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FE915

Evolution of Citrus Disease Management Programs and Their Economic Implications: The Case of Florida's Citrus Industry[1]

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Introduction

This article focuses on the expanded costs of managing exotic citrus diseases as they become endemic or established within a citrus industry; Florida is used as an example. The situation in Florida began before 2004, when citrus tristeza virus (CTV) and blight-decline were the major disease problems. Average annual pest control sprays were two sprays for processed juice fruit and six sprays for fresh market grapefruit. After the 2004–2005 hurricanes and termination of the citrus canker eradication program in 2006, the number of sprays to manage canker and other diseases increased to 3–4 sprays for processed juice fruit and 10 sprays for fresh market grapefruit. With the 2005 discovery of Huanglongbing (HLB) in Florida and citrus black spot in 2010, costs continued to increase, with annual pest control sprays of 8–9 sprays for processed juice fruit and 14 for fresh market grapefruit. Since 2003–2004, Florida's processed orange production/cultural costs have increased more than 107%, fertilizer costs have increased more than 160%, and spray–pesticide costs have increased more than 170%. Breakeven costs have also increased, ranging from 33% to 39% higher, depending on variety and yield. Fresh market grapefruit has had a comparable cost increase. Thus, managing new exotic endemic diseases is very costly, and it is imperative that state and federal governments focus on preventing the introduction of other diseases such as citrus variegataed cholorosis (CVC) and citrus leprosis virus (CiLV).

Total costs and, specifically, spray costs have increased in Florida as the citrus industry has gone from basically just a few diseases, such as blight and tristeza, to exotic diseases, such as citrus canker, HLB-greening, and citrus black spot. In this article, spray costs refer to pest management costs, and cost increases are compared to the base cost values. Using 2010–2011 US dollar values as the basis for comparison, the total base cultural costs without these exotic diseases for processed juice fruit would be $1,154/acre (spray costs, $190/acre) and fresh market grapefruit $1,368/acre (spray costs, $393/acre). Adding in these new diseases, the total cultural costs increase to $1,669/acre (spray costs, $453/acre) for processed juice fruit and $2,142/acre (spray costs, $928/acre) for fresh market grapefruit.

Changes in Production/Cultural Costs for Processed Oranges in Florida

Citrus production/cultural costs in Florida more than doubled between 2003 and 2011 (**Table 1**). These costs

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are not adjusted for inflation and reflect "nominal" values. Costs increased primarily because of higher input costs (fuel/energy, chemicals, and fertilizer) and the need to increase spray applications to control pests and diseases. Over this eight-year period, spray costs increased 170%, fertilizer costs increased 160%, and total costs increased 107%. Fresh market citrus had similar increases in cost during this same period.

Other citrus-producing countries have not been immune to the increase in production costs. In 2003, Florida's delivered-in cost to a juice processor was over three times higher than production costs in Sao Paulo (Brazil). By 2011, Florida costs were only 30% higher than Sao Paulo's costs.

Evolution of Citrus Disease Management Programs and Their Economic Implications

Annual citrus cost budgets have been published for these three Florida citrus production regions for over 25 years. These production areas are referred to as North and Central Ridge, Southwest Florida, and Indian River (**Figure 1**). Annual budget costs and other economic information about Florida citrus can be found at the following website: http://www.crec.ifas.ufl.edu/extension/economics.

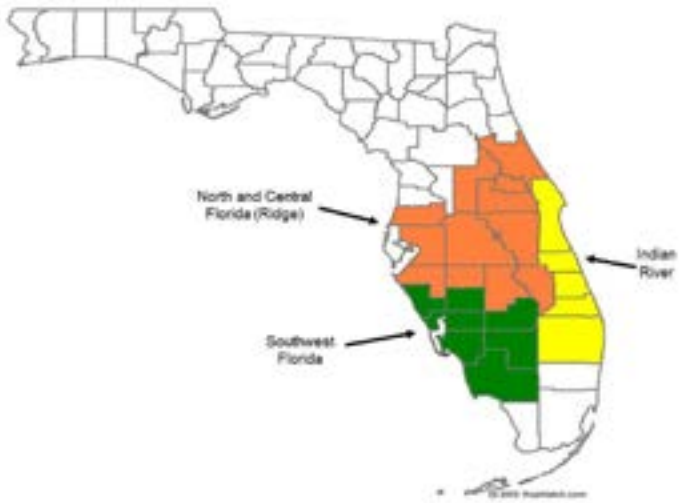

Figure 1. Three primary citrus production regions in Florida (North and Central Ridge, Southwest, Indian River). Credits: © 2005 MapWatch.com

The cost examples shown in this article represent late-variety Valencia processed juice oranges for the Central region, early-variety Hamlin processed juice oranges for the Southwest Florida region, and fresh market grapefruit for the Indian River region. In order to remove inflationary effects and to focus on just the economic factors, all costs have been adjusted to 2010–2011 US dollar values.

Before Citrus Canker, HLB, and Black Spot

Before 2005, citrus blight and, for citrus scion varieties grafted on sour orange rootstock, citrus tristeza were the two primary disease concerns in Florida. Both diseases restrict the uptake of nutrients from the roots to the tree canopies, resulting in a decline in tree health and economic productivity. Citrus canker has been a serious concern in commercial groves since 1998, when the Florida Citrus Canker Eradication Program was still in force.

Pest-management and spray programs for processed juice fruit consisted of two annual sprays, sometimes three if needed. Fresh market grapefruit averaged six sprays each year. The total cultural costs adjusted to 2010–2011 US dollar values for processed oranges were $1,143.85/acre for Valencia oranges (spray costs, $202.12/acre); $1,164.30/acre for Hamlin oranges (spray costs, $178.51/acre); and $1,368.37/acre for fresh market grapefruit (spray costs, $393.05/acre). The base cultural costs before citrus canker, HLB, and black spot diseases are shown in **Table 2**.

With Citrus Canker

During 2004 and 2005, four hurricanes and one tropical storm with strong winds and rain crossed Florida, resulting in a widespread dispersion of citrus canker throughout Florida's main citrus production regions. In 2006, Florida's citrus canker eradication program was terminated, and citrus canker became endemic in Florida. Growers began managing citrus canker with additional copper sprays: one additional copper spray for Valencia oranges, which are less susceptible to citrus canker; two additional sprays for Hamlin oranges; and four additional copper sprays for fresh market grapefruit. In some locations, natural windbreaks were planted as part of the canker management program for fresh market citrus. To comply with fresh market regulatory rules imposed by the USDA and by foreign markets, particularly Europe, fresh market citrus growers had to certify that grove blocks and fruit packed in cartons were free of citrus canker.

With the need to manage citrus canker after the eradication program ended, the total cultural costs for processed oranges increased to $1,186.80/acre for Valencia oranges (spray costs, $245.07/acre); $1,237.99/acre for Hamlin oranges (spray costs, $252.20/acre); and $1,565.93/acre for fresh market grapefruit (spray costs, $591.61/acre). The changes in total costs represented 4%, 6%, and 14% increases in total cultural costs for processed Valencia and

Hamlin oranges and fresh market grapefruit, respectively. Spray costs increased 21% for Valencia oranges, 41% for Hamlin oranges, and 51% for fresh market grapefruit (**Table 3**).

With HLB

In 2005, HLB was found in Florida. By 2006, growers began implementing an HLB management program advocated by Sao Paulo (Brazil) growers who had discovered HLB 18 months earlier. The standard HLB control program was to control the Asian citrus psyllid which is the insect that transmits HLB disease, to scout every tree at least four times a year to locate HLB symptomatic trees, and to eliminate symptomatic trees as soon as possible. By 2010, most Florida growers had moved away from scouting and eradicating symptomatic trees, but remained focused on spraying to control psyllids.

In 2010, Citrus Health Management Areas (CHMAs) began to be organized by growers. In 2012, there were 35 active CHMAs in Florida (http://www.crec.ifas.ufl.edu/extension/chmas/index.shtml). The purpose of CHMAs is to encourage neighboring citrus growers to work together to combat HLB, particularly through the coordination of psyllid control efforts. More aerial and ultra-low-volume spray applications have been incorporated into the psyllid control program. Local CHMAs encourage coordinated sprays to provide enhanced psyllid management over a wide geographical area as compared to isolated actions. The processed spray program for psyllids increased to seven sprays for Valencia oranges, eight sprays for Hamlin oranges, and 11 sprays for fresh market grapefruit.

By 2010, in response to HLB, total cultural costs for processed oranges increased to $1,567.88/acre for Valencia oranges (spray costs, $389.32/acre); $1,571.81/acre for Hamlin oranges (spray costs, $346.26/acre); and $1,770.04/acre for fresh market grapefruit (spray costs, $685.08/acre). The changes in total costs represented 37%, 35%, and 29% increases in total cultural costs for processed Valencia and Hamlin oranges and fresh market grapefruit, respectively. Spray costs increased 93% for Valencia oranges, 94% for Hamlin oranges, and 74% for fresh market grapefruit (**Table 4**).

With Citrus Canker, HLB-Greening, and Black Spot

In 2010, citrus black spot was found in a Southwest Florida citrus grove. It is suspected that this disease may have been introduced in the grove several years before environmental conditions enabled the disease to fully express itself. Although this disease does not affect the internal quality of citrus fruit, it will cause excessive fruit drop in both young and mature fruit if left unchecked (http://www.crec.ifas.ufl.edu/extension/black_spot/citrus_black_spot.shtml). As of the spring of 2012, the disease was confined to a small area in Southwest Florida. The concern is that this disease will eventually spread throughout Florida's commercial citrus producing regions.

The current recommendation for black spot disease control includes timely sprays alternating between copper and strobilurins. These chemicals can be included with other sprays to control citrus canker and the Asian citrus psyllid. However, at least one or two additional high-volume ground sprays are likely to be needed to manage black spot. Processed fruit spray programs for all three exotic diseases increased to eight sprays for Valencia oranges, nine sprays for Hamlin oranges, and 14 sprays for fresh market grapefruit.

The 2010–2011 total costs for managing the three exotic diseases (citrus canker, HLB, and black spot) are shown in **Table 5**. Processed fruit spray programs for all three exotic diseases increased to eight sprays for Valencia oranges, nine sprays for Hamlin oranges, and 14 sprays for fresh market grapefruit. Total cultural costs for processed oranges increased to $1,656.20/acre for Valencia oranges (spray costs, $477.84/acre); $1,681.09/acre for Hamlin oranges (spray costs, $455.53/acre); and $2,141.94/acre for fresh market grapefruit (spray costs, $928.29/acre). The changes in total costs represented 37%, 35%, and 29% increases in total cultural costs for processed Valencia and Hamlin oranges and fresh market grapefruit, respectively. Spray costs increased 136% for Valencia oranges, 155% for Hamlin oranges, and 136% for fresh market grapefruit.

Enhanced Foliar Nutrient Program

While most Florida citrus growers had stopped eradicating HLB-symptomatic trees by 2010, growers are continuing to focus on controlling the psyllid to reduce HLB infection. In addition, at least 80% of the growers are now using an Enhanced Foliar Nutritional Program (EFNP) to try to maintain the health and productivity of citrus trees. Initial observations from growers are that HLB-symptomatic tree yields have stopped declining and healthy tree yields have marginally increased. Many of these growers are continuing to reset/replant trees eradicated from other causes, such as citrus blight, tristeza, etc. The annual non-HLB tree loss rate is about 3%. Under a scout-and-eradicate HLB-symptomatic trees program, the additional annual tree rate was assumed to be 2%–3%.

Numerous EFNPs exist, each with different combinations of foliar nutrients for application to citrus trees. The total nutrients applied with the traditional, or normal dry bulk, fertilization program are usually reduced by the amount of those same nutrients being applied by the foliar nutrient sprays. The foliar nutrient spray applications range from three to six per year. As of July of 2012, no information was available to evaluate or compare the effectiveness of these programs, but cost comparisons are available for several EFNPs being applied (**Table 6**).

The costs of three foliar nutrient programs (**Table 6**) are compared to the traditional HLB management program, which includes scouting and HLB-symptomatic tree removal. Without tree reset/replacement, all three alternatives are higher than the traditional HLB management program: $118.78 for alternative #1, $168.85/acre for alternative #2, and $272.92 for alternative #3.

When reset/replacement costs are included, the total costs for the traditional HLB program increases by $208/acre. Most of this increase is due to replacing eradicated HLB symptomatic trees. Although the total costs with resets for alternatives #1, #2, and #3 increased, the cost differences when compared with the traditional cultural program decreased. Under the reset scenarios, the cost differences were $34.74/acre, $84.81/acre, and $188.88/acre for alternatives #1, #2, and #3, respectively.

Summary of the Cost Progression to Manage Citrus Diseases

Since 2003–2004, Florida's processed orange production/cultural costs have increased more than 107%. Over this same eight-year period, fertilizer costs have increased more than 160% and spray–pesticide costs increased more than 170%. Breakeven costs have also increased dramatically since 2003–2004, ranging from 33% to 39% higher, depending on variety and yield. Fresh market grapefruit has had a comparable cost increase.

The cost increases have been partially due to an increase of production inputs: labor, fuel-energy, fertilizer, and agricultural chemicals. However, the major driving factor is the management of new exotic diseases: citrus canker, HLB, and citrus black spot. Costs for managing citrus canker increased due to maintaining the 21-day copper spray time interval to minimize fruit drop and to grow "blemish free" fruit for the domestic and international fresh fruit markets. Early processed fruit varieties, such as Hamlin oranges, will require additional copper sprays to protect them from excessive fruit drop.

The cost of managing HLB in Florida should level off due to the use of more ultra-low-volume sprayers and aerial application. These spray application methods used to control the Asian citrus psyllid will reduce application costs and will allow growers to spray more frequently and use pesticides more efficiently. Also, grower participation in the CHMA program will enable timely spray applications for reducing the potential infestation of citrus greening.

Citrus black spot is a major concern with Florida citrus growers. Hopefully, this disease can be contained in Southwest Florida through effective sanitation methods before moving personnel and equipment from infected groves and by covering fruit transport trailers with tarps. For those growers who have to employ these sanitation procedures and the additional sprays to control black spot disease, these measures will result in much higher production/cultural costs. It will be a necessary for growers to receive higher fruit prices to cover the higher costs. Thus, managing new exotic endemic diseases is very costly, and it is imperative that state and federal governments focus on preventing the introduction of other diseases such as CVC and leprosis.

Table 1. Production costs for a Southwest Florida processed orange grove over ten years old

	2002–2003 without Citrus Canker and HLB		2010–2011 with Citrus Canker and HLB	
	$/Acre	% of Total	$/Acre	% of Total
Weed Control & Herbicide	183.13	23.6	195.91	12.3
Spray–Pesticide	**137.18**	**17.7**	**372.05**	**23.3**
Fertilizer & Lime/Calcium	**136.09**	**18.1**	**357.62**	**22.4**
Pruning/Topping	28.03	3.6	34.02	2.1
Tree Removal/Resets	102.44	13.2	274.33	17.2
Irrigation & Ditch Maintenance	184.16	23.7	222.27	13.9
HLB Scouting Management & Canker Decontamination	**0.00**	**0.0**	**141.41**	**8.8**
Total Production Costs	**771.03**	100.0	**1,597.61**	100.0
Note: Costs expressed as nominal values.				

Table 2. Costs for basic Florida citrus cultural care program prior to citrus canker, HLB, and black spot diseases, 2010–2011 (cost basis)

Annual Base Grove Care Per Acre (Mature Grove) 2010–2011	# of Spray Applications	Total Costs including spray costs (US$/Acre)	Spray Costs (US$/Acre)
Valencia (Central)	**(2)**	1,143.85	202.12
Hamlin (SW FL)	**(2)**	1,164.30	178.51
Grapefruit (Indian River)	**(6)**	1,368.37	393.05

Table 3. Costs for basic Florida citrus cultural care program with citrus canker, 2010–2011

With Canker 2010–2011	# of Spray Applications	Total Costs including spray costs (US$/Acre)	% Increase	Spray Costs (US$/Acre)	% Increase
Valencia (Central)	**(3)**	1,186.80	4%	245.07	21%
Hamlin (SW FL)	**(4)**	1,237.99	6%	252.20	41%
Grapefruit (Indian River)	**(10)**	1,565.93	14%	591.61	51%

Table 4. Costs for basic Florida citrus cultural care program with HLB, 2010–2011

With HLB 2010–2011	# of Spray Applications	Total Costs including spray costs (US$/Acre)	% Increase	Spray Costs (US$/Acre)	% Increase
Valencia (Central)	(7)	1,567.68	37%	389.32	93%
Hamlin (SW FL)	(8)	1,571.82	35%	346.26	94%
Grapefruit (Indian River)	(11)	1,770.04	29%	685.08	74%

Table 5. Costs for basic Florida citrus cultural care program with citrus canker, HLB, and black spot disease, 2010–2011

With Canker, HLB, and Black Spot 2010–2011	# of Spray Applications	Total Costs including spray costs (US$/Acre)	% Increase	Spray Costs (US$/Acre)	% Increase
Valencia (Central)	**(8)**	1,656.20	45%	477.84	136%
Hamlin (SW FL)	**(9)**	1,681.09	44%	455.53	155%
Grapefruit (Indian River)	**(14)**	2,141.94	57%	928.29	136%

Table 6. Cost comparison of traditional HLB management program to enhanced foliar nutrient programs, 2010–2011

	Traditional HLB Management	Foliar Nutrient Alternative #1	Foliar Nutrient Alternative #2	Foliar Nutrient Alternative #3
Number of Foliar Nutrient Sprays	--	4	5	6
	$/Acre	$/Acre	$/Acre	$/Acre
Production Costs	1,473.40	1,401.11	1,401.11	1,401.11
Foliar Nutrient Program	--	191.07	241.14	345.21
Total Production Costs Without Reset/ Replacement Trees	1,473.40	1,592.18	1,642.25	1,746.32
Cost Difference with Traditional HLB Management	0.00	118.78	168.85	272.92
Total Production Costs With Reset/Replacement Trees	1,681.09	1,715.83	1,765.90	1,869.67
Cost Difference with Traditional HLB Management	0.00	34.74	84.81	188.88

Source: Data provided by author Ronald P. Muraro, UF/IFAS, CREC, Lake Alfred, FL; with contribution from Fritz M. Roka, UF/IFAS SWFREC, Immokalee, FL. http://www.crec.ifas.ufl.edu/extension/economics