Influence of Mechanical Harvesting on Subsequent Citrus Crop Yields: Is There a Lag-Effect?

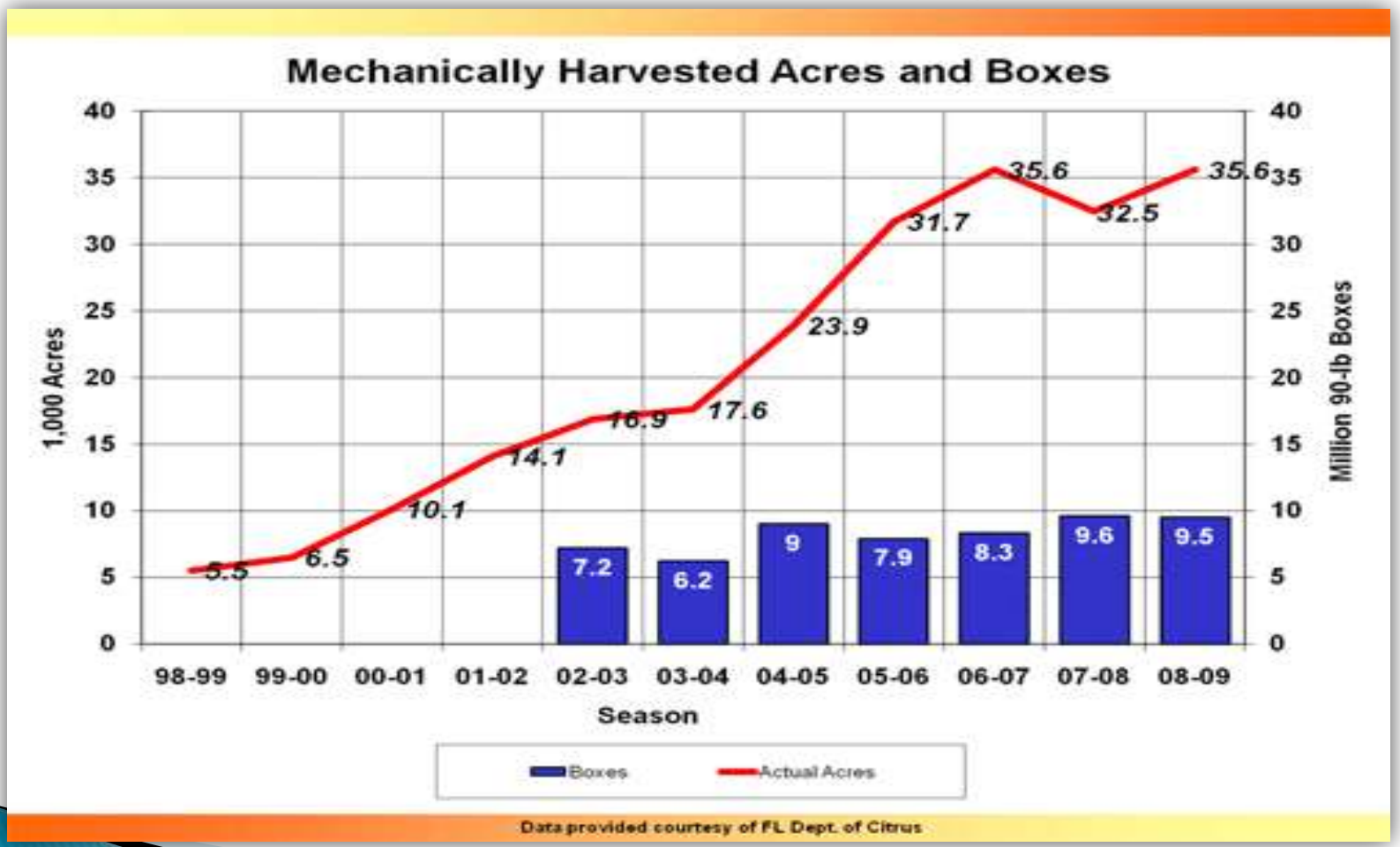
Katrina R. Leonard

MS Thesis April 2010

UF/IFAS FRED

Fritz Roka and Lisa House, committee co-chairs

Total Acreage & Boxes Mechanically Harvested 1997-2009 (FDOC, 2009)



Objective

- To determine if mechanical harvesting has an adverse effect on:
  - Short term crop yield
  - Tree Health
- If yes, to what extent?

Hypotheses

- Hypothesis 1:
  - No yield effect from MH on next year's crop.
- Hypothesis 2:
  - No yield effect after several years of MH.

Literature Review

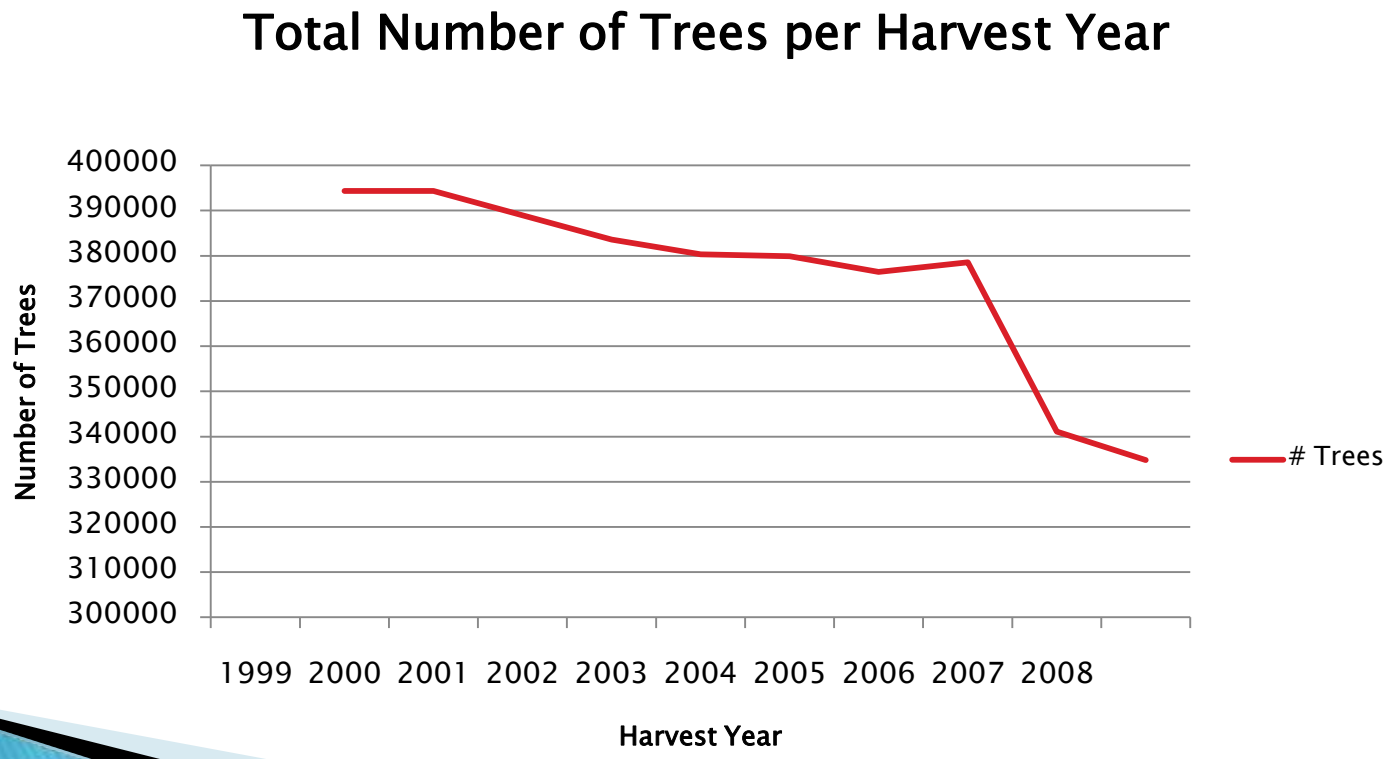
- Coppock (1971), Whitney & Wheaton (1987), Whitney et al. (1986), Li et al. (2005), Li & Syvertsen (2005), and Li et al. (2006)
  - All studies evaluated at least five years of mechanical harvesting treatments.
  - Conclusions: No significant yield reductions noted in any studies –
    - except when Valencia oranges were harvested during the “late-season.”

Data

- Cross Sectional Data:
  - 4 growers (Collier & Hendry counties)
  - 8 groves
  - 47 blocks (5varieties, 4 rootstocks)
- Time Series Data:
  - Yield data by block from 1999-2008
- Grower records:
  - annual yield by block
  - block description
  - method of harvest
    - 55% hand
    - 45% mechanical
- FASS records:
  - tree inventory by block
  - county average yield

Trees Harvested per Year

- Total number of trees harvested per year has declined significantly since 2006



Methodology

- Question:

  Does harvest method influence citrus production?

  Need to isolate harvest method from other influencing factors.

- Methodology:

  Yield (bx/ac) = $a + b_1$(Harvest method) $+ b_n$(other stuff)

  Regression analysis, Ordinary Least Squares (OLS)

Variables considered

- Harv Meth this yr
- Harv Meth last yr
- Years Mechanical

- Other stuff
  - varities (Early, mid, late)
  - rootstock (swingle, carrizo, etc)
  - Tree age & density
  - County yield
  - Grower and grove ID
  - Hurricane

Hurricane Variable

- Hurricane Wilma
  - Hit southwest Florida in 2005
  - Separate time series data into two groups
    - 1999–2003
    - 2004–2008
  - Effect from Hurricane Wilma became apparent in 2005–2006 citrus season and has lingered

Econometric Results

- Rootstock: relative to Carrizo
  - Swingle: Significant and ***positive***
  - Cleo: Significant and negative
- Variety: relative to Valencia
  - Early : Significant and positive
  - Mid: Significant and positive
- Tree age: Significant and positive
- County yield: Significant and positive
- Hurricane: Significant and ***negative***

Econometric Results

- Key finding:
  - Harvest method,
    - current year
    - lag method
    - cumulative years of mechanical

    NOT statistically significant

Variable	Est. Coefficient	Error	Pr > |t|
Intercept	540.92	85.98	< .0001
HarvMeth this yr	-15.62	20.08	0.44
HarvMeth last yr	2.66	23.03	0.91
YRs Mechanical	-0.29	4.16	0.95
Early	124.47	16.47	< .0001
Swingle	108.50	17.64	< .0001
Tree Age	56.89	8.16	< .0001
County Yield	0.51	0.12	< .0001
Hurricane	-112.51	17.06	< .0001

Hypotheses

- Hypothesis 1:
  - No yield effect from MH on next year's crop.

  Fail to reject

- Hypothesis 2:
  - No yield effect after several years of MH.

  Fail to reject

Conclusions

- Using yield data from commercial groves,
  - mechanical harvesting did NOT adversely affect fruit yields