California Citrus Greening Survey - Preliminary Results on ACP/HLB Risk Perception and Information Confidence

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

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Issue

In the late 18th century, a citrus disease called die-back began to take hold in India (Gottwald, da 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, 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 does not fully ripen, leading some to refer to HLB as citrus greening disease. The fruit also becomes inedible and the cost for treating an endemic grove is high as removal of infected trees and those near it are likely required. 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 in both residential and commercial citrus trees (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 experienced 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.

Study Method

To gain insights on grower perception of the threat of ACP and HLB, their responses to the threat including where they seek information and their confidence in that information, we surveyed citrus growers in California in 2020. 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.

The results from this and subsequent surveys are informing the modelling of 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 such as 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).

Key Insights

Many of the surveyed growers perceive HLB as a risk and believe their neighbors have and will take necessary steps to control ACP and HLB. They express strong support that the consequences of HLB will fall heaviest on growers. Further, respondents appear more likely to consult UC cooperative extension and CDFA resources for information about ACP and HLB than other publicly available resources. Not surprisingly, growers also had greatest confidence in these information sources than other publicly available sources. Lastly, some respondents believe HLB is already in commercial citrus groves in California. If that is in fact the case, identifying cost-effective measures for ACP and HLB management seem more urgent than ever.

Figure 1. Detection of ACP in commercial grove

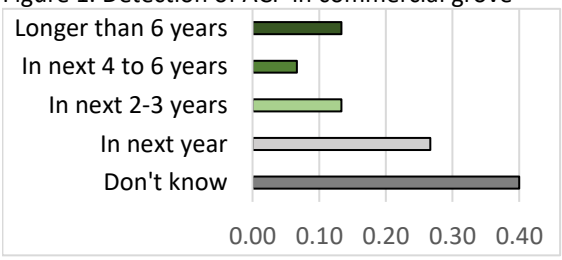
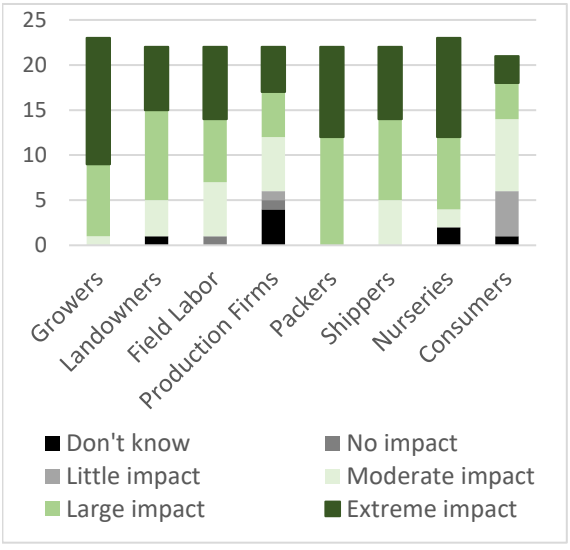


Figure 2. Impact of HLB infections in California



Detailed Findings

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 and packers 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 they will be highly impacted by HLB.

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 a 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.

When asked about when HLB will be present in commercial groves nearly 28% of respondents did not know, while approximately 45% believe that HLB is present or will be present within the next year (Figure 3). Furthermore, nearly all growers believe that HLB is a threat to the citrus industry (Figure 4). Similar to risk perceptions of ACP, growers have a very high risk perception of HLB; and those with high risk perception may be more likely to adopt monitoring and preventative measures to protect themselves.

Figure 3. Detection of HLB in commercial grove

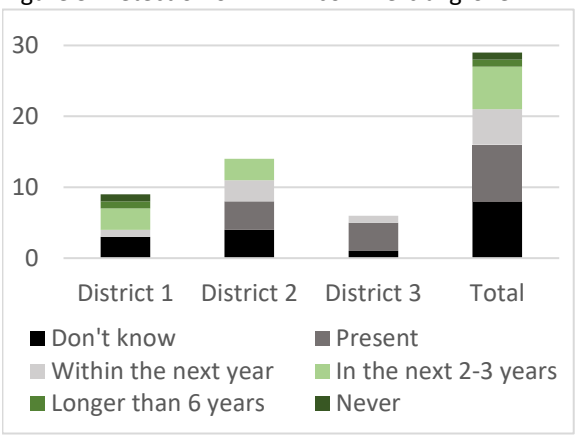
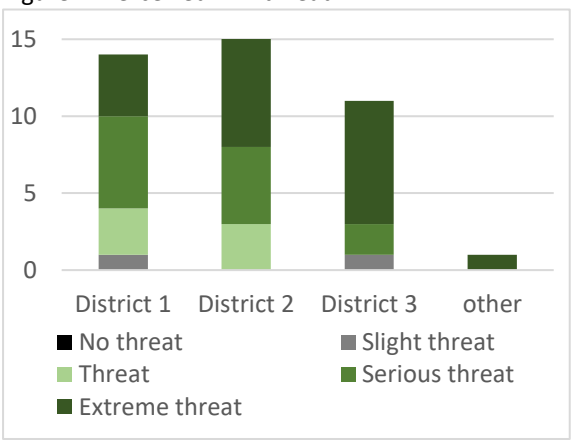


Figure 4. Perceived HLB threat



Moreover, 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. We also asked growers where they go for information and the confidence they have in that information (Figures 5 and 6). Not surprisingly, growers go to and have

Figure 5. Information Sources Frequented

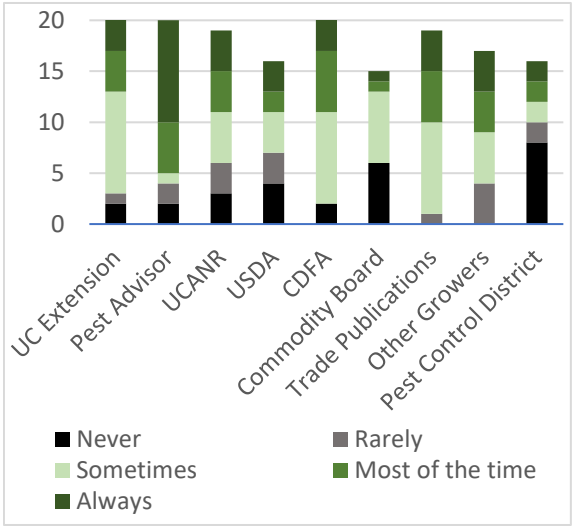
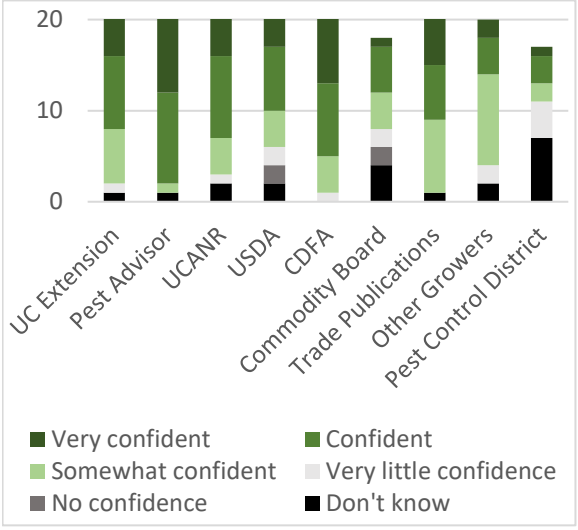


Figure 6. Information Source Confidence



confidence in crop advisors, other growers, UC Extension and ANR, CDFA, and trade publications. Interestingly, growers were less likely to seek out information from USDA, or pest control districts and are not sure how confident they would be or are not confident in the information pest control districts would provide.

The results of the study indicate that growers are uncertain about when they will be infected with ACP or HLB and perceive them as a serious threat. 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 PCDs are sources of information or do not know or have little confidence in the information they provide. This raises the question of whether farmers will cooperate with coordinated spraying to address ACP infections or address HLB in time to reduce an outbreak.

To replicate some of the complex interactions of cooperation and coordination to address ACP and HLB, an agent-based model has been developed to predict disease severity and the economic impacts of HLB on the California citrus production. 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, the rate of infection, and economic consequences.

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

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