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### Title

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### Longevity of Imidacloprid Soil Drench on Citrus Nursery Stock for Sale at Retail Stores in Florida

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The Florida psyllid testing project (Manjunath et al. 2008, Halbert et al. 2012) showed that about 10% of regulatory samples of *Diaphorina citri* Kuwayama collected by Florida Department of Agriculture and Consumer Services, Division of Plant Industry (FDACS/DPI) inspectors from plants for sale in Florida were positive for *Candidatus Liberibacter asiaticus* (Las). Most of the commercial nurseries that produce the plants do not have psyllids or Las, so the most likely source of contamination is the retail venues themselves. If this is the case, great benefit could be achieved by preventing psyllid infestation in retail stores. Florida has a requirement that citrus plants for sale be treated with an imidacloprid-based soil drench (ISD). Producers are required to tag the plant with the date of treatment. The treatment expires in six months, but our data indicate that three months probably is more realistic. In 2009, there was an increase in plants infested with psyllids 30 days post-ISD treatment. In later years, this increase was not so pronounced or did not exist, suggesting that growers are getting better control.

#### Introduction:

One of the most important management strategies for dealing with huanglongbing (HLB, citrus greening) is to produce and sell clean plants. Plants should be free from HLB and from *Diaphorina citri* Kuwayama, the psyllid vector of HLB pathogens.

About 10% of regulatory samples of *D. citri* samples collected from plants for sale in Florida between 2005 and 2009 were positive for *Candidatus Liberibacter asiaticus* (Las) (Fig.1). Most of these samples came from retail venues (Manjunath et al. 2008, Halbert et al 2012).

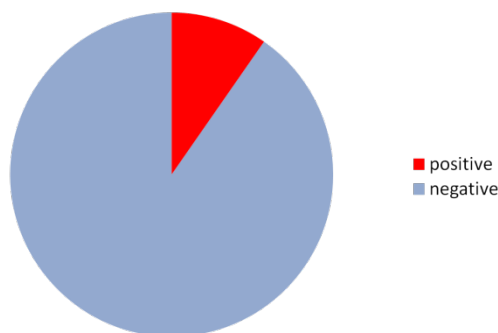


Figure 1. Positive and negative status of samples of *Diaphorina citri* Kuwayama collected from plants for sale in Florida and subsequently tested for *Candidatus Liberibacter asiaticus*, 2005-2009. N=1,186 (Halbert et al. 2012).

Most commercial nurseries that produce plants for sale do not have psyllids or Las, so the source of the contamination probably is the retail venues themselves. If this is the case, great benefit could be achieved by preventing psyllid infestation in retail stores.

Imidacloprid-based insecticides are an important part of the tool kit to keep plants for sale free from *D. citri*. Florida has a requirement that citrus plants for sale be treated with an imidacloprid-based soil drench (ISD). Producers are required to tag the plants with the date of treatment. The treatment expires in 6 months.

Theoretically, plants arrive constantly at a retail venue (Fig. 2). New plants arrive before the older plants are all gone, but because of sales, most of the plants present will be in newer cohorts. A few plants (less popular cultivars or unsightly specimens), will remain for a long time.

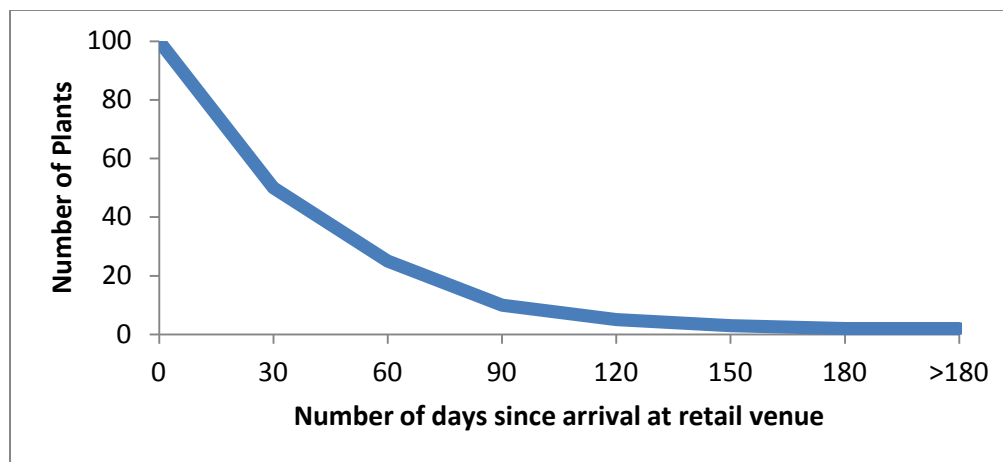


Figure 2. Theoretical (hypothetical) longevity distribution of plants at a retail venue.

### Results and discussion:

By definition, if inspectors find psyllids, the ISD has failed. Thus, one can see longevity of the ISD by viewing frequency distributions of psyllid samples collected by time cohorts past the ISD treatment date (Figs. 3-5). Given attrition of plants due to sales (Fig 2), if the frequency of collections remains the same over the time cohorts, the proportion of infested plants in later cohorts actually is increasing rapidly.

In 2009 and 2010, the ISD lasted about a month. In subsequent years, efficacy decreased over time, with a rise in infested plants at about 4 months.

Plants with expired tags had proportionally more psyllids and (in 2009) a higher proportion of Las-positive psyllid samples (Fig 4). These plants constitute a source of infestation and infection for newly arriving plants.

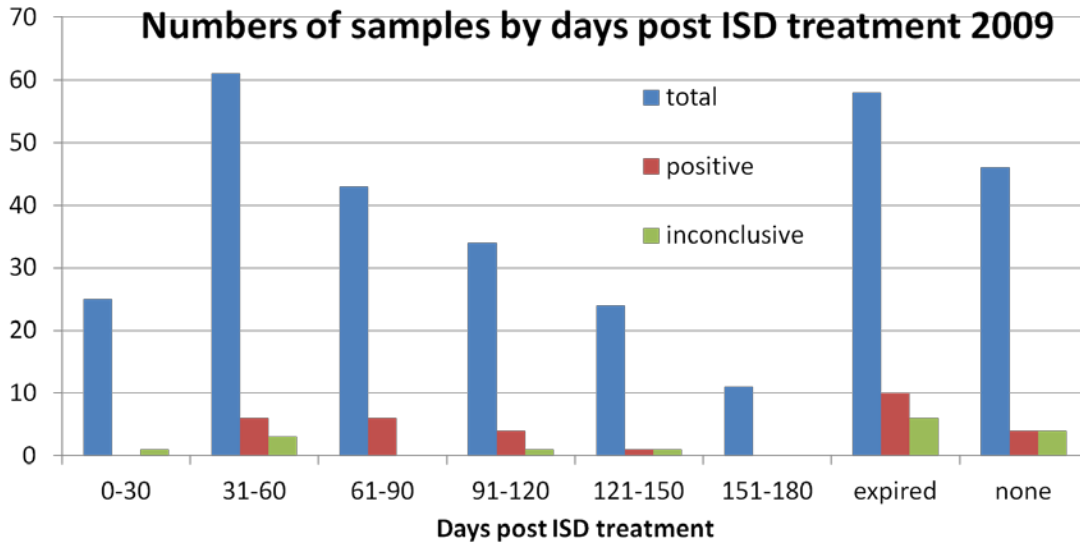


Figure 3. Frequency distribution by days post-imidacloprid soil drench for regulatory samples of *Diaphorina citri* Kuwayama collected from plants for sale in Florida in 2009.

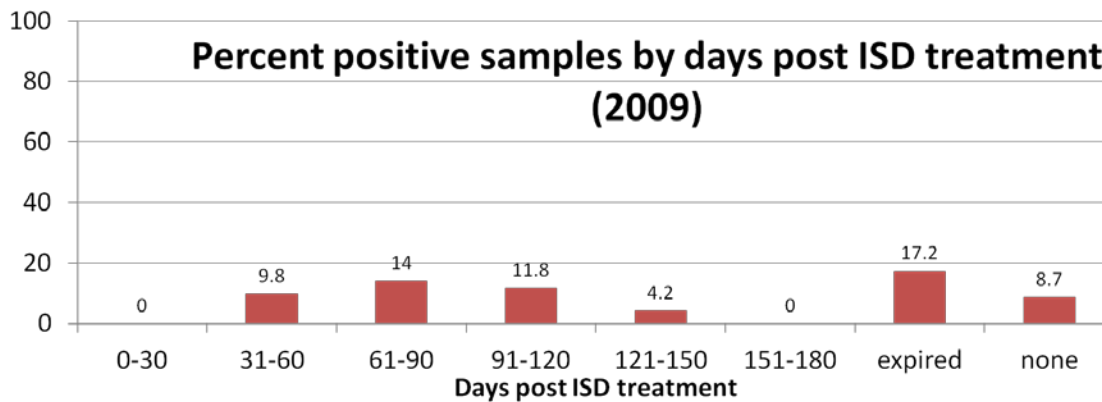


Figure 4. Percent of regulatory samples of *Diaphorina citri* Kuwayama collected from plants for sale in Florida in 2009 positive for *Candidatus Liberibacter asiaticus*. Samples are organized by days post imidacloprid soil drench.

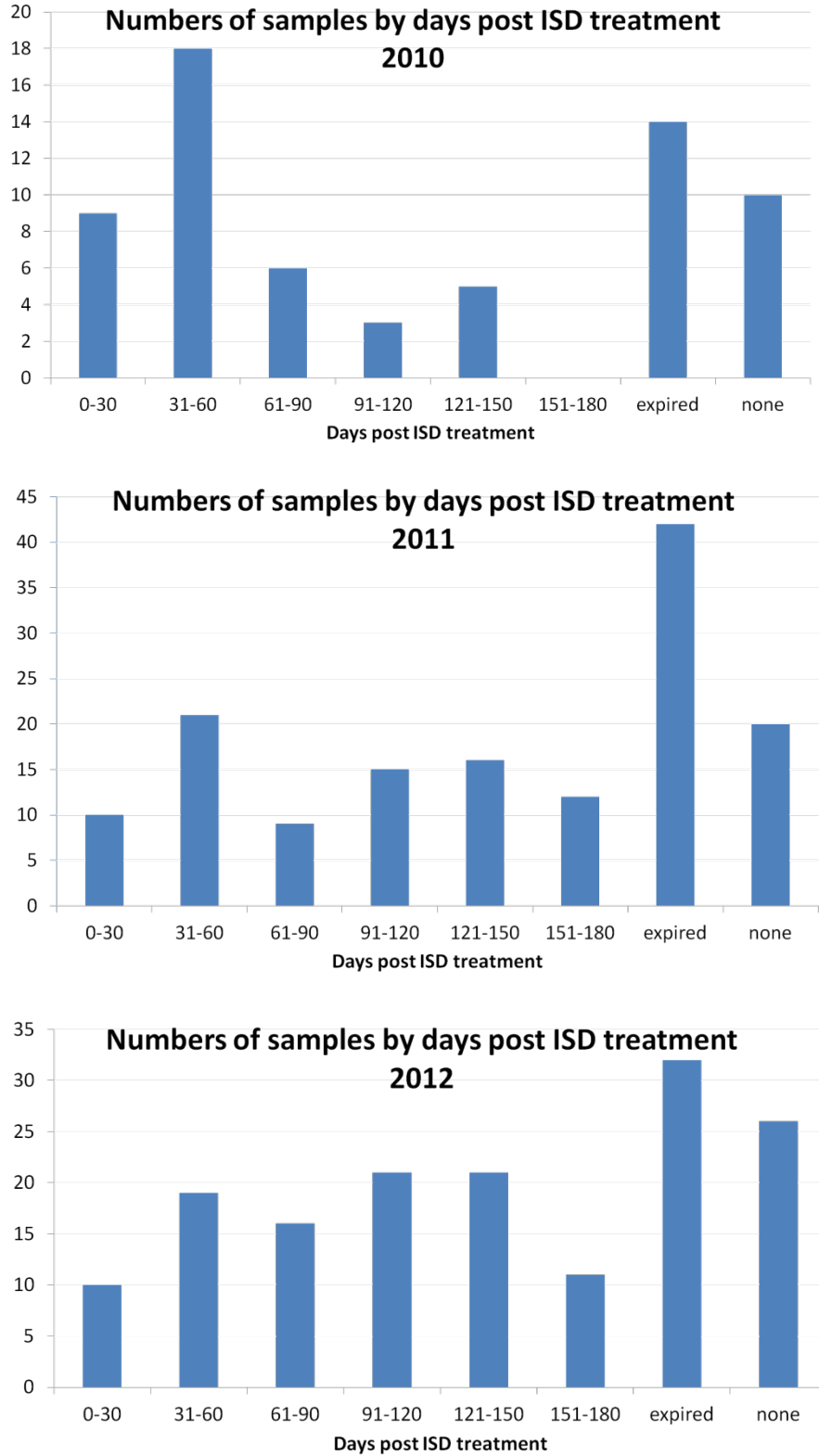


Figure 5. Frequency distribution by days post-imidacloprid soil drench for regulatory samples of *Diaphorina citri* Kuwayama collected from plants for sale in Florida, 2010-2012.

We still find plants infested with psyllids in retail venues (Fig 6). It is not known whether the decrease over time is due to fewer psyllids or less attention to inspection because both *D. citri* and HLB are widespread in Florida.

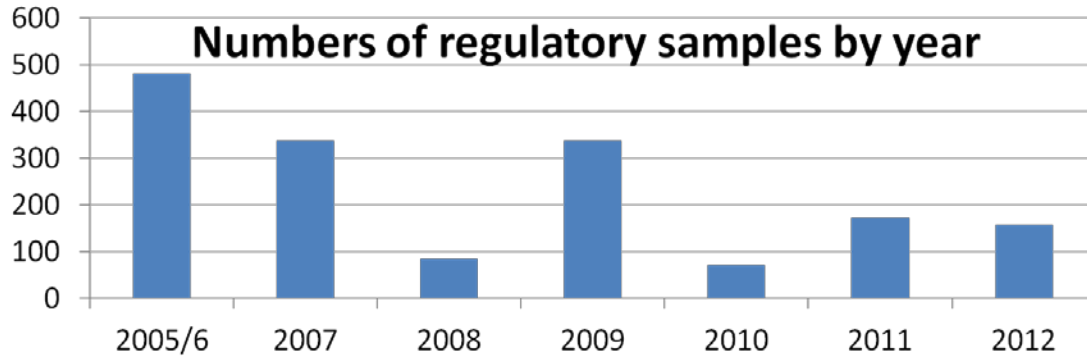


Figure 6. Numbers of regulatory samples of *Diaphorina citri* Kuwayama collected from plants for sale in Florida by year.

#### Conclusions:

1. The efficacy of the imidacloprid soil drench has improved, shown by the lack of a spike in recent years in infestations on plants drenched 31-60 days before the inspection.
2. Plants with expired tags are most likely to have psyllids and, in 2009 they had the highest percentage of Las-positive samples. **These plants serve as a source of inoculum of both psyllids and Las for new arrivals.**
3. Asian citrus psyllids continue to be found on plants for sale at retail stores in Florida, but it is difficult to know whether the decrease in regulatory psyllid samples is due to fewer infested plants or less emphasis on inspection now that both *D. citri* and HLB are widespread in Florida.

#### Acknowledgment:

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#### References

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- Manjunath, K.L., S.E. Halbert, C. Ramadugu, S. Webb, and R.F. Lee. 2008. Detection of '*Candidatus Liberibacter asiaticus*' in *Diaphorina citri* and its importance in the management of citrus huanglongbing in Florida. *Phytopathology* 98: 387-396.