Citrus Health Management Areas: An Empirical Analysis of the Effect of Coordinated Control on Asian Citrus Psyllid Populations

Kelly A. Grogan
Food and Resource Economics
University of Florida
kellyagrogan@ufl.edu
(352) 294-7633

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**Preliminary analysis- More analysis is necessary before any conclusions can be made regarding the efficacy of Citrus Health Management Areas.

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Kelly Grogan, Assistant Professor, Food and Resource Economics, University of Florida

Huanglongbing

Huanglongbing, commonly known as Citrus Greening Disease, is a major threat to citrus production worldwide.

Effects include:
- bitter fruit
- misshapen fruit
- early fruit drop

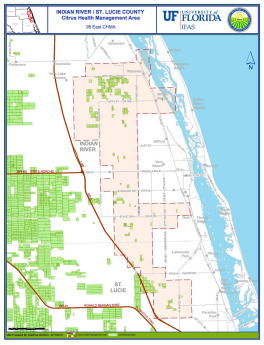
Disease spread:
- vectored by Asian Citrus Psyllid
  - short distance (tree to tree) movement connects neighboring fields
  - long distance movement connects neighboring and non-neighboring fields

Disease Management Options

1. Aggressive psyllid control through insecticide applications to slow spread of the disease
2. Address disease symptoms through foliar applications of nutrients
3. Combinations of (1) and (2)

Citrus Health Management Areas

- Self-defined and self-formed regions of growers
- Participating growers coordinate insecticide applications
  - timing, active ingredient
- Within-CHMA participation varies across time and space
- Psyllid counts taken every three weeks
- 55 CHMAs across the state



Research Questions

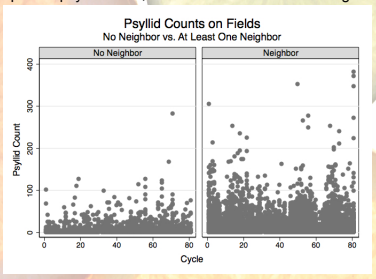
- How do within-CHMA participation rates affect psyllid counts across the CHMA?
- How do state-wide participation rates affect psyllid counts?
- How does intensity of coordination affect psyllid counts?

Data

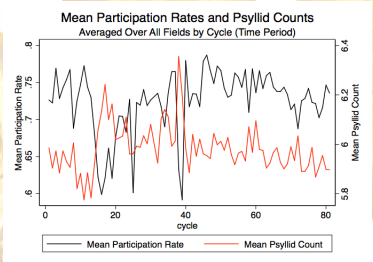
- GIS coordinates of all fields
- Maps allow identification of direct neighbors
- For "participating" growers
  - Psyllid counts taken every three weeks, August 2011 to present
  - Acreage known
  - Participation designated by allowing psyllid counts, not necessarily applying insecticides
- Data to be collected:
  - more accurate participation rates
  - number and kinds of insecticide applications per year

Preliminary Analysis and Results

If spatial coordination is important, we would expect differences between growers with and without direct neighbors. The figure below demonstrates this strikingly. Psyllid counts on fields with at least one neighbor have close to triple the psyllid count, relative to fields with zero neighbors.

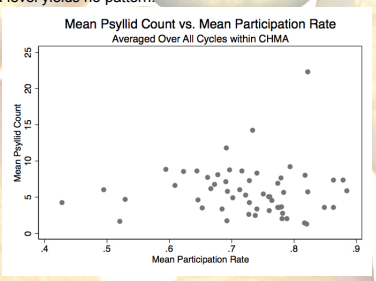


If participation affects psyllid counts, we may see mirrored patterns in psyllid counts and participation rates. The figure below demonstrates this. However, it is unclear if the effect is causal or if psyllid counts affect participation.

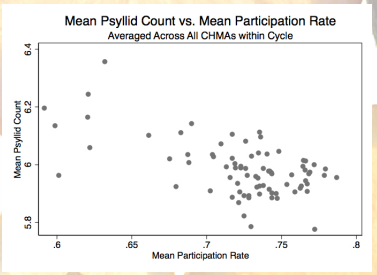


State Level Participation vs. CHMA-Level Participation

The optimal spatial scale at which participation occurs is unknown. Plotting mean psyllid counts at the CHMA-level vs. participation at the CHMA-level yields no pattern.



However, plotting mean psyllid counts by cycle vs. participation by scale yields a negative relationship, suggesting that state-level coordination of insecticide applications may be necessary to reduce psyllid populations effectively. More analysis is needed to confirm this hypothesis.



Next Steps

A more thorough spatial analysis is required to determine how participation rates affect efficacy, and to determine the scale at which coordinated control would be most advantageous.

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