
California Citrus Greening Survey - Preliminary Results

Ajay Singh, Department of Environmental Studies, California State University Sacramento
Adelyn Flowers, Department of Economics, California State University Sacramento
Jonathan D. Kaplan, Department of Economics, California State University Sacramento

Funding provided by USDA-NIFA Emergency Citrus Disease Research and Extension Grants

Research Brief #2021-1 August 2021

California State University Sacramento



Issue

In the late 18th century, a citrus disease called die-back began to take hold in India (Gottwald, Graça, and Bassanezi 2007). Around the same time, a similar phenomenon was noticed by farmers in Southern China and referred to as huanglongbing (HLB) (da Graça and Korsten 2004). The bacterium *Candidatus Liberibacter asiaticus*, the presumptive causal agent for HLB, also referred to as citrus greening, infects a tree's phloem, suffocating the roots causing the tree to die. Once HLB infects a tree, it quickly spreads throughout the tree (Farnsworth et al. 2014). Even if a tree survives initial infection, much of its fruit becomes inedible, and the cost for treating an endemic grove is high. Since its discovery in Asia, HLB has spread to more than 40 countries across Asia, Africa, and the Americas (Bove, 2006). In 1998, the Asian Citrus Psyllid (ACP), the primary vector for HLB, was discovered in Florida and within seven years HLB was detected in Dade County in southern Florida, causing an estimated \$4.5 billion impact on the Florida economy between 2007 and 2011 and decreased production by an estimated 8 million tons per year between 2000 and 2020 (Alvarez et al. 2016, Farnsworth et al. 2014; Hodges and Spreen 2012, Simnett and Kramer 2020).

In 2008, ACP was detected in San Diego County, California and is now established throughout southern California on both residential and commercial citrus (Byrne et al. 2018; Hoddle, 2012). Because of the risk of HLB, California's citrus industry must have an effective response to avoid repeating the disaster in Florida. That response will entail a better understanding of the rate of transmission and spread of the disease, effective management practices, the rate of farmer adoption of those practices, and needed rate of cooperation to adequately address HLB. Because there is no control for HLB to date, the only effective management of disease spread is vector control; necessitating the need for monitoring, reporting, and area-wide cooperation between growers. Estimating the rate of spread entails assessing the biology, geography, and population dynamics of ACP (Gottwald, Luo, and McRoberts, 2014). However, vector control will mitigate the risk and severity of infection, requiring a coupling between the bio-physical conditions of disease spread with possible grower response rates. Considering the bio-physical and human dimensions of disease spread will help us better understand,

and communicate, when and where possible outbreaks of the disease may occur and more accurately assess a grower's risk of infection.

Key Findings

Many growers perceive some HLB risk and believe they and their neighbors will take necessary steps to control ACP and HLB. Further, growers appear more like to consult UC cooperative extension and crop advisor resources for information about ACP and HLB. Not too surprising, growers also had greater confidence in these information sources than other publicly available sources.

Methodology

To gain insights on grower perception of the threat of ACP and HLB and their responses to that threat, citrus growers in California were surveyed in 2020. This study will help model grower risk perceptions of ACP/HLB, adoption of best management practices, and likelihood of cooperating in area wide spraying. Risk perceptions are an indicator of levels of motivations to adopt behaviors, like best management practices, to threats like ACP/HLB. Risk perception is determined by assessing an individual's fear of the consequences of a risk and their knowledge about the risk (Slovic, 1987). Originally planned as in-person surveys, COVID-19 and public health and safety measures required a change to an online survey. An invitation was distributed through the Citrus Research Board electronic newsletter, CDFA's Citrus Insider news, and through select industry news and media outlets. Participants were provided with a \$10 incentive payment.

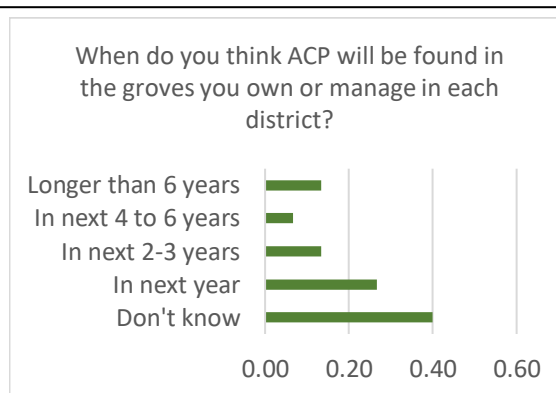


Figure 1.

Detailed Results

Of those surveyed, 34 were growers, 25% of whom believed that one or more of their groves would be infected with ACP in the next year and 40% did not know when that would occur (Figure 1). When asked who would be most economically impacted by HLB infections in California, more than 95% of growers believed that it would have a large or extreme impact on growers while only 30% believed it would have the same impact on consumers (Figure 2). These results indicate that growers risk perception is high because they are uncertain about the spread of the disease and believe growers will be highly impacted by HLB.

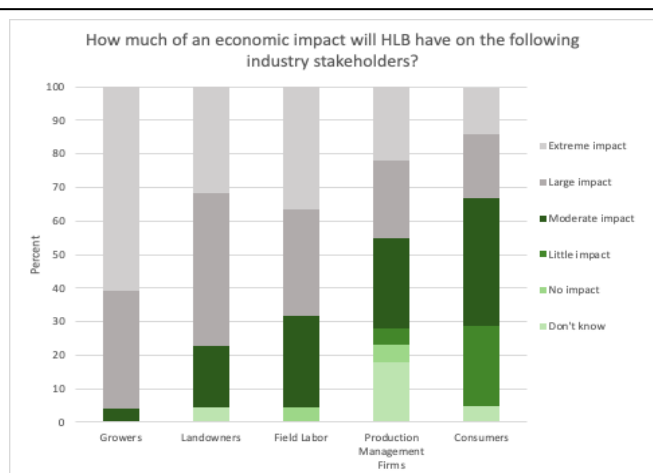


Figure 2.

Even though there is high uncertainty about the spread of ACP/HLB and a belief of dire consequences to growers, only a third of growers said they would be moderately to extremely likely to implement a monitoring program or are participating in a Psyllid Management Area (PMA). When asked about concerns of joining Psyllid Management Area, a third were moderately to very concerned about challenges to having adequate levels of grower participation and a quarter were concerned about PMA activities being integrated into current IPM programs. And approximately 80% of respondents believe that other growers in their district will do whatever it takes to manage ACP, indicating that growers are likely to take an individual approach to managing the spread of ACP. However, when asked who should be responsible to lead efforts to reduce the threat of HLB, 57% of respondents said that CDFA should take the lead, 29% said growers, and only 14% said county ag commissioners should take the lead.

To better understand where citrus growers go for information about ACP/HLB, we asked where they go for information and the confidence they have in that information (Figures 3 and 4). Not surprisingly growers go to and have confidence in crop advisors, other growers, UC Extension and ANR, CDFA, and trade publications. Interestingly, growers do not go to PMAs nor do they have confidence in the information PMAs would provide.

The results of the study indicate that growers may take an individualistic approach to managing ACP and believe that other growers will address any problems in their groves. However, growers also recognize the need for coordination and cooperation between growers and with CDFA to address HLB. Interestingly, our results indicate that growers do not believe that local coordination efforts through PMAs will be trusted sources of information or effective. This indicates that there will be a complex interactions between coordinated and individual efforts to protect growers from HLB and reduce the severity of its impacts. To simplify the complex interactions and make sense of them, an agent-based model may help predict disease severity and the

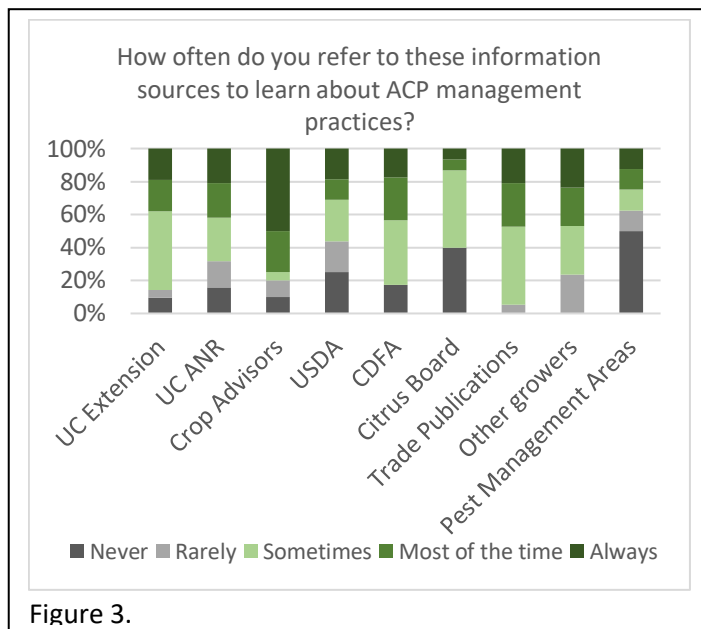


Figure 3.

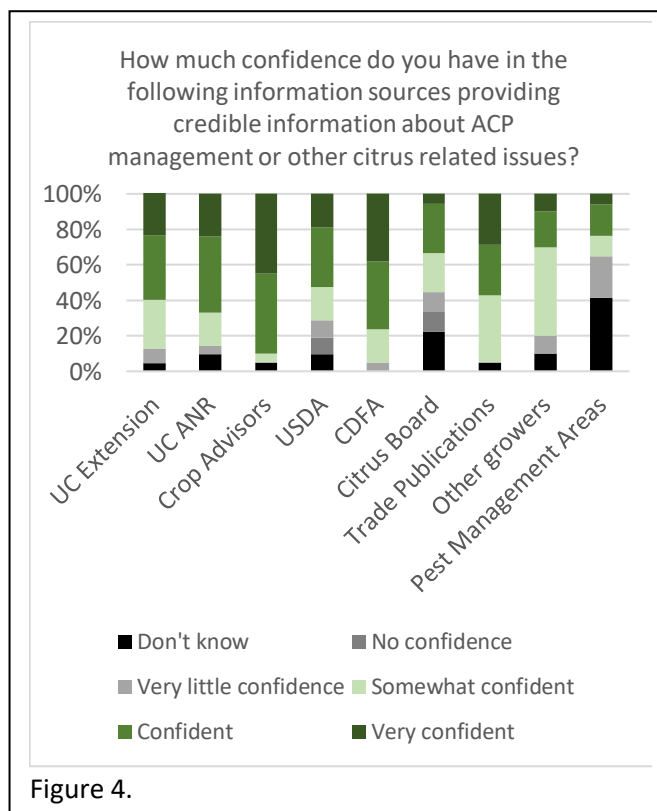


Figure 4.

impact HLB on the California citrus industry. Beginning in 2021, researchers will continue this work to better understand the rate of adoption of risk mitigating practices, levels of cooperation between growers, and coordination of information sharing by surveying growers at field days in both California and Florida. This information will be used to create a risk model that can be coupled with bio-physical model to more accurately depict population dynamics of ACP/HLB and the rate of infection.

For more information about this study contact: Ajay Singh (singh@csus.edu) or Jonathan Kaplan (kaplanj@csus.edu)

References

- Alvarez, Sergio, Eric Rohrig, Daniel Solís, and Michael H. Thomas. 2016. "Citrus Greening Disease (Huanglongbing) in Florida: Economic Impact, Management and the Potential for Biological Control." *Agricultural Research* 5 (2): 109–18. <https://doi.org/10.1007/s40003-016-0204-z>.
- Byrne, Frank J., Elizabeth E. Grafton-Cardwell, Joseph G. Morse, Adam E. Olguin, Adam R. Zeilinger, Cheryl Wilen, James Bethke, and Matthew P. Daugherty. 2018. "Assessing the Risk of Containerized Citrus Contributing to Asian Citrus Psyllid (*Diaphorina Citri*) Spread in California: Residence Times and Insecticide Residues at Retail Nursery Outlets." *Crop Protection* 109 (July): 33–41. <https://doi.org/10.1016/j.cropro.2018.02.024>.
- Derek Farnsworth, Kelly A. Grogan, Ariena H.C. van Bruggen, and Charles B. Moss. 2014. "The Potential Economic Cost and Response to Greening in Florida Citrus." *Choices* 29 (3): 1–6.
- Gottwald, Tim R., John V. da Graça, and Renato B. Bassanezi. 2007. "Citrus Huanglongbing: The Pathogen and Its Impact." *Plant Health Progress* 8 (1): 31. <https://doi.org/10.1094/PHP-2007-0906-01-RV>.
- Graça, J. V. da, and L. Korsten. 2004. "Citrus Huanglongbing: Review, Present Status and Future Strategies." In *Diseases of Fruits and Vegetables Volume I*, edited by S. A. M. H. Naqvi, 229–45. Dordrecht: Springer Netherlands. https://doi.org/10.1007/1-4020-2606-4_4.
- Hoddle (2012) <https://cirs.ucr.edu/blog/2012/04/13/huanglongbing-detected-hacienda-heights-los-angeles-county>
- Hodges, A.W. and Spreen, T.H., 2012. Economic impacts of citrus greening (HLB) in Florida, 2006/07–2010/11. *EDIS*, 2012(1).
- Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280-285.
- Simnett, S. and Kramer, J. 2020, Citrus Greening Disease caused falling production in Florida, but production is forecast to stabilize in 2019/2, Economic Research Service, United States Department of Agriculture, accessed August 2021 at <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=98417>