

THE ECONOMICS OF PIERCE'S DISEASE IN CALIFORNIA

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ABSTRACT

The first goal of this research project is to estimate the medium to long-run economic impact to growers and consumers of California's grape and orange industries, and to taxpayers from the establishment of the glassy-winged sharpshooter (GWSS) in California. The public control program to date has managed to contain the GWSS in the southern part of the State. As part of the public program citrus growers are reimbursed their expenses for winter control of GWSS and a quarantine that regulates the movement of fresh citrus, fresh grapes, and nursery host crops to areas currently free of GWSS. In the southern San Joaquin County due to effective winter GWSS control in citrus, the cost for grape growers to treat GWSS using one soil application of imidacloprid a year (\$50-\$60 per acre) is offset by reductions in the use of other insecticides such as the foliar applications of imidacloprid and treatments for pests such as the grapeleaf skeletonizer. In the Temecula Valley; however, GWSS becomes active earlier, orchards and vineyards are generally smaller, and the orange/grape land interface is more complex causing growers in this area to incur additional costs. In addition to a soil application of imidacloprid, vineyards in the Temecula valley may also need an additional irrigation at \$12.50 an acre at the time of the imidacloprid application, plus two additional spray treatments with Danitol at \$35.50 an acre. Total costs for GWSS control in the Temecula Valley is \$98 to \$108 an acre. About \$50-\$60 of that cost is also offset by reductions in the use of insecticides needed to treat pests that are now controlled with the soil application of imidacloprid. The net increase in costs is about \$48 an acre per year. The incidence of Pierce's disease (PD) in the Temecula Valley is also higher than before GWSS became established. Growers are replanting between 2% and 3% of vines every year due to PD for an additional cost to growers of \$65 an acre. The total increase in per acre costs to control GWSS and PD is \$103 a year. The average number of acres cultivated in grapes from 2005 to 2007 in the Temecula Valley is about 1,300, making the total estimated annual losses to growers in the Temecula Valley about \$133,900 a year. These losses could increase substantially if the public control program were discontinued as winter GWSS treatment in citrus would cease and, without a quarantine, GWSS would spread. Costs for grape growers would increase throughout grape growing regions due to higher control costs where GWSS is currently established, and the need to implement control measures in areas currently free of GWSS.

LAYPERSON SUMMARY

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INTRODUCTION

In 1989 a pest new to California, the glassy-winged sharpshooter (GWSS), was collected in Irvine, CA. Since then it has spread throughout southern California, into the southern San Joaquin Valley including Kern County and parts of southern Tulare County, and along the coastal counties of Santa Barbara and San Luis Obispo. Detections, mainly of egg masses on nursery shipments, have been found in many counties throughout the Central Valley as far north as Tehama County, in the Napa Valley, and in the Bay Area counties (CDFA 2007; <http://max.cdfa.ca.gov/pdcp-gis/pdcp-gis.asp>). The main hosts for the GWSS are citrus, grapes, almonds and alfalfa. The GWSS overwinters in citrus, avocados, in riparian vegetation and some ornamentals such as crape myrtle. As grape vines and almond trees leaf out in the springtime, the GWSS moves onto those hosts.

Governmental agencies have been involved in two control programs to manage and contain the GWSS. One program involves the control of the GWSS on citrus before it can move into vineyards and transmit the Pierce's disease (PD) bacterium. This program overcomes the divide created between the citrus growers who are not typically affected by GWSS and would not typically treat for GWSS, and grape growers who are negatively affected by large populations of GWSS migrating from citrus to grapes. Currently any citrus grove within ¼ mile of a trapped vine (i.e. a trap placed in a vineyard contains a GWSS) is treated, unless the grove is located along the northern boundary of the infestation, in which case the barrier is ½ mile of a trapped vine. While some citrus growers may benefit from the control of the GWSS in their groves, chemical treatments may also disrupt IPM pest control practices, imposing additional costs on the citrus industry. All these effects are important to include in any economic analysis of PD in California.

Finally, there is a state quarantine in place to limit the spread of the GWSS into uninfested grape growing areas of California. The quarantine consists of on-site sanitation practices, inspections and surveys, and spraying plant leaves with a chemical such as methomyl (Lannate®) to treat difficult to detect egg masses not caught by inspectors. As a result, management of PD in California includes a bundle of methods that have economic impacts on the wine, table and raisin grape, citrus, and nurseries industries. These different methods to control GWSS and PD have significantly improved the situation, and damages today are not as severe as initially anticipated. Even though better methods have been developed to manage GWSS, the costs of production for each industry may not have returned to pre-GWSS infestation levels.

Due to the size of the industries affected by the control of GWSS and PD in California, even small changes in the costs of production can have a major impact on the benefits and costs to producers, consumers and taxpayers. The grape industry is a major agricultural producer in California. With average annual revenues (2004-2006) to the wine, table and raisin grape industries totaling \$3 billion, grape production is the largest fruit industry in California (USDA 2006a). When revenues from the citrus and nursery industries are combined with the revenues from the grape industry, their total revenues of \$20.8 billion make it the second largest agricultural sector in the U.S. behind corn (\$26.8 billion) and before soybeans (\$18.3 billion) (USDA 2006a; USDA 2006b; Jetter 2007).

OBJECTIVES

1) The first objective of this study is to estimate the costs and benefits to wine grape, table grape and raisin growers, consumers and taxpayers from changes in the costs of grape production due to the establishment of the GWSS. The changes in production costs will be based on current best practices and will include chemical treatments, removal of infested vines, quarantine restrictions and public control programs. The increase costs of production affect newly infested producers directly because they bear the burden of paying the increased costs of production; however, consumers and producers are also affected through the market effects due the changes in the costs of production.

Objectives 1 will be completed through the use of economic market models. Market models are used to estimate the losses to both producers and consumers when changes in the costs to grow and market a crop are significant enough to affect market prices, production and supply.

Changes in treatment costs due to the establishment of the GWSS and the public control program.

For Objective 1 data are needed on the changes in the costs of production for affected growers due to the establishment of the GWSS in California, and the amount of acreage lost to PD around the turn of the century. For Objective 1 data are also needed on grape, citrus and nursery production, prices, revenues and trade data from 1998 through 2007 (the last year for which data are available); current costs of production; and elasticities (elasticities measure the percentage change in a quantity variable for a one percent change in a price variable – for example it could measure the percentage change in production for a one percent change in the farm price.)

How the GWSS affects current production was determined through meetings held with UCCE farm advisors and growers to discuss how the establishment of the GWSS affected their pest control programs for grapes. The meetings were held in November and December 2008 in the southern San Joaquin Valley in November and December 2008. Additional information was obtained through phone interviews with Pest Control Advisors in southern California and The results of these meetings were compared to University of California Cooperative Extension Budgets to determine how all pest control

treatments changed as a result of the treatments required for GWSS (Hashim-Buckley 2007; Peacock et al. 2007; Peacock et al. 2007b; Vasquez et al. 2007). Production and price data for grapes were collected from the National Agricultural Statistics Service.

Economic Effects in the Southern San Joaquin Valley – Data to use in the market model

Objective 1. A meeting was held with grape growers, and public agencies involved with the public control program to determine how the establishment of GWSS has affected different groups in this area. Three groups are affected by control of the GWSS in the southern San Joaquin Valley, grape growers, citrus growers and taxpayers. While there is currently a low incidence of PD in Kern and Fresno counties, the incidence can rapidly increase should GWSS not be controlled.

The first line of defense against the spread of PD by the GWSS is the public control program whereby citrus is treated during the winter months to prevent the build up of GWSS populations. To control for GWSS in citrus an application of Assail is made in the fall followed by an application of imidacloprid in the spring. Imidacloprid is applied at a rate of 32 fl oz an acre (2 lb ai/gal formulation) through the irrigation system. The control program is conducted on an area-wide basis to achieve longer-term reductions in GWSS populations. The control in citrus occurs about once every three years based on monitoring of GWSS populations. However, treatments are scheduled based on monitoring and trapping. Under the public program citrus growers are reimbursed for their treatments of GWSS and participation in the public program is currently voluntary for the citrus grower. There is no economic effect on citrus growers based on changes in the costs of production.

The second line of defense against the spread of PD is to treat grape vines for GWSS. A majority of grape growers apply imidacloprid once annually to control GWSS and prevent the transmission of PD. Applications of the soil formulation of imidacloprid (such as Admire Pro) are typically at the maximum rate of 14 fl oz an acre (4.6 lb ai/gal formulation) through the irrigation system. The cost of applying imidacloprid is currently about \$50-\$60 an acre.

Treatments for GWSS sharpshooter control affect the control of other pests, and in turn are affected by the control of other pests. The GWSS also controls the variegated grape leafhopper and grape skeletonizer. The cost savings by growers is \$62 an acre based on UCCE budgets, or about the same amount as the current costs to apply Admire Pro. GWSS control is also affected by control for the vine mealybug (VMB) (*Planococcus ficus*). In 1994 VMB was first found in the Coachella Valley and has since spread throughout most grape growing counties in California including the southern San Joaquin Valley. Treatment for the VMB consists of a soil application in late May or early June of imidacloprid and 2–3 spray treatments. The soil treatment is in addition to the soil treatment for GWSS in the spring.

According to the PCAs interviewed during August 2010 the incidence of PD in the southern San Joaquin Valley is at about the same, or slightly less than it was before the GWSS invaded. As a result no additional costs due to changes in the incidence of PD are being born by growers in the southern San Joaquin County. There are also no additional quarantine costs incurred by grape growers as mature fruit destined for the fresh market is hand harvested and field packed.

Total costs of production for citrus growers are also affected by the public control program and quarantines against moving citrus out of infested areas. Treatments with imidacloprid may help suppress nematodes, citrus peelminer and California red scale. Better control of these insects can be achieved by applying an additional amount of imidacloprid when treating for GWSS; however, the grower is responsible for those costs. The citrus industry is affected by the interior quarantine and fruit from infested areas needs to be inspected and treated before leaving a quarantine area. Quarantine treatments involve fumigation using EverGreen (pyrethrum + piperonyl butoxidor). Turbocide has also been mentioned as a material that can be used as a fumigant. If GWSS are found in a grower's orange shipments, the grower bears the cost of treating GWSS in his or her grove if the grower did not participate in the area wide program. This aspect of the public control program is believed to encourage greater participation by citrus growers in the control of GWSS. Because growers are reimbursed for their control costs for GWSS in citrus, there are no additional costs to the citrus industry for this program.

Economic Effects in the Temecula Valley

In the Temecula Valley there is also a public program to control GWSS. Area wide coordination of treatments has been more difficult in the Temecula Valley. Many groves are being carved up into rural homesteads and cultural procedures are completed by farm management companies instead of a grower/owner. With a lower proportion of groves being treated in the Temecula Valley than in the southern San Joaquin Valley, GWSS pest pressure is greater in the Temecula Valley.

Private treatment of GWSS in the Temecula Valley also consists of an annual treatment of Admire. However, because there is greater GWSS pest pressure, higher costs of production for grape growers in the Temecula Valley are being realized as the application of Admire is being supplemented with annual sprays of Danitol in some areas. For vineyards located near citrus groves about two applications of Danitol are needed a year. Growers in the Temecula Valley would also no longer be required to treat for the grapeleaf skeletonizer. There is no problem with leafhoppers in this area.

The Temecula Valley has a drier climate than the San Joaquin Valley. In order for growers to apply Admire when it can do the most good, a separate irrigation may be required. Farm managers with whom meetings were held estimate that half the time they need to complete a separate irrigation in order to apply Admire. The extra irrigation costs are estimated to be \$12.50 on average. Danitol is applied at a rate of 11 oz per acre, with the cost per ounce equal to \$1.62. With two treatments a year the cost to treat GWSS with Danitol is \$35.86. The total additional cost to grape growers to treat GWSS in the Temecula Valley is about \$48 a year when rounded.

In addition to GWSS treatments growers in the Temecula Valley also have a slightly higher incidence of PD than before the establishment of the GWSS. The incidence of PD is currently about 2% to 3% in the valley, up from about 1% before the GWSS established. While there are a few large plots that are infested, PD in grape vineyards tends to be localized. Growers will pull vines and replant instead of removing a whole plot. The costs to replant about 2% of vines a year is \$65 an acre based on UCCE wine grape budgets for the San Joaquin Valley. The total cost to treat GWSS and manage PD is equal to \$103 an acre per year in the Temecula Valley. Total grape acreage in the Temecula Valley is about 1,300 acres. Total annual costs to the grape industry in California is estimated to be about \$133,900 a year.

The Temecula Valley was one of the areas hardest hit by the spread of PD by the establishment of the GWSS. Acreage lost to PD is approximately 336 acres, or 15.6% of total acreage between 1998 and 2000.

Economic Effects to the Nursery Industry

A survey was sent to 114 nursery operators to determine how the GWSS has affected their production of nursery stock and the costs associated with GWSS and PD control. A total of 35 nursery operators responded to the request. Out of the 35 nursery operators who responded eight operations had to destroy plants due to the presence of GWSS. The total wholesale value of the destroyed plants was \$ 95,500 for an average loss of \$10,611 per infested operation.

Questions were asked on the barrier methods used to prevent the entry of GWSS and inspections of traps installed by CDFA. Almost 30% of the operators who responded to the question used some type of barrier method. The methods used were shade cloths, an insect screen, oleander hedge or some combination of barriers. Most of the barrier methods used also provide additional protection against other pests. Oleander hedges also protect against various sucking insects, shade cloth protects against grasshoppers, and the insect screen protects against aphids and thrips. Half of the operators do some in-house monitoring of the traps installed by CDFA. Monitoring varies though from as frequently as once a week to as little as every other month.

Over 50% of the nursery operators applied pesticides to manage the GWSS. The operators used a variety of chemical treatments including Tame, Sevin, Tristar and Avid. Total application costs varied from \$175/acre to \$2160/acre for an average of \$940 an acre.

Objectives 2 and 3

Objective 2: Estimate the costs and benefits of public policies to manage and contain the GWSS. The public control policies include public programs to treat the GWSS in citrus to prevent its spread into grape vineyards in the spring, and the associated containment program. An additional public policy to contain the spread of GWSS and, thus, the transmission of PD, is a state quarantine on the movement of nursery, citrus and other host crops out of infested regions.

The current treatment scenarios for GWSS and PD provide the baseline data for the analysis for objectives 2 and 3. For objective 2 the benefits of the public program will be estimated assuming that if no program exists individual growers will not treat the GWSS in way to prevent its spread throughout California. This will impose additional treatment costs on growers in areas currently free of the GWSS. The amount of additional treatments that will need to be completed will vary with the presence of the vine mealybug and other sharpshooters. Pest control advisors and UCCE farm advisors were surveyed by phone to determine how their costs of production would change if the public program were discontinued. In the Temecula Valley and the San Joaquin Valley where there are vine mealybug infestations if the public program were discontinued it is believed that pest pressures would increase resulting in growers spraying an additional 1-2 spray treatments a year. Growers would spray either imidacloprid or Danitol and average control costs would be about \$35.00 to \$50.00 a treatment, causing pest control costs to go up by \$70 to \$100 per acre. In counties located in the Central Valley that are not currently infested with vine mealybugs PCAs believe that growers will complete an additional 4-5 spray treatments a year for an additional cost of \$140 to \$200 an acre.

In the Coastal wine grower counties growers are currently treating for the blue-green sharpshooter to prevent the spread of PD in that area. The blue-green sharpshooter has one generation a year, but is usually not treated based on UCCE Sample Costs of Production. In comparison the glassy-winged sharpshooter has two generations a year and, due to its greater ability to transmit the bacterium that causes PD, it is expected that growers will treat it to prevent populations from increasing. An

additional soil application of imidacloprid and an additional two to three spray applications of Danitol or imidacloprid will be needed to keep GWSS populations suppressed. The total increase in costs is about \$105 to \$150 an acre per year. This data will be used in a market model to estimate the net losses to growers and consumers. The losses to growers will be estimated by the type of grape produced (i.e. table, raisin, wine) in order to complete objective 3.

3) Estimate the optimal check-off rate for the grape industries that benefit from the treatment of the GWSS on overwintering crops. The rate will take into account the costs and benefits to the grape growers in both infested areas and areas that benefit from the containment of the GWSS within infested areas, and the costs and benefits to growers of overwintering crops. The results of the first two objectives will be used as parameters in the model that estimates check-off rates.

DISCUSSION

The public control program to date has managed to contain the GWSS in the southern part of the State. Due to the effective control of GWSS in citrus in the southern San Joaquin Valley, the cost to grape growers of GWSS control has been offset by cost reductions in the use of other insecticides. The area with a net increase in the costs of production for grape production, the Temecula Valley contributes a very small share to California, and U.S. production of grapes (2.8% of U.S. production). Given the low percentage of grape production in the area with the increase in costs and no net change in costs in the areas with the greatest percentage of U.S. production, there is no shift up of the U.S. grape supply curve due to GWSS control in the southern San Joaquin Valley.

While the public GWSS control program has managed to keep the change in the costs of production to levels that do not affect market demand, the consequence for growers in the Temecula Valley is that their extra treatment costs are not partially offset by changes in market prices. The increase in changes in the costs of production then result in a decrease in profits for a grower.

If the public control program were discontinued winter GWSS treatment in citrus would cease and, without a quarantine, GWSS would spread. Costs for grape growers would increase throughout grape growing regions due to higher control costs where GWSS is currently established, and the need to implement control measures in areas currently free of GWSS. The net effect would be an increase in market prices and lower market supply, making consumers worse off in addition to producers.

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