

Growers' risk perception and trust in control options for huanglongbing citrus-disease in Florida and California



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ABSTRACT

Citrus huanglongbing disease (HLB) is an acute bacterial disease that threatens the sustainability of citrus production across the world. In the USA, the Asian citrus psyllid (ACP) is the vector responsible for spreading the disease. Successful suppression of HLB requires action against ACP at large spatial scales, i.e. growers must cooperate. In Florida and California, the citrus production regions have been split into vector-management areas and growers are encouraged to coordinate spraying of insecticide across these (to achieve area-wide control). We surveyed growers from Florida and California, obtaining samples of opportunity at grower meetings, to assess the consensus of opinions concerning issues that influence HLB management. Our results show that a grower's perception of the risk of disease infection and their trust in control options are central to the decision on whether to join an area-wide control program. Growers' perceptions on risk and control efficacy were found to be influenced by information networks and observations about the state of the HLB epidemic and psyllid populations. Within the growers' information networks, researchers and extension agents were reported to have the largest influence on perceptions. Differences in opinion between California and Florida growers as to the efficacy of treatments could be explained as a function of experience: growers from areas with lower densities of ACP were associated with rating insecticide control more positively than those where psyllids population density was higher. Thirty percent of growers identified the expected lack of participation by other growers as a reason why they themselves would not participate in area-wide control.

1. Introduction

Plant diseases collectively account for annual losses in the order of 12–15% of global crop production (Savary et al., 2012), however, diseases that completely threaten the production of specific types of crop at a global or regional scale are relatively rare. Citrus huanglongbing (HLB) disease is one of that category of rare, acute plant diseases that threaten the sustainability of citrus production across all citrus producing regions of the world (Gottwald, 2010).

The disease is caused by a fastidious bacterium, *Candidatus Liberibacter* spp., with three species known to be associated with HLB symptoms in different regions. In the USA the Asian Citrus Psyllid (ACP, *Diaphorina citri*) is the invasive vector that is responsible for spreading *Candidatus Liberibacter asiaticus* (CLAs) (Gottwald, 2010). The disease is now widespread in Florida and is causing significant economic losses

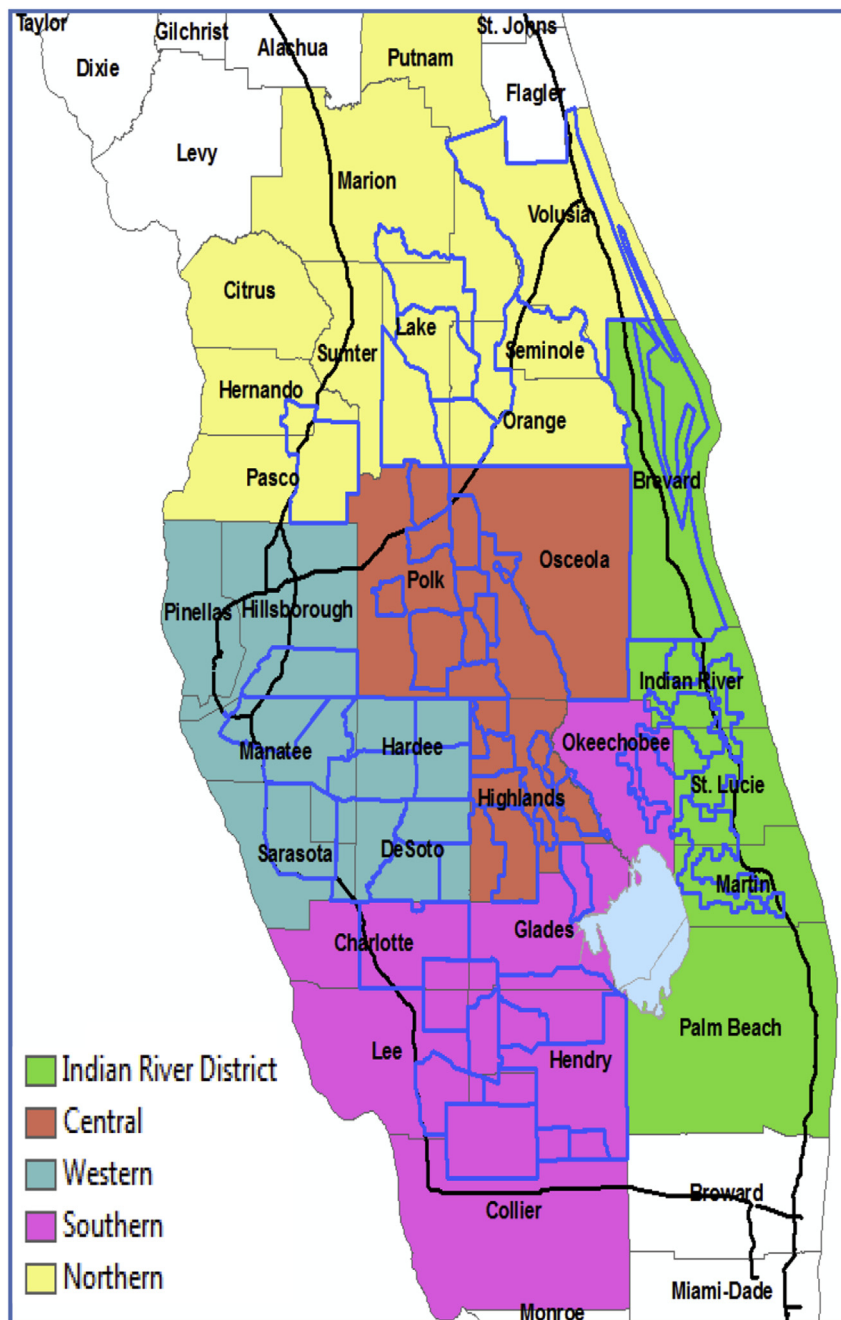
(see Box 1). The disease was found in California in 2012 and now it has been identified in over 800 trees in residential areas of Southern California but has not yet been detected in commercial trees (see Box 2). Disease control programs in both states are coordinated around spatially organised groups of growers who take coordinated actions on psyllid control. We refer to this approach as an area-wide control program. For detail on the organisation see Box 1 and Box 2.

When one considers the dynamics of HLB epidemics at state or regional scales it is apparent that human behaviour has a major impact on the rate of disease spread. It is recognized that successful suppression of HLB requires action at large spatial scales (Gottwald, 2010). In most settings, and certainly in both Florida and California, the effective area over which coordinated action is required exceeds the area of a single plantation and vector control, thus, entails coordination among several-to-many growers or crop managers. Furthermore, in both states control

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Box 1



A map of Florida with the areas used to categorise where the participants' orchards were located.

Huanglongbing citrus-disease in Florida. The ACP was first detected in Florida in 1998 and spread rapidly throughout the state. *Candidatus Liberibacter asiaticus* (CLAs) was confirmed to be present in Florida in 2005. In the intervening 13 years from that detection until now, HLB has spread through all of Florida's citrus producing acreage and is considered to be near 100% incidence in all orchards > 2yrs of age. The disease has caused approximately a 75% reduction in citrus production while more than doubling the cost of production per acre. A recent analysis by Mitchell (2017) estimated the net loss of consumer and producer economic surplus at \$466M per year since HLB was first detected in Florida.

In Florida coordination of disease management into area-wide programs is based on Citrus Health Management Areas (CHMAs). CHMAs were purposely constructed with known vector and disease prevalence in mind and using information on the known dispersal capability of the vector to establish the required physical extent over which coordinated treatment is needed to achieve local population suppression. Information on the level of grower participation in CHMAs and the size of the ACP population (estimated using tap-sampling of trees) is gathered every 3-weeks and is available through a website maintained by the University of Florida (www.flchma.org). Singerman et al. (2017) give a recent account of economic reasons why CHMAs differ in level of performance in suppressing ACP populations and preventing spread of HLB.

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