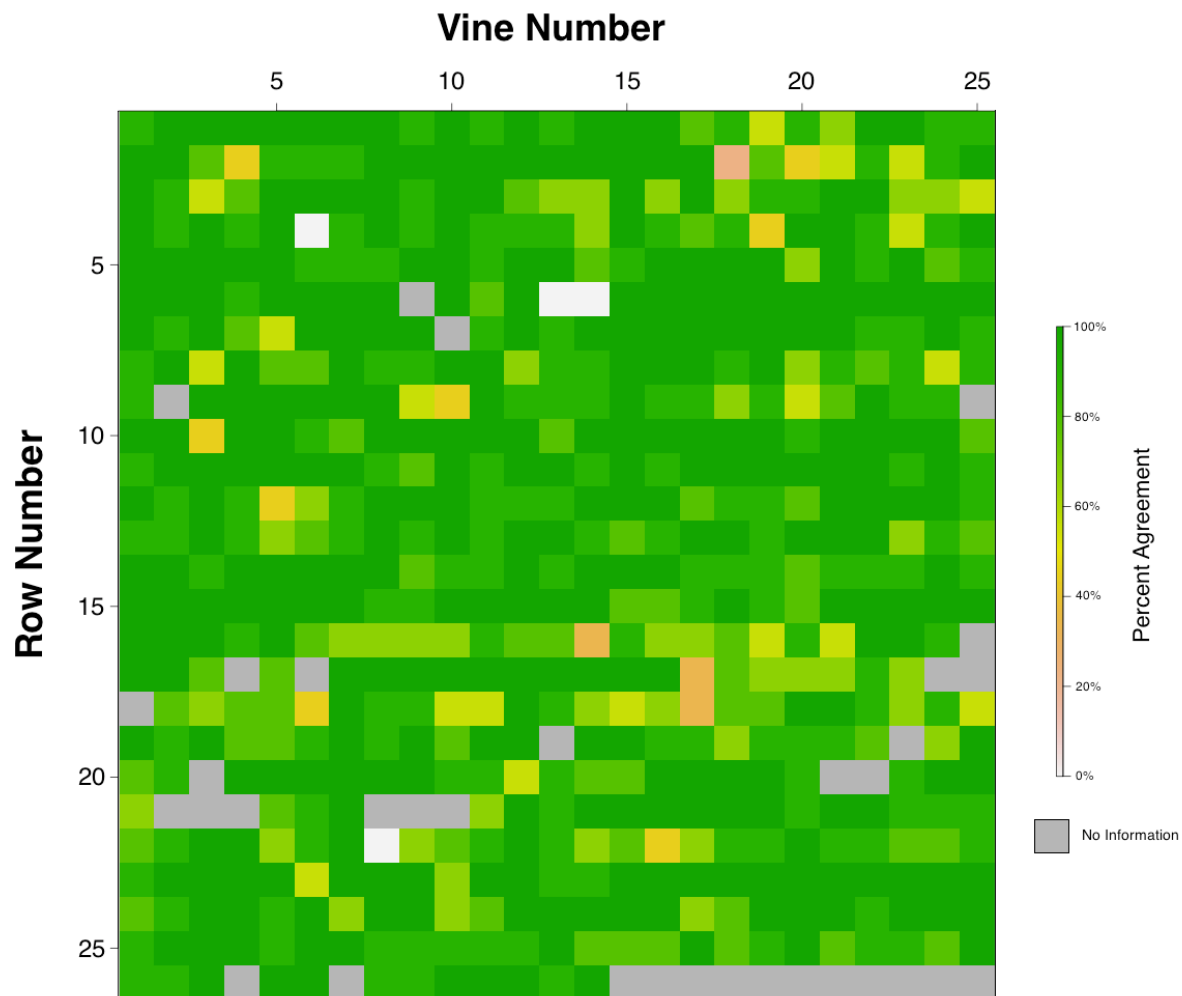


Figure 1. Cell plot of the 616 vines that were rated in September, 2014. The colors indicate the percent agreement among scores of individual raters. Scores are counted as “in agreement” if they equal the integer above or below the mean for any given vine. Grey areas indicate missing vines.

Percent Agreement	0% (0/9)	11% (1/9)	22% (2/9)	33% (3/9)	44% (4/9)	56% (5/9)	67% (6/9)	78% (7/9)	89% (8/9)	100% (9/9)
Number of Vines	4	0	1	3	8	19	41	62	164	314
Percent of vines	0.60	0.00	0.16	0.49	1.30	3.08	6.66	10.1	26.6	51.0

Table 1. The number and percent of vines in each of the ten agreement categories.

Review of the data showed that one team member rated a number of vines as 4's while other members rated these vines as 0's or 1's. This difference in scores is probably best explained by confusion over pruning damage versus disease damage. We discussed this issue with team members before the scoring took place, but it was clear that there was still some confusion.

Removing the data for the one team member with the most divergent scores increased the percent vines where at least 50% of the scores agreed from 97.4% (Table 1) to 99.3% (Table 2). Most of this change occurred in the category "100% agreement" which increased from 51.0% (Table 1) to 58.6% (Table 2). Seven out of eight scores agreed for 26.6% of the vines (Table 2).

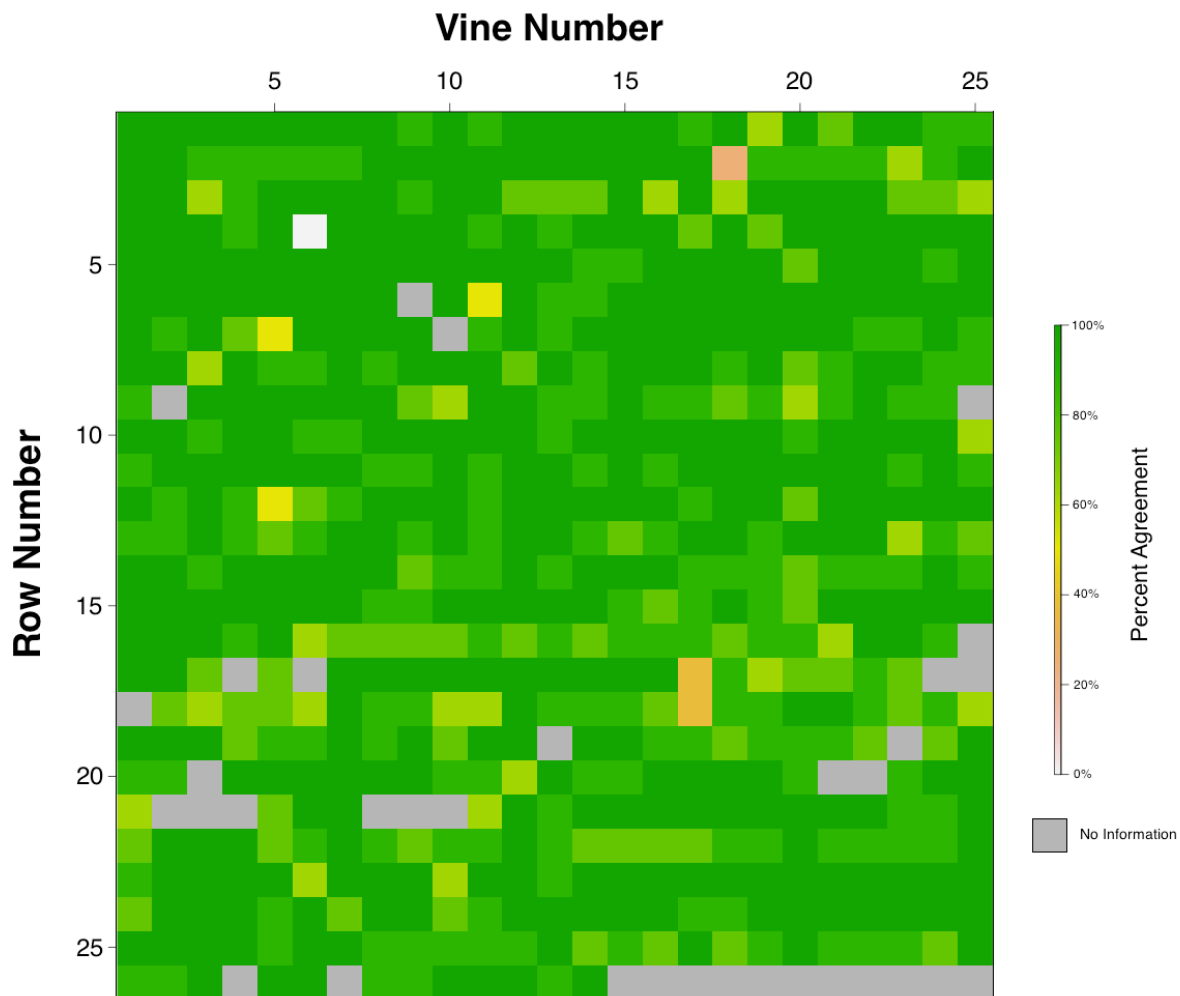


Figure 2. Cell plot of the 616 vines that were rated in September, 2014 with one team member's scores removed.

Percent Agreement	0% (0/8)	13% (1/8)	25% (2/8)	38% (3/8)	50% (4/8)	63% (5/8)	75% (6/8)	88% (7/8)	100% (8/8)
Number of Vines	1	0	1	2	3	24	60	164	361
Percent of vines	0.16	0.00	0.16	0.32	0.49	3.90	9.74	26.6	58.6

Table 2. The number and percent of vines in each of the nine agreement categories.

In conclusion, review of the data from the September, 2014 rating indicates that for greater than 97% of the vines, the majority of team members scored the vines within one integer above or below the mean. Removing the scores of the most divergent team member increased this percentage to 99.3. This demonstrates that the rating system was well understood by team members and provides a relatively uniform measure of PD disease symptoms that can be used to describe the vines in this experiment.