CARIBBEAN FOOD CROPS SOCIETY

46

Forty Sixth
Annual Meeting 2010

Boca Chica, Dominican Republic
Vol. XLVI – Number 2
T-STAR Invasive Species Symposium

PROCEEDINGS
OF THE
46th ANNUAL MEETING

Caribbean Food Crops Society
46th Annual Meeting
July 11-17, 2010

Hotel Oasis Hamaca
Boca Chica, Dominican Republic

"Protected agriculture: a technological option for competitiveness of the Caribbean"

"Agricultura bajo ambiente protegido: una opción tecnológica para la competitividad en el Caribe"

"Agriculture sous ambiance protégée: une option technologique pour la compétitivité de las Caraïbe"

United States Department of Agriculture,
T-STAR Sponsored Invasive Species Symposium

Toward a Collective Safeguarding System for the Greater Caribbean Region:
Assessing Accomplishments since the first Symposium in Grenada (2003)
and Coping with Current Threats to the Region

Special Symposium Edition
Edited by
Edward A. Evans, Waldemar Klassen and Carlton G. Davis

Published by the Caribbean Food Crops Society

ISSN 95-07-0410

Copies of this publication may be received from:

Secretariat, CFCS
c/o University of the Virgin Islands
USVI Cooperative Extension Service
Route 02, Box 10,000
Kingshill, St. Croix
US Virgin Islands 00850

Or from

CFCS Treasurer
P.O. Box 506
Isabella, Puerto Rico 00663

Proceedings of the Caribbean Food Crops Society. 46(1): 107-117. 2010

SESSION 3: CITRUS GREENING- ADVANCES IN RESEARCH AND PRACTICAL EFFORTS TO PREVENT, MITIGATE AND CONTAIN THE DISEASE

CITRUS GREENING DISEASE: THE PATHOGEN, THE DISEASE, ITS TRANSMISSION AND HORTICULTURAL APPROACHES TO MITIGATING REDUCTIONS OF YIELD AND QUALITY

Megan M. Dewdney, Timothy M. Spann and Michael E. Rogers, University of Florida–IFAS, Citrus Research and Education Center, 700 Experiment Station Road, Lake Alfred, Florida 33850-2299. Phone: 863-956-1151; FAX: 863-956-4631; Email: mmdewdney@ufl.edu; span@ufl.edu; mrgs@ufl.edu

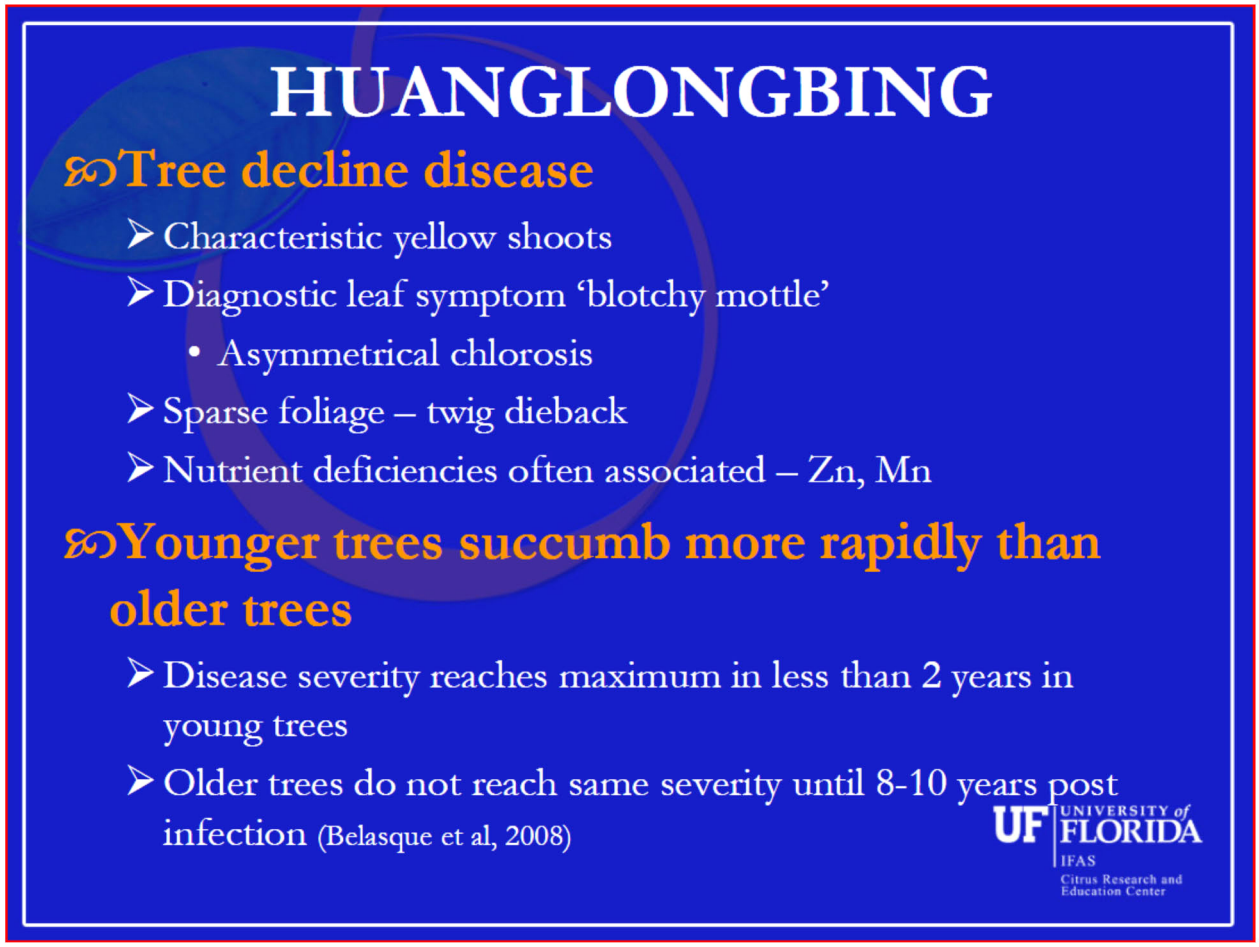

Figure 1. Responses of citrus trees to infection with *Candidatus* Liberibacter asiaticus, causal agent of huanglongbing, or citrus greening disease in Florida.

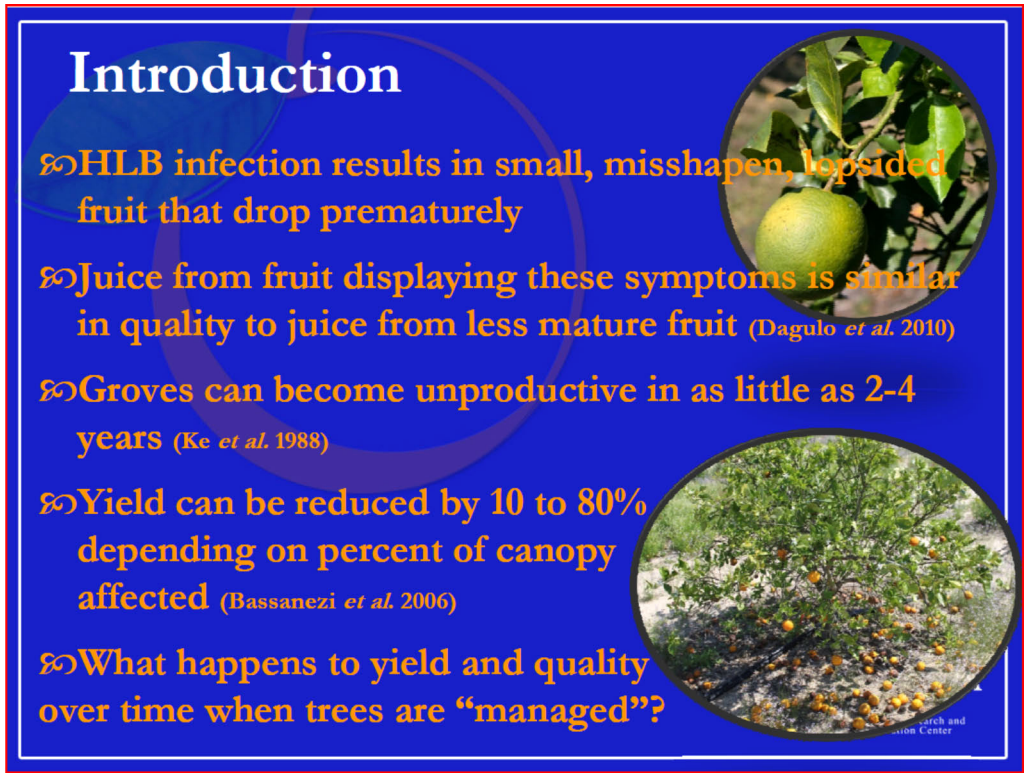

Figure 2. HLB-infection of citrus trees can have devastating effects on the economic viability of citrus operations; however, a key question is whether trees can be managed in a manner to greatly mitigate the detrimental effects of the disease.

Figure 3. Replicated studies were conducted to gain a quantitative understanding of the effects of HLB infection on fruit size and yield per tree as well as on juice quantity and quality.

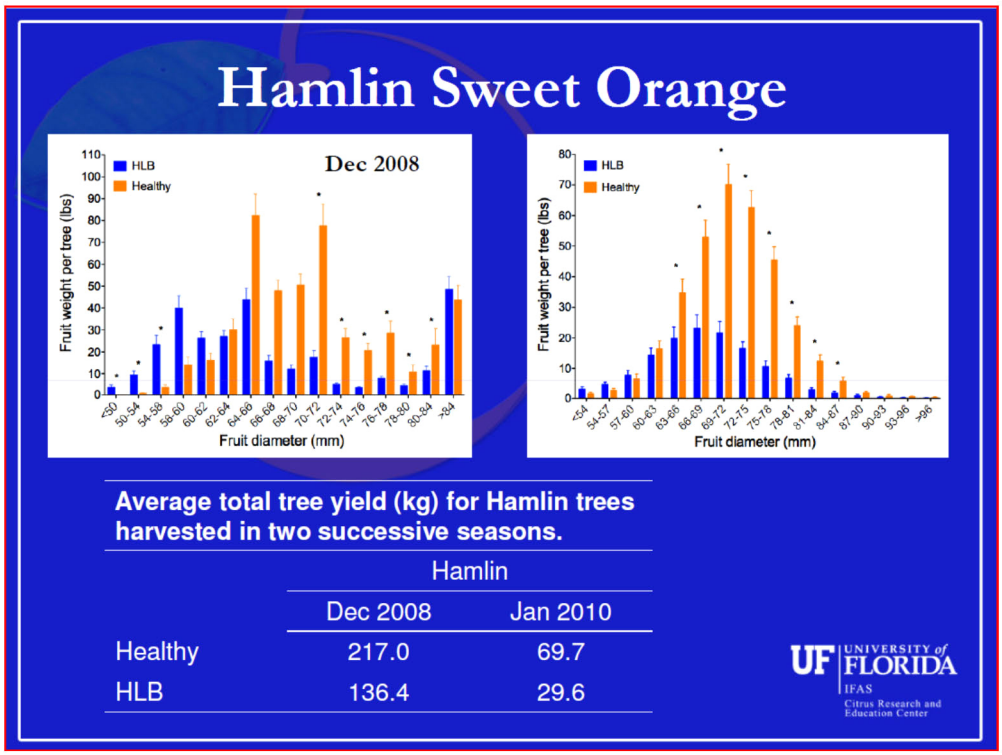

Figure 4. HLB infection has a strikingly great impact on Hamlin sweet orange fruit yield.

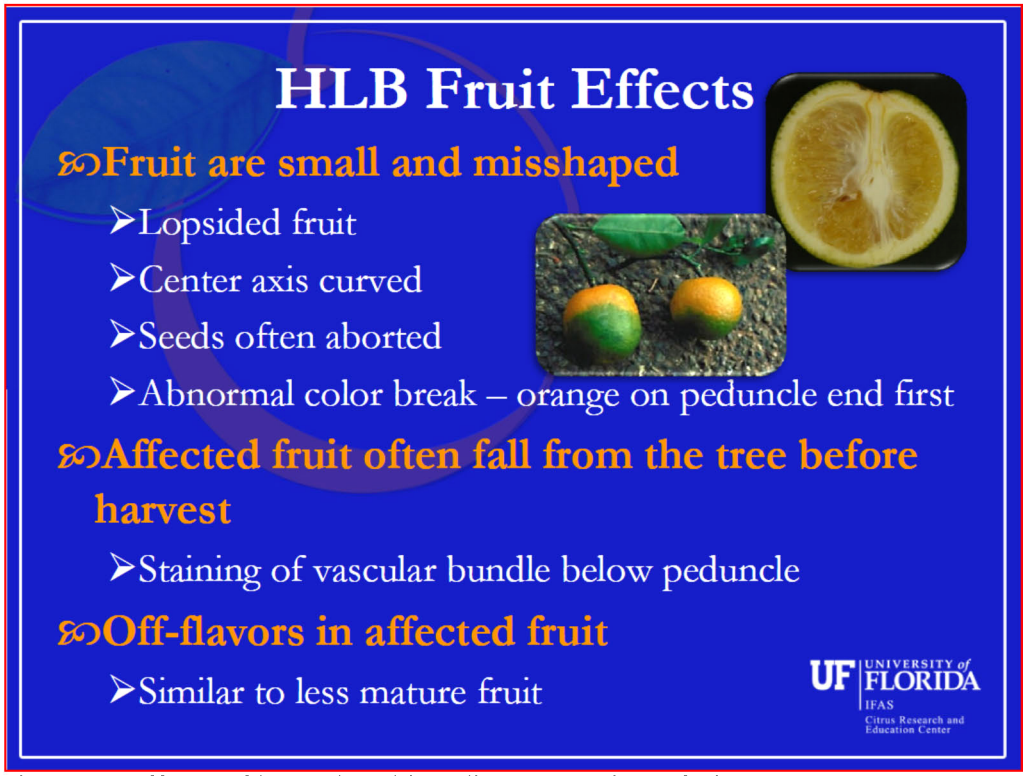

Figure 5. Effects of huanglongbing disease on citrus fruit.

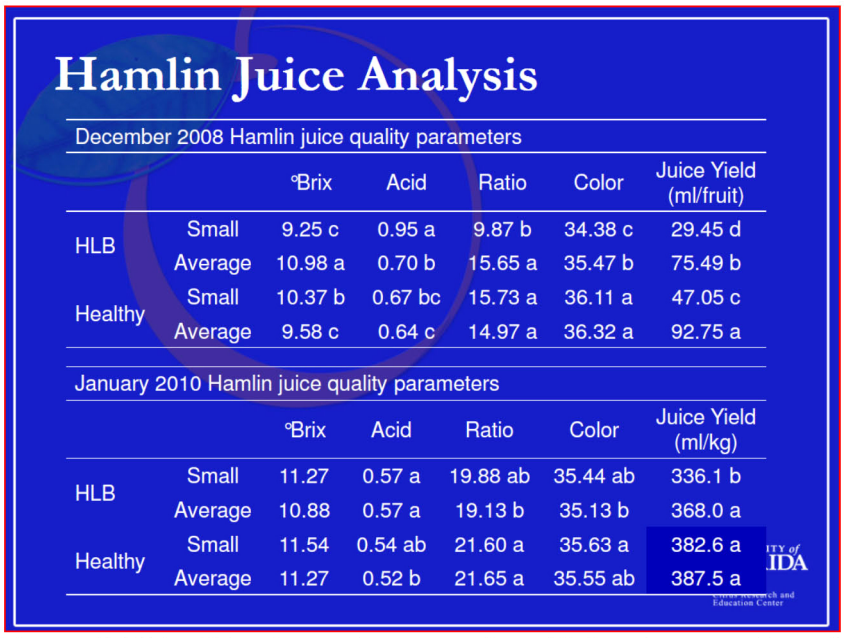

Figure 6. This slide shows the properties of juice from small- and average-sized Hamlin fruits harvested in December 2008 and January 2010 (the acidity of juice from small-sized fruits from infected trees tends to be more acidic than that of average-sized fruits regardless of the disease status of the tree, and the yield of juice from fruits from infected trees is greatly reduced).

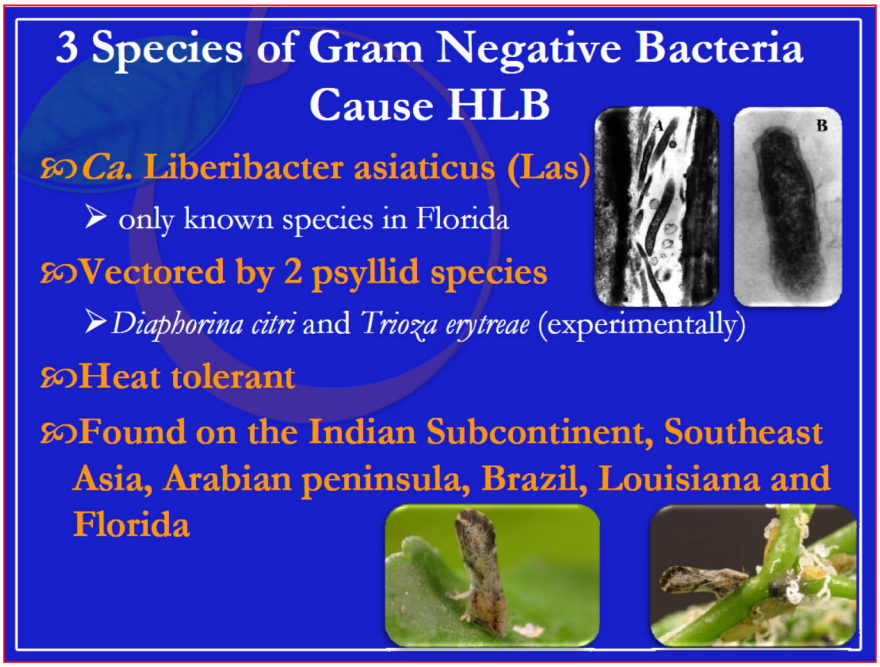

Figure 7. Three *Candidatus* Liberibacter species cause huanglongbing, but only *Ca*. L. asiaticus has reached Florida. The asian citrus psyllid, *Diaphorina citri* is the vector in Florida, and the African citrus psyllid, *Trioza erytreae*, does not occur in the Western Hemisphere. Ca. L. asiaticus, a fastidious, heat tolerant bacterium, is found on the Indian Subcontinent, Arabian peninsula, Southeast Asia, Brazil, Florida, and Louisiana.

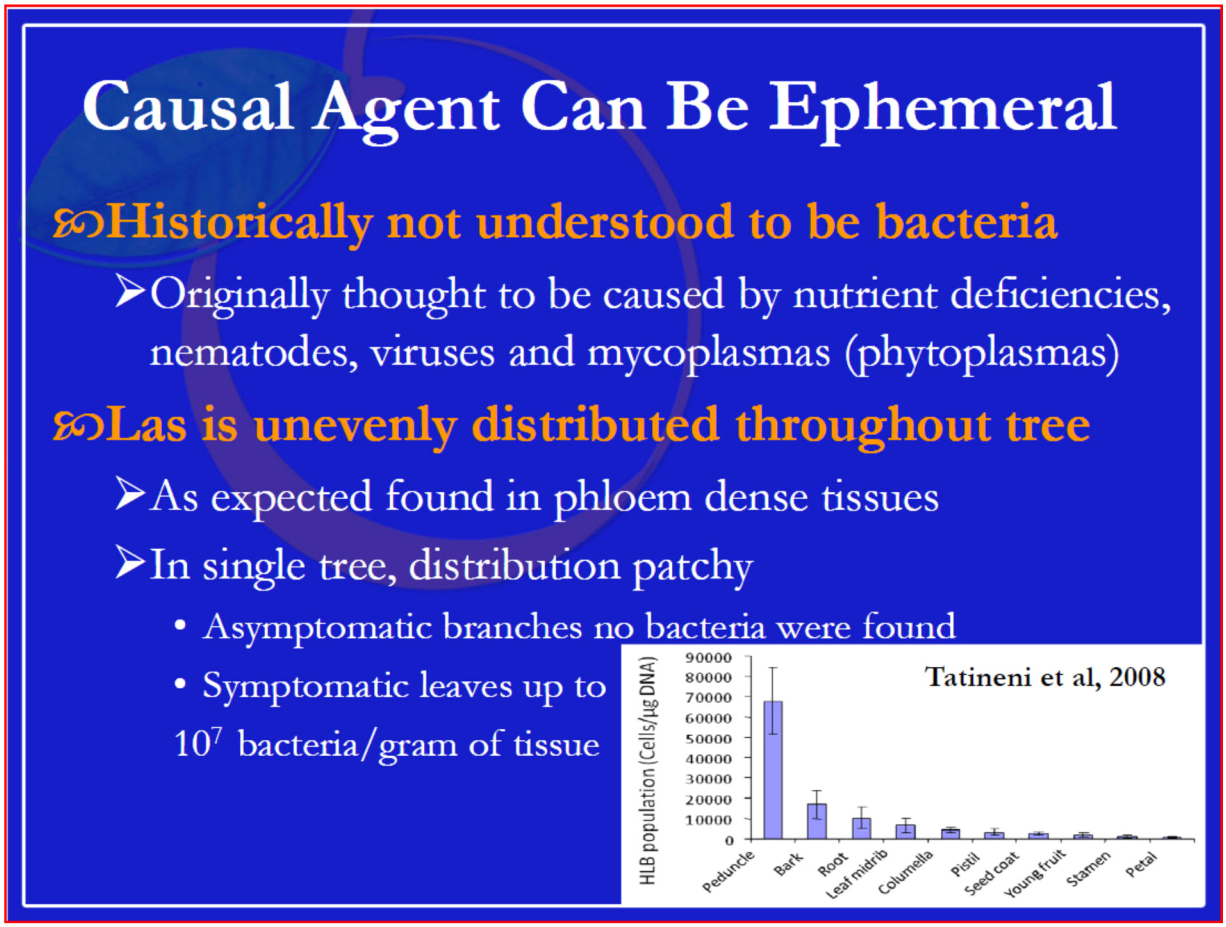

Figure 8. The determination of the causal organism of huanglongbing, Candidatus Liberibacter spp., has been very difficult, since the symptoms have much in common with nutrient deficiencies, and infections of nematodes, viruses, and mycoplasmas (phytoplasmas). The Liberibacter bacteria are found in the phloem of dense tissues. The distribution of infected phloem is patch. By far the highest concentrations of the bacteria are found in the peduncles, with much lower concentrations in the bark, roots, midribs of leaves, and columnella, the central column-like structure found in the citrus fruit.

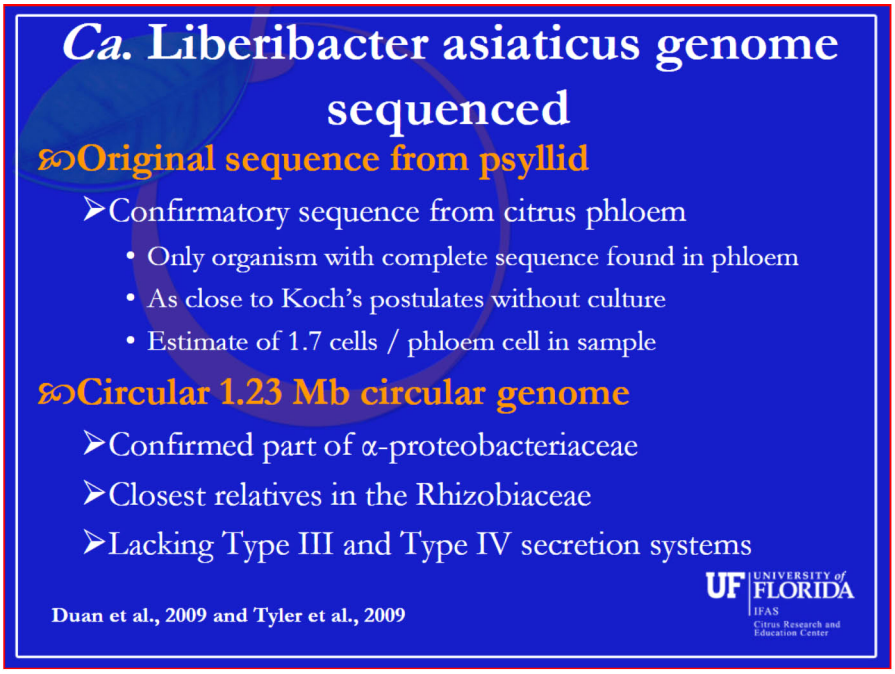

Figure 9. The sequence of DNA of *Candidatus* Liberibacter asiaticus isolated from the Asian citrus psyllid was determined and a confirmatory DNA sequence was obtained by analyzing the DNA of the bacterium present in the citrus phloem. *Ca.* L. asiaticus has a 1.23 MB circular genome. The taxonomic position of this organism is as follows: Kingdom: Monera; Phylum: Proteobacteria; Class: Alphaproteobacteria; Order: Rhizobiales; Family: Rhizobiaceae.

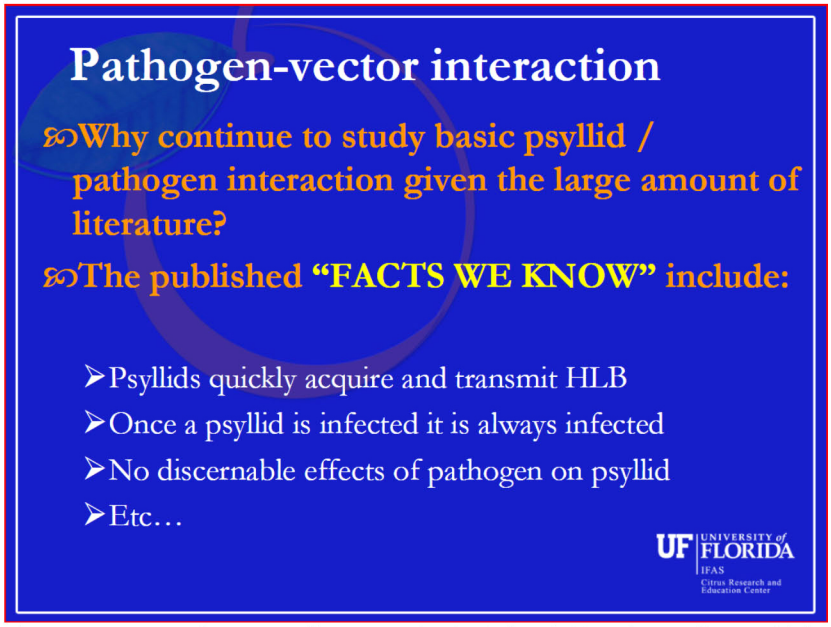

Figure 10. Previous studies concluded the following: (i) psyllids quickly acquire and transmit *Candidatus* Liberibacter asiaticus; (ii) infected psyllids never become free of the bacterium, and (iii) *Candidatus* Liberibacter asiaticus has no adverse effects on the vigor, life span or reproductive capacity of the psyllid, *Diaphorina citri*. However, these findings are incorrect.

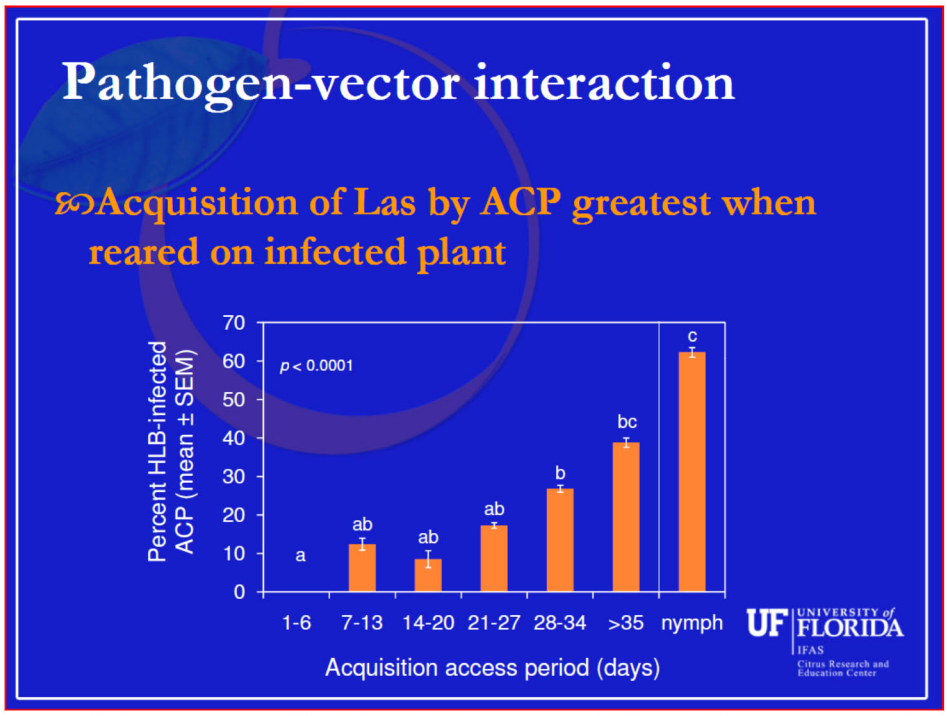

Figure11. Asian citrus psyllids that develop on an infected citrus tree acquire much more *Candidatus* Liberibacter asiaticus bacteria than those that first encounter infected tree as adults; further the immature psyllids pick up progressively more bacteria with the passage of time.

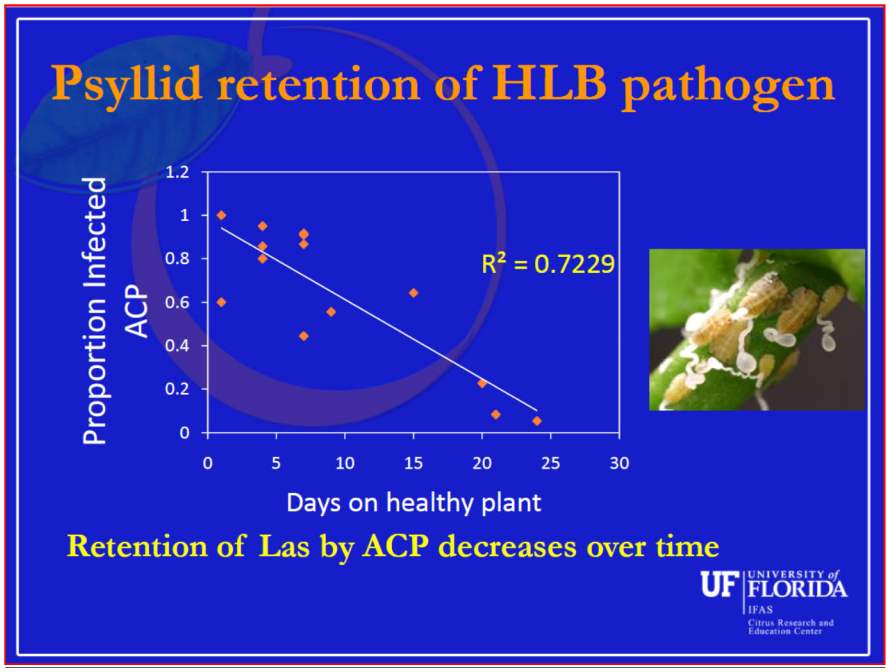

Figure 12. The retention of Candidatus Liberibacter asiaticus by infected psyllids that have transferred to an uninfected tree decreases steadily over about four weeks.

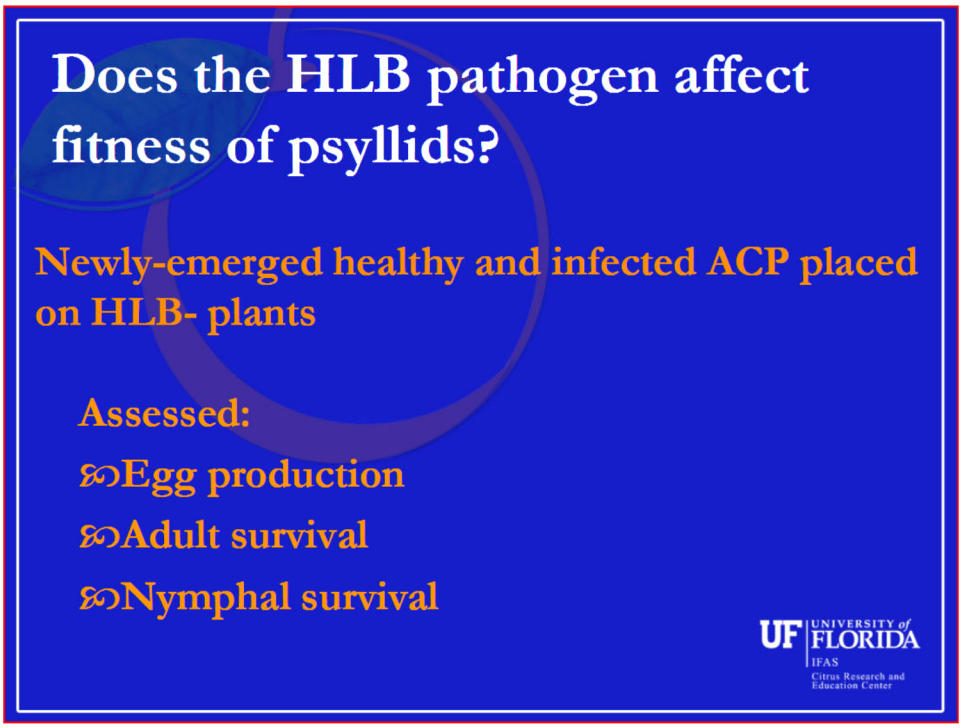

Figure 13. We assessed the egg production, nymphal survival, and adult survival of newly emerged healthy Asian citrus psyllids on uninfected citrus trees, and the newly emerged psyllids placed on HLB-infected trees.

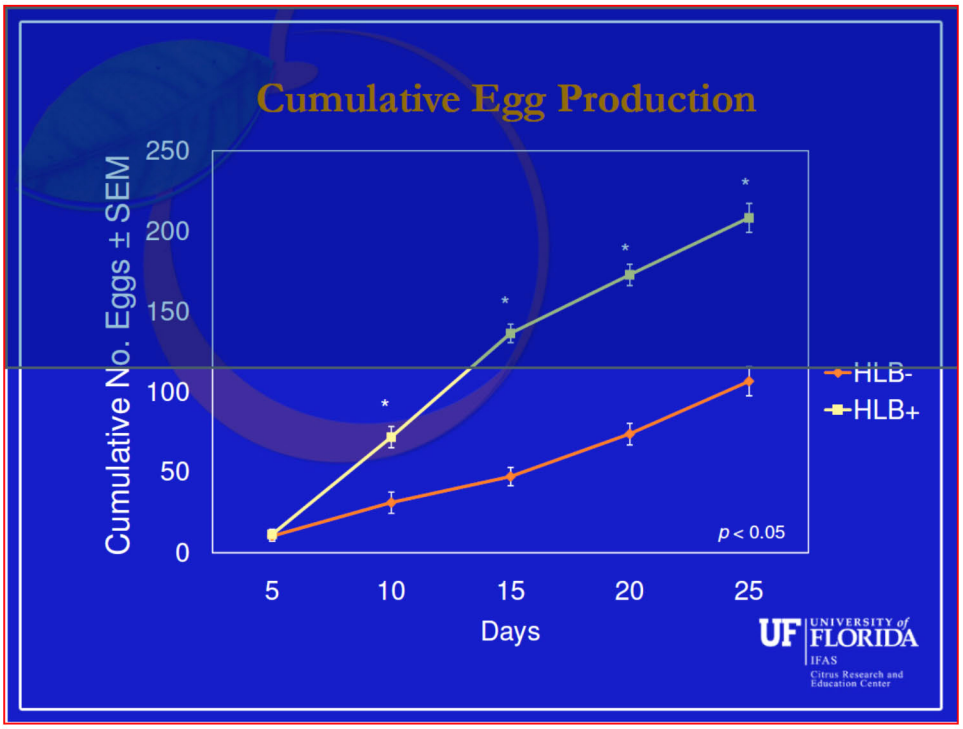

Figure 14. Surprisingly, HLB-infected Asian Citrus Psyllids deposit about two-fold more eggs over their life spans than uninfected psyllids.

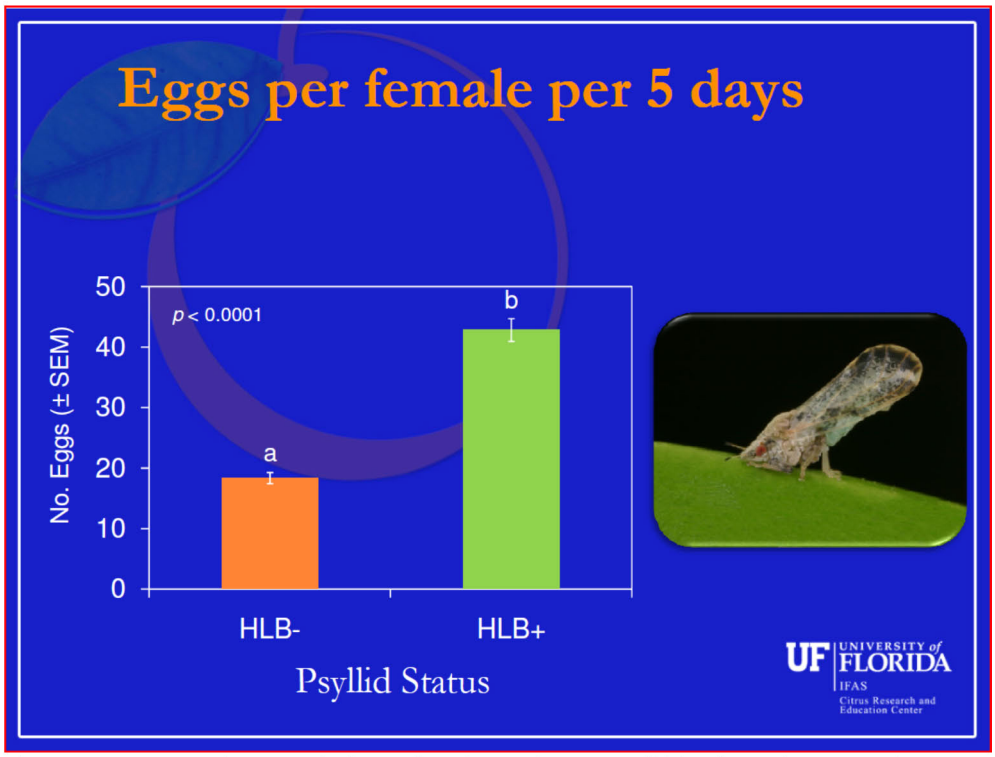

Figure 15. Indeed, HLB-infected Asian Citrus Psyllids deposit more than two-fold more eggs during a five-day period of peak egg laying than uninfected psyllids.

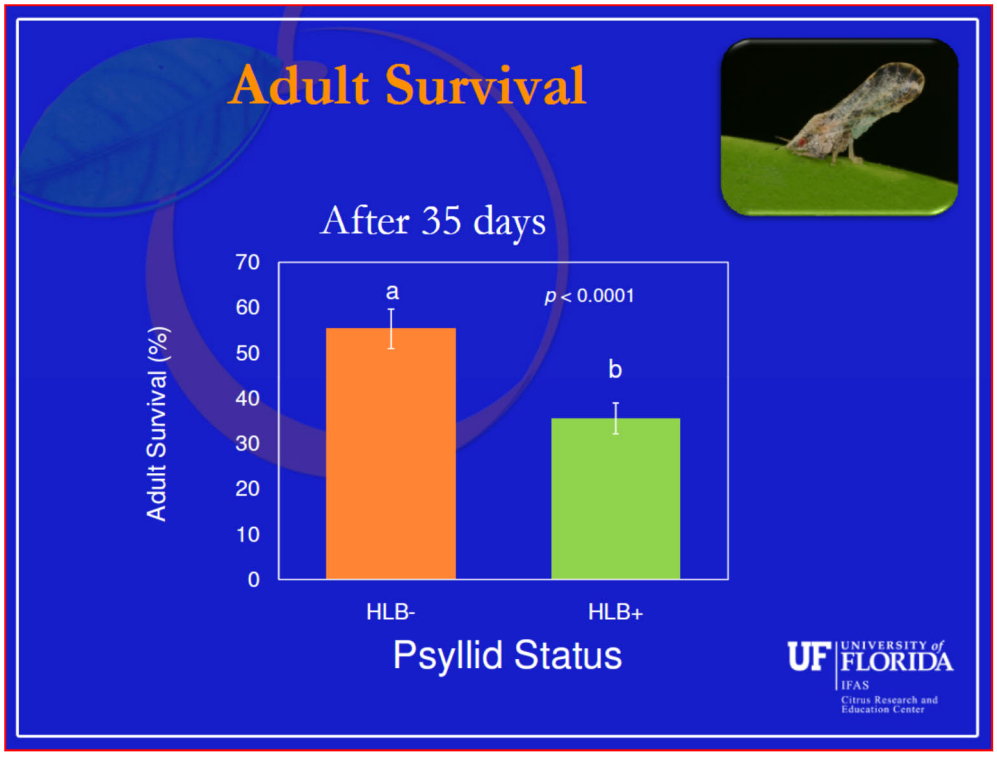

Figure 16. The percent survival of uninfected adult Asian citrus psyllids through 35 days is substantially greater than the survival of infected adult psyllids.

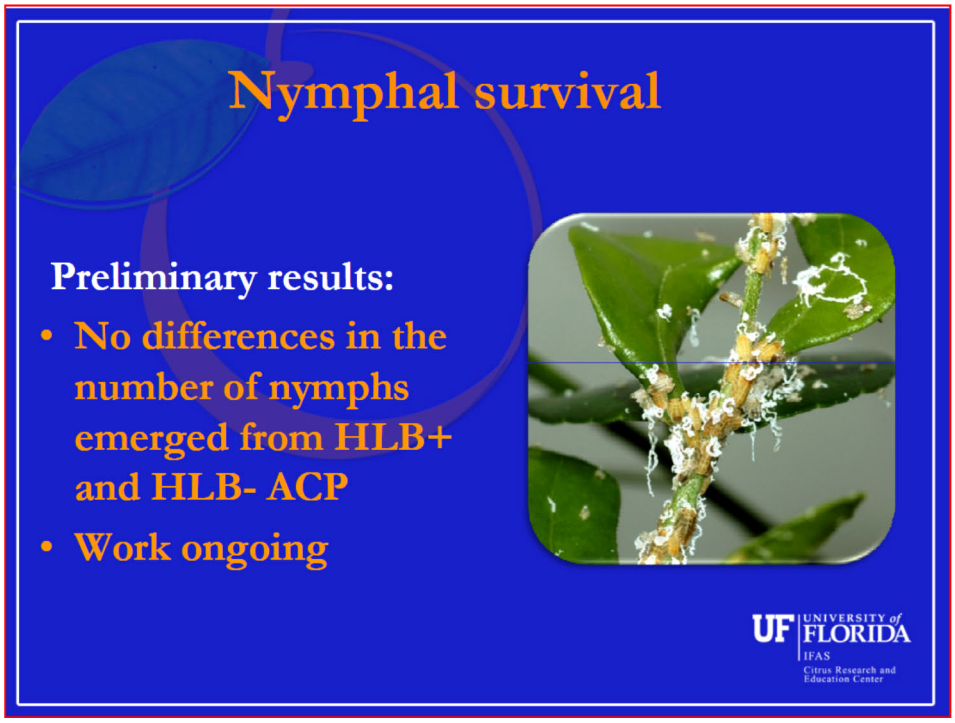

Figure 17. Survival of HLB-infected nymphs has proven to be no different from that of HLB-free nymphs.

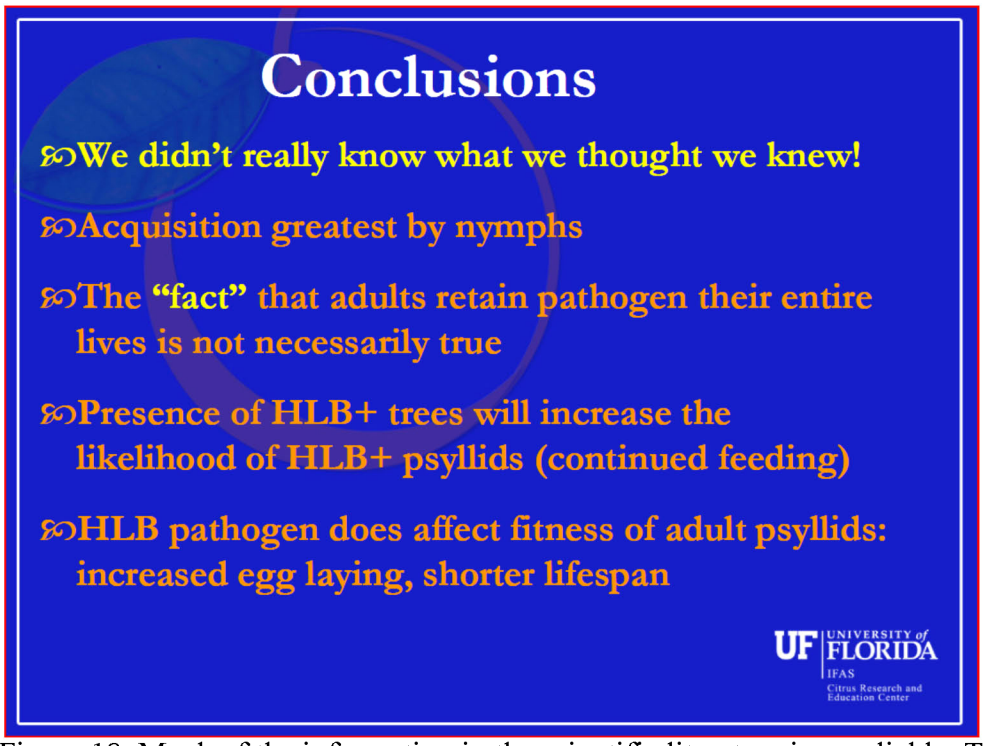

Figure 18. Much of the information in the scientific literature is unreliable. The acquisition of the bacterium from infected trees is greater by nymphs than by adult psyllids. Not all adults retain the bacterium for the duration of their lives. The presence of the bacterium in the phloem increases the probability of prolonged feeding by the psyllids. The bacterium causes psyllids to increase the number of eggs laid and it shortens their lifespans.

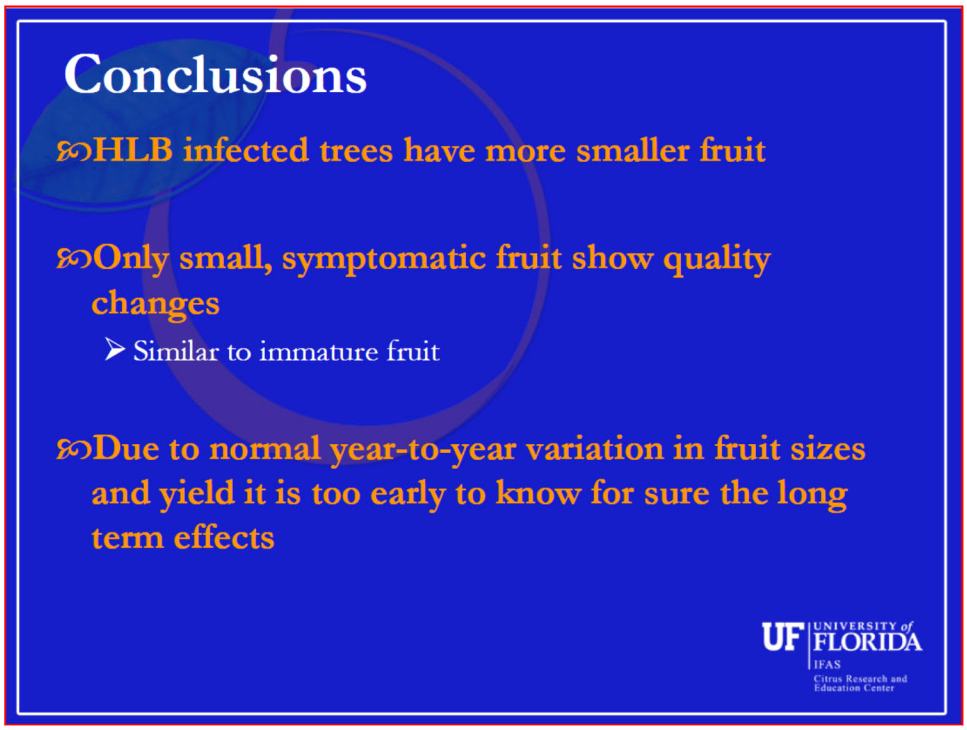

Figure 19. HLB infection causes citrus trees to increase the proportion of small fruit produced. It is the small symptomatic fruits that undergo unequal ripening and have poor or unacceptable quality. The long-term effects of HLB infection on fruit quality and yield have not been characterized quantitatively.

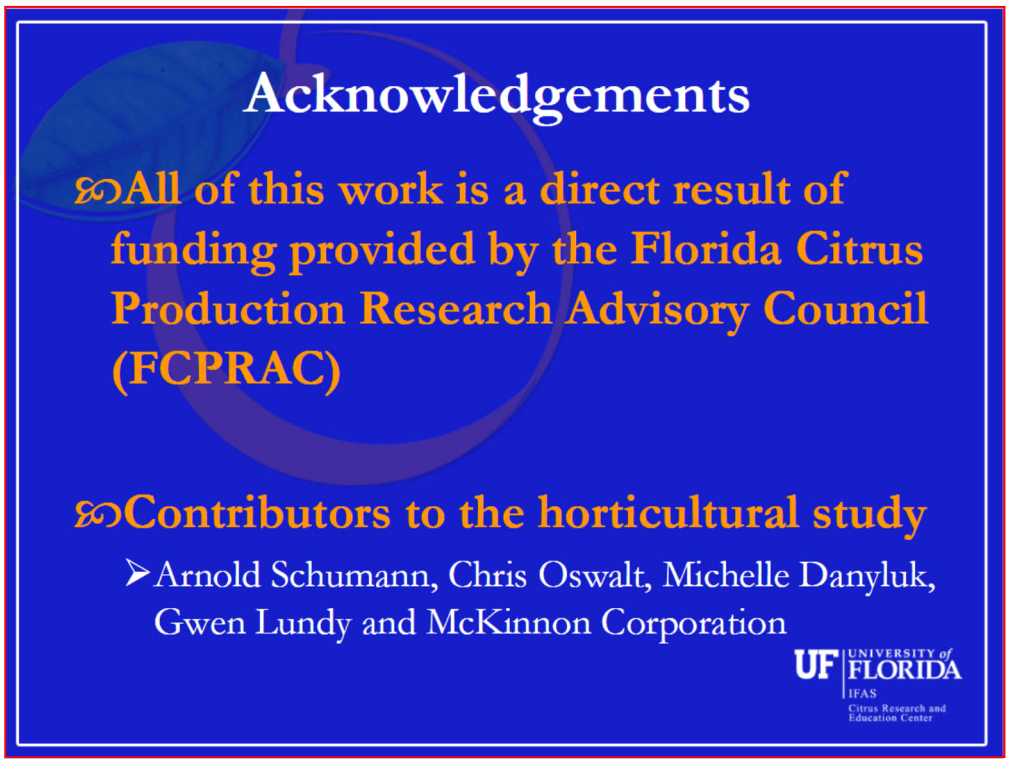

Figure 20. We are grateful to the Florida Citrus Production Research Advisory Council and to many colleagues without whose assistance this study could not have been undertaken.