Huanglongbing and the Citrus Industry: Economic Analyses of Management Strategies.

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Outline

1. Overview
   - ✓ Education
   - ✓ Research
   - ✓ Projects
2. Potential Economic Approaches
   - ✓ Present value of total damage cost
   - ✓ Profitability
   - ✓ Benefit/cost analysis
   - ✓ Marketability
3. Concluding Remarks

Education

- ***Ph.D., Agricultural & Applied Economics***

  Texas Tech University, December 2009
- ***M.S., Statistics***

  Texas Tech University, August 2008
- ***M.S., Agricultural & Applied Economics***

  Texas Tech University, May 2004
- ***B.B.A., Finance and Management***

  Ave Maria College, December 2001

Relevant Research

- **Fresh Tomato** Trade among NAFTA Countries
- **Fresh Vegetables** in Dallas-Ft. Worth
- Fresh Tomato Consumption in Northeast Texas
- The Economics of Foliar Fungicide Applications in Winter **Wheat** in Northeast Texas
- Huanglongbing and the California **Citrus** Industry: A Cost Comparison of Do Nothing vs. Do Something Management Practices
- Mexican **Meat** Demand at the Table Cut Level
- The **Dairy** Industry's Derived Demand for Feed Grains and Its Effect on the Cottonseed Market
- European Union **Cotton** Demand

Projects

- Northeast Texas Initiative for Cooperative Development (NTICD). Funded by the Small Socially-Disadvantaged Producer Grant (SSDPG), Rural Business-Cooperative Service, Rural Development, United States Department of Agriculture (with Project Director Jose A. Lopez and collaborators Jim Heitholt, Robert Williams, and Curtis Jones), $175,000. [2013].
- Breaking Barriers for Beginning Hispanic Farmers and Ranchers. Funded by Beginning Farmer and Rancher Development Program (BFRDP), National Institute of Food and Agriculture (NIFA), United States Department of Agriculture (USDA) (with Project Director Bob Williams, and Collaborators Jose A. Lopez, Curtis Jones, and Mario Villarino), $674,768. [2010-2013].
- Alliance to Achieve and Maintain Competitiveness in Logistics within NAFTA through Strategic Leadership (LOGIS). Funded by the Fund for the Improvement of Postsecondary Education (FIPSE), North American Mobility Program in Higher Education, US Department of Education (with Project Director Jennifer Oyler and collaborators), $190,000. [2010-2014].

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Present Value of Total Damage Cost

- This approach requires estimating the total production loss ($/acre) in year *t* and then calculating the present value of the total damage cost ($/acre) over a period of time, say 20 years.
- If nothing is done to manage HLB, the total damage costs ($/acre) from HLB ($D_t$) in year *t* equals the total production loss ($/acre) from HLB in year *t* (TL_t).
- If something is done to manage HLB, the total damage costs ($/acre) from HLB ($D_t$) is the sum of the total loss in production value per acre (TL_t) plus the additional costs associated with limiting HLB spread per acre (AC_t).
- For additional information, refer to Lopez and Durborow (2014).

PV_{Damage}

(1) $TL_t = HP_t - HLBP_t$

(2) $HP_t = \left(HY_t \times k_t \times P_{pt}\right) + \left(HY_t \times (1 - k_t) \times P_{ft}\right)$

(3) $HLBP_t = P_{ft} \times HLBY_{ft} + P_{pt} \times HLBY_{pt}$

(4) $HLBY_{ft} = HLBTY_t - HLBY_{pt}$

(5) $HLBY_{pt} = HLBTY_t \times k_t$

(6) $PV_{Damage} = \sum_{t=1}^{T}(1 + i)^{-t} \times D_t$

Note: Total yield (75-pound cartons per acre) under the presence of HLB ($HLBTY_t$) is estimated differently under do-something and do-nothing approaches.

Do – Nothing Approach

(7) $D_t = TL_t$

(8) $HLBTY_t = HY_t \times RY_t$

(9) $RY_t = e^{(-1.8TD_t)}$

(10) $TD_t = \sum_{j=0}^{j=t} \left(y_j - y_{j-1}\right) s_{t-j}$

(11) $y_t = e^{-(-\ln(y_o))^{e^{-Rt}}}$

(12) $s_t = \dfrac{1}{1+\left(\left(\frac{1}{s_o}-1\right)e^{-rt}\right)}$

Do-Something Approach

(13) $D_t = TL_t + AC_t$

(14) $AC_t = \Delta FC + RT_t + PT_t$

(15) $RT_t = CR \times CTreeL_t$

(16) $PT_t = CP \times CTreeL_{t-1}$

(17) $HLBTY_t = HY_t - DY_t - DY_{t-1} - DY_{t-2} - DY_{t-3} - DY_{t-4} - DY_{t-5}$

(18) $DY_t = \frac{CTreeL_t}{121} \times HY_t$

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Profitability Analysis

- This approach estimates net returns ($/acre) from investing in a management strategy such as the proposed MS3T technology.

$$Rn = P * (Y_t - Y_c) - (C_m + C_a)$$

- P is fresh-orange price ($ per 75-pound carton),
- Y_t is the observed yield from treating with the MS3T technology (75-pound cartons per acre),
- Y_c is the observed yield from control group, such as untreated plots or plots treated with an alternative management strategy (75-pound cartons per acre),
- C_m is the cost of the MS3T technology ($/acre),
- C_a is the application cost of the MS3T technology ($/acre) such as labor.

Profitability Analysis

- The probability of treatment resulting in a yield difference larger than the estimated yield difference needed to offset the cost of the treatment is calculated from the observed yield difference between the treatment and control group and their observed standard deviation which is calculated from a pooled variance.
- The following probabilities are estimated.
- The probability that net returns from treatment will at least break even:

$$PT\,[Rn > (1+0)*(C_m + C_a)];$$

- The probability that net returns from treatment will be at least 25% greater than the investment on the treatment:

$$PT\,[Rn > (1+0.25)*(C_m + C_a)];$$

- The probability that net returns from treatment will be at least 50% larger than the investment on the treatment:

$$PT\,[Rn > (1+0.50)*(C_m + C_a)]$$

Profitability Analysis

$$\mathrm{PT} = 1 - \mathrm{Prob}\, t \left[\frac{\beta_0 - \left(Y_f - Y_c\right)}{S_p \left(\frac{1}{n_t} + \frac{1}{n_c}\right)^{1/2}}, df_e \right]$$

- The yield difference needed to offset the cost of treatment is computed as:

$$\beta_0 = \frac{(1+ER_n)(C_m+C_a)}{P}$$

- This profitability analysis is conducted based on Bayesian inference.
- For additional information, refer to Lopez, Rojas, and Swart (2015).

Other Factors to Consider

- The MS3T Technology is multifunctional allowing for a comprehensive management of HLB and other bacterial and fungal diseases.
- The MS3T Technology is expected to reduce application frequency.
- Integrated Pest Management Strategy

  Copper Zinkicide MS3T

  Copper MS3T Copper MS3T

  MS3T MS3T Copper MS3T MS3T Copper

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Benefit/Cost Analysis

- This approach compares benefits and costs across time by either computing the ratio (benefit/cost analysis) or the difference (net present value analysis) of benefits and costs.

$$\frac{B}{C} = \frac{PV[B_0,\ldots, B_n]}{PV[C_0,\ldots, C_n]}$$

- The present value of streams of benefits ($B_0,\ldots, B_n$) and costs ($C_0,\ldots, C_n$) over a period of n years are:

$$PV[B_0, \ldots, B_n] = \sum_{i=1}^{n} \frac{B_i}{(1+r)^n}$$

$$PV[C_0, \ldots, C_n] = \sum_{i=1}^{n} \frac{C_i}{(1+r)^n}$$

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Marketability

- What market strategy does a firm use to introduce a new product into the market?
- The market strategy to adopt depends on the competitive environment (market structure) in which the firm operates.
- Perfect competition
- Imperfect competition
  - Monopoly
  - Monopolistic Competition
  - Oligopoly

Perfect Competition

- A competitive market made up of many competing firms, each of which is too small for its independent decisions to influence the market in a way perceptible to the firm.
- Characteristics of Perfect Competition:
  - Large number of small firms
  - Homogeneous products/commodities
  - Easy entry into and exit out of the market as prices change
  - Perfect knowledge
  - Mobile resources

Imperfect Competition

- Sales of differentiated products rather than commodities
- Advertising usually profitable
- Firms are price makers to some degree

Monopoly (Seller)

- A monopoly is a market structure where there is only one firm selling a specific commodity/product.
- Characteristics of a Monopoly:
  - There is only one seller of a given commodity
  - The commodity has no close substitutes
  - Entry into the market is very difficult to impossible

Monopolistic Competition

- Monopolistic competition is a market structure where there are many firms, each competing to sell a product or service that is somewhat different
- Also known as differentiated competition
- So much competition that price results may resemble those in perfect competition
- However, if a monopolistic firm is successful in differentiating its product, then it can hold a quasi-monopoly position and can earn monopoly profits

Characteristics of Monopolistic Competition

- Many firms
- Differentiated products
  - Many close substitutes
- Fairly easy entry into the market

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Concluding Remarks

- The PV of the total damage cost is useful for assessing the impact of a new management strategy to an industry.
  - It allows you to assess the cost savings/additions from a new management strategy.
- The profitability analysis is useful to assess whether the yield gain offsets the costs of a new management strategy.
  - It can be enhanced by conducting probabilities, such as the probability of breaking even.
- When benefits and costs can be quantified, the benefit/cost analysis can be used to assess whether or not support a management strategy
- The market penetration strategy to adopt for a new technology depends on the firm's competitive environment.
- Access to data is essential in conducting any economic analysis.

Thank You!

REFERENCES

Lopez, J.A., K. Rojas, and J. Swart. 2015. "The Economics of Foliar Fungicide Applications in Winter Wheat in Northeast Texas." *Crop Protection*, 67:35-42.

Lopez, J.A. and S. Durborow. 2014. "Huanglongbing and the California Citrus Industry: A Cost Comparison of Do Nothing vs. Do Something Management Practices." *Texas Journal of Agriculture and Natural Resources*, 27:51-68.