ROOTSTOCK VARIETY INFLUENCE ON PIERCE'S DISEASE SYMPTOMS IN GRAFTED CHARDONNAY AND CABERNET SAUVIGNON (*VITIS VINIFERA* L.) GRAPEVINES

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Reporting Period: The results reported here are for work conducted from November 1, 2002 to October 31, 2003.

ABSTRACT
Chardonnay and Cabernet Sauvignon are *Vitis vinifera* scion varieties that are susceptible to Pierce's disease (PD). We evaluated the effect of rootstock variety on PD symptom expression in these varieties grown in a vineyard with high natural PD pressure and abundant vectors. No rootstock completely eliminates PD symptoms in the susceptible scions. However, rootstocks differ in the level of PD symptoms in the susceptible scions grafted to them and the percentage of vines bearing fruit varies with rootstock variety. Rootstocks appear to contribute to PD management in susceptible scion varieties, but are not independently capable of rescuing susceptible scions. Evaluation of PD management practices should emphasize vineyard testing to encourage the efficient identification and development of field suitable techniques and methods.

INTRODUCTION
Rootstocks are already widely in use in viticulture to manage damage from soil-borne pests and provide adaptation to particular soils. Grape rootstocks can impact the symptom expression of diseased scions in at least one disease (fanleaf degeneration). In other crops, rootstock variety has been reported to impact expression of *Xylella fastidiosa* (*Xf*) diseases in scions (He et al. 2000, Gould et al. 1991). Pierce (1905) reported that rootstock variety affected expression of "California vine disease" (now known as Pierce's disease) in grape. Grape rootstock trials in Mississippi showed a large effect of rootstock trial on vine longevity in a region recognized for high Pierce's disease pressure (Loomis 1965, 1952, Magoon and Magness 1937). If grape rootstocks could contribute Pierce's disease resistance or tolerance to their scions, this would be a major benefit to viticulture in Pierce's disease prone areas. Elite wine, juice, and table grape varieties could be grown in areas where viticulture is currently restricted to Pierce's disease resistant and tolerant varieties whose consumer appeal is low.

OBJECTIVES
Evaluate the impact of rootstock variety on expression of Pierce's disease symptoms in naturally infected PD susceptible *Vitis vinifera* scion varieties Chardonnay and Cabernet Sauvignon.

RESULTS AND CONCLUSIONS
Chardonnay (*Vitis vinifera*) vines grafted on nine rootstocks and own-rooted Chardonnay vines were planted in Tallahassee, Florida in the vineyard of the Center for Viticulture, Florida A&M University in the spring 2001 planting season (Table 1). The vineyard site has a high incidence of Pierce's disease and glassy-winged sharpshooters inhabit the site. Fruiting and vine vigor observations were made on June 19, Pierce's disease (PD) symptoms were evaluated on July 19, and survival observations were made in early October, 2003. PD symptoms on leaves were assessed and vines given a numerical score from 0 to 5, with 0 representing no symptoms, 1 = minor symptoms up to 15% of leaves with marginal necrosis (MN), 2 = 15-30% of leaves with MN, 3 = 30-50% of leaves with MN, 4 = 50-75% of leaves with MN, 5 = over 75% of leaves with MN or vine dead. There were four replicates for grafted vines with each replicate consisted of two vines of the same treatment (eight vines total per stion). The mean score of the two vines is recorded as the score for that replicate.

2003 is the first year in which the percent of vines fruiting was recorded. Chardonnay vines demonstrated substantial variation in number of vines that fruited (Table 1). Own rooted vines were almost all dead and no fruiting was observed on surviving vines. In contrast, half of the surviving vines grafted on O39-16 fruited, and more than a third of the original vines grafted on 5BB fruited (no vines grafted on 5BB have died to date). Impact on fruit yield is the critical feature of PD-foliar and cane symptoms, while severe in a given season, may not necessarily prevent fruit set and maturation. At the experimental vineyard site, PD pressure is sufficiently high that even some muscadine grapevines (*Vitis rotundifolia*) show PD symptoms. However, these muscadine vines do not succumb to PD, but recover. It may be that vines on selected rootstocks are recovering in a similar manner. Thus reduction in PD symptoms per se may not be as critical as promotion of regular bearing, since the experience with muscadines is that symptoms do not tell the entire story. Loomis (1952, 1965) reported that a rootstock with *V. vinifera* and *V. rotundifolia* parentage extended the life of susceptible scions in Mississippi,

but even Chardonnay on O39-16 showed severe PD symptoms in this trial-although note that the fraction of surviving vines in fruit was fairly high, at 40%, and that the best rootstock for promoting vine survival and fruiting was 5BB (vines grafted on 3309C had higher vigor, but lower fruiting percentage).

At the end of the 2002 season we observed high PD symptom scores in Chardonnay vines across all rootstocks. The recovery and fruiting of vines on selected rootstocks indicates that while reduction in PD symptoms may be occurring, regrowth or survival following infection may be more important for promoting and sustaining yield.

Cabernet Sauvignon grapevines grafted to nine rootstocks were planted in spring, 2002 and PD symptoms were scored on July 18, 2003. Vines grafted on 110R showed the fewest symptoms, while vines grafted on Freedom showed the most severe symptoms (Table 2). No Cabernet Sauvignon vines fruited this year.

Additional rootstocks grafted to Chardonnay and Cabernet Sauvignon were planted in spring 2002 to further investigate the possible influence of rootstock on PD expression. The rootstocks Dog Ridge, 161-49C, and Lenoir are of special interest. Dog Ridge and 161-49C have been reported as increasing vine longevity in areas of high PD pressure (Loomis 1952, 1965). Pierce (1905) suggested Lenoir as a rootstock to manage this disease.

No rootstock has produced 100% fruiting vines at the end of the third season of growth. However, all eight of the vines grafted on 5BB are still alive and three of these fruited this season. In contrast, only one quarter of the own-rooted vines are still alive (2 of 8) and neither of them fruited. Rootstock variety appears to have an impact on the survival and yield potential of susceptible scion varieties, judging from this limited study. Chardonnay and Cabernet Sauvignon grafted to additional rootstocks are in cultivation and will provide more information in coming years.

Rootstocks do not appear capable of completely rescuing or preventing PD infection of and damage to susceptible *Vitis vinifera* scion varieties (here Chardonnay and Cabernet Sauvignon). However, some rootstocks appear to enhance vine survival and fruiting-echoing the results of (Loomis (1965, 1952) and Magoon and Magness (1937). Combinations of particular rootstocks with other management strategies may be one way to enhance individual techniques which used alone are not wholly satisfactory.

This study testifies to the importance of field and vineyard studies and natural infection when investigating Pierce's disease management strategies and techniques. The study described here relies on high natural populations of vectors and abundant *Xf* populations, which are found at the test vineyard in Florida. In contrast, artificial inoculation may introduce unnaturally high levels of bacteria to the plant, obscuring potentially useful results by an overly strenuous test. Greenhouse and laboratory screening is expensive and typically requires constant plant care and maintenance, with daily care often necessary. In contrast, our grapevines in the vineyard in Florida are managed according to standard viticultural practices, including natural rainfall in place of artificial irrigation or individual pot watering, and consequently the cost for care of individual plants is quite low. Vineyard testing of management practices in a naturally infective environment is an efficient and effective approach to evaluating PD control strategies.

Table 1. PD symptom scores and vine survival, fruiting, and vigor ratings of Chardonnay grapevines.

Rootstock	Number of surviving vines	Percent vines fruiting	PD symptom score	Vine vigor	Survival index
O39-16	5	40	4.0	2.8	1.8
101-14 Mgt	7	14.3	3.5	3.7	3.3
110R	4	25	4.4	3.8	1.9
3309C	7	28.6	3.3	4.5	3.9
44-53M	4	25	4.0	3.4	1.7
5BB	8	37.5	3.5	3.5	3.3
5C	6	50	3.6	4.5	3.3
Freedom	3	33.3	4.0	4.2	1.8
Own-rooted	2	0	4.6	1.7	0.4
Ramsey	6	50	3.8	4.0	3.0

Vine vigor ratings:
1 = shoot growth below 1/2 main trunk
2 = shoot growth between 1/2 to 2/3 of the main trunk
3 = shoot growth between 2/3 to the top of trellis wire
4 = 1 cordon with shoots
5 = 2 cordons with shoots
Survival index = % vine survival x vine vigor (calculated from means)

Table 2. Pierce's disease rating of Cabernet Sauvignon grapevines.

Rootstock	Number of vines	PD symptom score
Freedom	7	4.4 a
101-14 Mgt	7	4.0 ab
Ramsey	7	4.0 ab
44-53M	8	3.6 ab
5BB	8	3.1 ab
5C	8	3.1 ab
O39-16	6	3.0 ab
3309C	8	2.9 ab
110R	8	2.7 b

REFERENCES

Gould, A.B., W.J. French, J.H. Aldrich, B.V. Brodbeck, R.F. Mizell III, and P.C. Andersen. 1991. Rootstock influence on occurrence of *Homalodisca coagulata*, peach xylem fluid amino acids, and concentrations of *Xylella fastidiosa*. Plant Disease 75: 767-770.

He, C.X., W.B. Li,, A. Ayres, J.S. Hartung, V.S. Miranda, and D.C. Teixera. 2000. Distribution of *Xylella fastidiosa* in citrus rootstocks and transmission of citrus variegated chlorosis between sweet orange plants through natural root grafts. Plant Disease 84: 622-626.

Loomis, N.H. 1952. Effect of fourteen rootstocks on yield, vigor, and longevity of twelve varieties of grapes at Meridian, Mississippi. Proceedings of the American Society for Horticultural Science. 52: 125-132.

Loomis, N.H. 1965. Further trials of grape rootstocks in Mississippi. Proceedings of the American Society for Horticultural Science 86: 326-328.

Magoon, C.A., and J.R. Magness. 1937. Investigations on the adaptability of grape root stocks to Gulf Coast conditions. Proceedings of the American Society for Horticultural Science 35: 466-470.

Pierce, N.B. 1905. The Vineyard: Mr. Pierce and the Lenoir. Pacific Rural Press, 69: 79.

FUNDING AGENCIES

Funding for this project was provided by the University of California Pierce's Disease Grant Program.