AgInfomatics

The Value of Neonicotinoids in North American Agriculture:

A Case Study of Neonicotinoid Use in Florida Citrus

2014

This report series, researched and produced by AgInfomatics, LLC, is a comprehensive analysis of the economic and societal benefits of nitroguanidine neonicotinoid insecticides in North America. The research was sponsored by Bayer CropScience, Syngenta and Valent in support of regulatory review processes in the United States and Canada, with Mitsui providing additional support for the turf and ornamental studies.

AgInfomatics, an agricultural consulting firm established in 1995 by professors from the University of Wisconsin-Madison and Washington State University, conducted independent analyses exploring the answer to the question: *What would happen if neonicotinoids were no longer available?* Comparing that answer to current product use revealed the value of neonicotinoids.

Robust quantitative and qualitative study methods included econometrics modeling of insecticide use, crop yield data and market impacts; surveys of growers, professional applicators and consumers; regional listening panel sessions; and in-depth case studies.

Active ingredients in the study included clothianidin, dinotefuran, imidacloprid and thiamethoxam.

The Value of Neonicotinoids in North American Agriculture

Reports include:

Estimated Impact of Neonicotinoid Insecticides on Pest Management Practices and Costs for U.S. Corn, Soybean, Wheat, Cotton and Sorghum Farmers

Methods and Assumptions for Estimating the Impact of Neonicotinoid Insecticides on Pest Management Practices and Costs for U.S. Corn, Soybean, Wheat, Cotton and Sorghum Farmers

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Executive Summary

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As part of a project to understand the benefits and value of neonicotinoids in North American agriculture, AgInfomatics conducted case studies of two growers in different production systems. Citrus in Florida and cotton in the Mid-South were selected as the focus of these cases in order to explore more deeply concerns expressed at grower and industry professional listening sessions, that the loss of neonicotinoids could lead to dramatic and severe changes in those crop production systems. In each case, listening session participants said that those changes could threaten the ongoing production of the crop and lead to negative economic multiplier effects throughout rural communities. The cases were selected after these growers participated in a grower listening session. Both growers were interviewed during site visits to their operations in spring 2014.

Although citrus and cotton represent a relatively small crop acreage compared to corn, soybean or canola, these case studies illustrate potential unintended consequences that the loss of neonicotinoids could have on growers, agricultural professionals and communities associated with citrus and cotton production. Such insights should be taken into consideration by regulators or policymakers contemplating policies affecting their use.

This case study examines the value of neonicotinoids in citrus production by focusing on a single grower in central Florida. It describes his operation, his use of neonicotinoids, interactions with beekeepers, and concerns raised by this grower and others about potential impacts on Florida citrus and Florida's rural communities if neonicotinoids are no longer available.

1.0 Context and Background

Florida citrus growers (orange, grapefruit and specialty fruits) have been fighting for nearly a decade to save their trees from "citrus greening" disease, also known as Huanglongbing (HLB). Researchers attribute HLB disease to the bacterium "*Candidatus Liberibacter asiaticus,*" which is introduced to citrus trees (all varieties) by the Asian citrus psyllid when it feeds on citrus leaves and stems.[1] Once a tree is infected, the fruit becomes unusable for juice or as fresh produce, yields decline, and the tree withers and dies within a few years. Although the HLB pathogen can also be introduced through grafting infected wood onto a healthy tree, citrus growers are mainly concerned with HLB transmission from the Asian citrus psyllid.

Based on 2014 data, there are approximately 500,000 acres of citrus in Florida, just over half of the citrus acreage that existed 40 years ago. Florida citrus production and processing are concentrated in central and southern Florida, but groves are found across much of the state. The contribution of citrus to Florida's economy is roughly $9 billion per year, providing around 76,000 full-time and part-time jobs.[2] Approximately 90 percent of Florida citrus is processed into juice, and the remainder is shipped as fresh fruit.

Disease, freezes and hurricanes have contributed to declining citrus acreage through the years and have also shortened the expected lifespan for citrus groves. While historically citrus trees could be productive for 40 years or more, disease and natural disasters over the past 40 years, culminating in HLB, have led to less predictable longevity. Citrus growers manage their groves as

“blocks” of trees, which may be planted with different varieties at different densities per acre. Trees vary substantially in the amount of fruit produced. When trees are no longer productive (due to age, damage or disease), they are removed and replaced with “resets” (single trees planted to replace individual diseased trees within a mature block) and “solid sets” (a whole block of new trees). New trees take three to four years to grow into fruit-producing maturity, and five to seven years before they are fully productive. At a density of 165 trees per acre, a solid-set block of trees would cost roughly $10,000-plus dollars per acre to plant and bring into production.

Growers are particularly concerned about protecting these young reset trees from HLB during the three to four years they take to mature. The most effective approach for protecting juvenile reset trees is applying neonicotinoid products in a prescribed volume to the soil at the base of the young tree.[3] Although called a “soil-drench” method, it is a precise application of a measured amount of insecticide solution. Foliar applications of neonicotinoids are also allowed by label but are less effective than a soil application, and the period of protection for each application is much shorter. Because of this shorter protection period and concerns about Asian citrus psyllid becoming resistant to this mode of action, growers minimize foliar applications of neonicotinoids.[4] Throughout citrus regions of Florida, growers use foliar applications of other (non-neonicotinoid) modes of action, including pyrethroids, organophosphates and carbamates, to control the overall psyllid populations; and they coordinate control efforts through Citrus Health Management Areas (CHMAs).

The use of neonicotinoids by citrus growers illustrates the complexities and potential unintended consequences if they were no longer available or further restricted. Without neonicotinoids as a tool to protect the young reset trees, growers and investors may be unwilling to assume the costs and risks of new production. Growers are concerned that in that situation, it would be very difficult to plant new trees, that growers may simply harvest existing trees as long they can, and that the entire Florida citrus industry would decline beyond recovery without viable replacement trees. Losing viable citrus production in Florida would have a ripple effect on jobs in harvesting, processing and packing plants; transportation; and multiple agricultural services, including equipment sales and consulting. The further decline or loss of Florida citrus would have dramatic effects on communities throughout the citrus regions of Florida and would increase reliance on imported juice from other countries.

2.0 Grower Introduction

Lindsay Raley is a citrus grower based in Lakeland, Florida, with roughly 1,200 acres of citrus groves in Polk, Highlands and Hardee counties. He is president of Raley Groves, the family citrus business. Raley’s family has been involved with Florida citrus since the 1920s. His mother was among the first women to run a family citrus business in Florida, taking leadership of the operation when her first husband died. Lindsay grew up working in the groves, and he returned to the family business after completing a Bachelor of Science degree in geography at the University of Colorado.

I believe the loss of neonicotinoids would have a devastating impact on the Florida citrus industry. Neonicotinoids are currently the only real protection Florida growers have in their toolbox to be able to protect their young trees from HLB infection. The loss of neonicotinoids would make an already very difficult situation much, much harder to manage.

Lindsay Raley
Citrus grower, Lakeland, Florida

Raley grows primarily round oranges (juice oranges like Valencia, Hamlin, Mid Sweet) intended for processing, along with some tangerines, some grapefruit (about 30 acres) and about 20 acres of peaches, using new varieties developed at the University of Florida. In addition to managing the family citrus operation, Raley has several organizational roles. He is both president and chairman of the board for the Dundee Citrus Growers Association (DCGA) in Dundee, Florida. He is also a member on the board of directors of Florida's Natural Growers Cooperative in Lake Wales, Florida, and has served as a member of the Florida Citrus Commission.

In his role as president and chairman of the DCGA, he helps oversee operation of the association, a grower-owned agricultural cooperative with more than 100 grower members as well as citrus packing plants in Dundee and Lake Hamilton, Florida. The DCGA also processes fruit from other grower associations that no longer operate their own packing plants. The fresh citrus season in Florida generally runs from late September through June, with processing from December to June. During peak season, the packing plants employ more than 300 people.

Through the years, Raley Groves has survived a range of citrus production challenges, and Raley manages the groves to ensure appropriate fertilization and control of various pests and disease. Most fertilizers are applied as dry blends three to four times per year, following a nutrient management plan. His groves also use a combination of drip irrigation and micro-jet applications as part of fertigation and chemigation systems. Young trees are fertigated through drip irrigation on a biweekly schedule throughout the growing season (spring through fall), although one high-density test plot is fertigated daily. In addition to the soil-drench application of neonicotinoids, he uses foliar application of pyrethroids and organophosphates for pest management.

3.0 Use of Neonicotinoids in the Production System

Raley relies on neonicotinoids to protect young reset trees, up to about three or four years, from Asian citrus psyllid and HLB. He uses three neonicotinoid products registered for use on Florida citrus on a schedule developed by the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS).[5] The products are Admire® Pro (imidacloprid), Platinum® 75 SG (thiamethoxam), and Belay® 50 WDG (clothianidin). Raley uses a soil-drench application on his young trees at labeled rates. The drench application is administered through a hand-held, trigger-controlled spray wand that delivers a pre-measured, 8 ounce mixture per "shot." The shot is applied to the ground near the tree. Very small trees receive one shot on the ground near the tree; larger trees get two or three shots depending on size. Raley is confident the neonicotinoid is working because the trees show no sign of leafminers, which neonicotinoids also control. Although neonicotinoids are registered for foliar applications, he uses that method judiciously out of concern for managing pest resistance.

Most of Raley's groves have about 145-165 citrus trees per acre, although he is experimenting with a higher density of around 300 trees per acre in one 3-year-old set. Each pesticide has label limitations that specify total allowable amounts of active ingredient that can be used per acre per year. Higher density reset plantings are treated with less active ingredient per

tree, and Raley has some HLB disease in his experimental higher density set. He is confident that without the neonicotinoids, those trees would not have established. Where the resets are mixed in among mature trees, the total amount of active ingredient applied per acre remains far below the per-acre limit. Although he is careful to follow label instructions for total active ingredient, application methods and required safety equipment, he is less worried about accidental skin contact with the neonicotinoid product than he is with some other agricultural chemicals. He likes that neonicotinoids are safe to work with and effective.

For Raley and other citrus growers, neonicotinoids are especially important in controlling HLB because they prevent the Asian citrus psyllid from feeding on the citrus plant. Studies conducted by the UF/IFAS have established that the psyllid must actively feed on the citrus tree for at least one hour to transmit the bacteria that causes HLB.[3] The research shows that when neonicotinoids are used, the psyllid will probe into the plant but withdraw without feeding, thereby, reducing potential for introducing the HLB pathogen.[4] Raley is aware of other systemic products recently registered for psyllid control in Florida; but he has not used them because of their cost and their lack of the critically important anti-feeding properties of neonicotinoids, which make the alternatives ineffective for protecting his young trees. While the use of other pesticide classes helps suppress the overall psyllid populations within the groves, for Raley, neonicotinoids are essential for controlling HLB, especially among resets.

4.0 Interactions Between Citrus Production and Pollinators

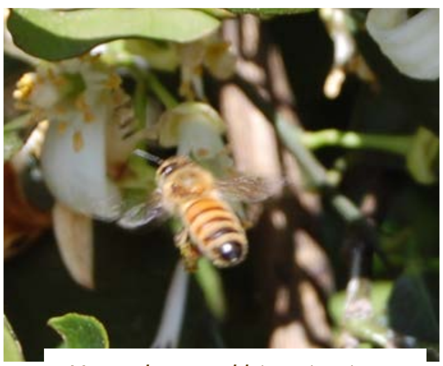
Citrus crops are self-pollinating. They do not depend on bees or other insects for pollination, but many growers work with and support beekeepers who depend on the citrus bloom for high-value orange blossom honey. Raley has worked with the same beekeepers for many years. He has never paid beekeepers to place hives on his property; and other than an occasional case of honey, he has never received any compensation from them. They have a positive relationship and communicate effectively about timing and location of hive placement. Those beekeepers have not expressed concerns to Raley about his pest management efforts or specific types of chemicals used for insect control. Honeybees are most active in citrus groves during the bloom period, which runs approximately March 1 through April 1 of each year. During that period, citrus growers have additional restrictions on any foliar chemical applications to protect pollinators.

5.0 Implications for Growers if Neonicotinoids Are Lost

Raley is not aware of any available effective alternatives to neonicotinoids for protecting his reset trees. He is aware of some promising technologies on the horizon, including potential commercialization of heat treatment technologies, but none that could replace the protection he gets with neonicotinoids. For Raley, not having neonicotinoids would make a difficult situation even worse, and he questions how he would finance or reinvest in new trees without the existing protection they provide. Although a dismal prospect, without viable reset plantings, he would likely continue to manage his current groves with every tool available until they stopped producing. He is concerned about the aggregate effect on Florida's citrus-processing infrastructure as a result of many growers facing those same decisions.

Without neonicotinoids, Raley would use even more foliar applications of broader-spectrum pyrethroid and organophosphate pesticides to reduce psyllid populations around his trees. The period of psyllid control with those chemistries is relatively short; and while psyllids will die when the application is made, others will soon move into the treatment area. Raley is aware of alternative systemic treatments. However, the combination of high price and lack of feeding inhibition with resulting potential for the psyllids to introduce the HLB pathogen makes them less useful. With neonicotinoids, the psyllid does not feed and has less opportunity to infect the tree.[4]

He is hopeful that research will identify additional management tools in time. When HLB was first identified in Florida, Raley recalled that the original HLB protocol from UF/IFAS was to remove all infected trees. After nearly a decade of removing trees due to citrus canker disease, Florida growers generally rejected that protocol as an unworkable solution. The current combination of neonicotinoids and other chemistries is allowing for at least some degree of control and protection for his groves.



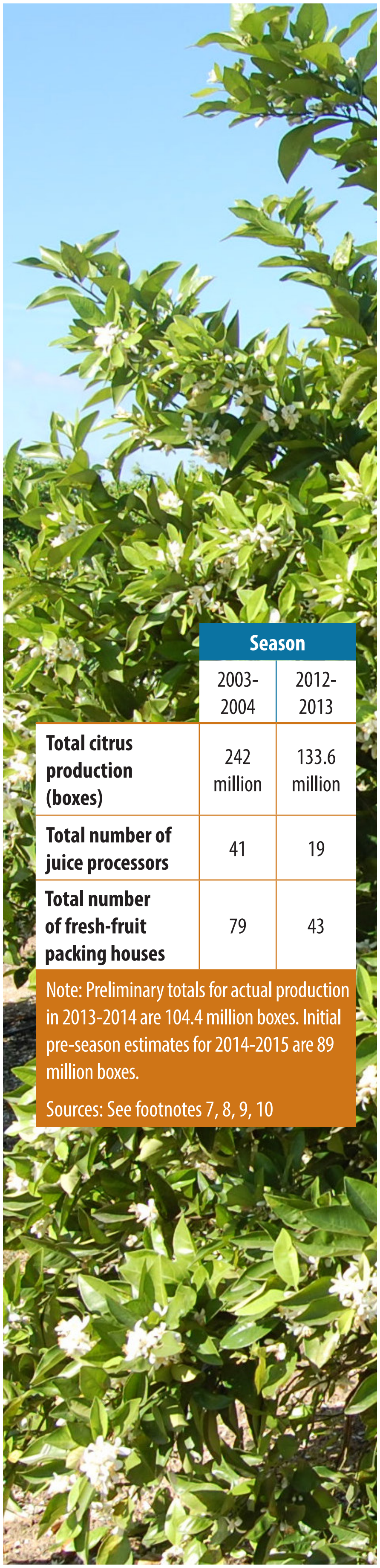
Honeybee and hives in citrus.

Raley is enthusiastic about promising new treatments for HLB related to heating infected trees to kill the bacteria. With this treatment, an infected tree is covered with plastic sheeting for several days, which allows solar heat to raise the temperature around the tree high enough to kill the bacteria. The treatment has been successful at bringing back vigor and healthy fruit in some trees that are in the beginning stages of HLB, though it apparently does not remove the bacteria from the roots and does not protect the tree from reinfection.[6] Even with the heating treatment, the flush of new growth attracts psyllids, and the tree would be vulnerable to reinfection as psyllids return to feed.

As with other citrus groves in central Florida, Raley's land with its sandy soil is well-suited for citrus production, but he is not sure what else. He is trying to gradually increase peach acreage, using the University of Florida's Sun Variety. Although there is a potential market window for fresh peaches in March and April (between the seasons for South American peaches and those in Georgia), he does not see nearly the same potential in peaches as in citrus. Overall, it is unclear how long he would continue citrus production without effective control of Asian citrus psyllid and HLB.

6.0 Implications Beyond the Individual Grower

Beyond Raley's operation, there are concerns throughout the Florida citrus industry that without effective control of HLB, further declines in citrus production will further erode Florida's infrastructure and capacity to process citrus. Raley's experience with DCGA illustrates the challenge. The association has seen regional declines in demand for processing and has picked up contracts from other grower associations that no longer have the capacity to process their own fruit. DCGA employs more than 300 people during the peak processing months of November and December. Those are in addition to people hired by individual growers to assist with the harvest.



	Season	
	2003-2004	2012-2013
Total citrus production (boxes)	242 million	133.6 million
Total number of juice processors	41	19
Total number of fresh-fruit packing houses	79	43

Note: Preliminary totals for actual production in 2013-2014 are 104.4 million boxes. Initial pre-season estimates for 2014-2015 are 89 million boxes.

Sources: See footnotes 7, 8, 9, 10

To add context to these concerns, in 2003-2004, before HLB (and additional hurricane impacts), Florida produced 242 million boxes of oranges (each box consists of two cartons; each carton holds 45 pounds of oranges).[7] By the 2012-2013 growing season, Florida had dropped to 133.6 million boxes of oranges. Initial estimates from the Florida Department of Citrus suggested 115 million boxes for 2013-2014,[8] and preliminary estimates for 2014-2015 predict less than 90 million boxes.[9] In 2003-2004 there were 79 packing houses and 41 processors; and by 2012-2013 those had dropped to 43 packing houses and 19 processors.[7] Fresh-packed citrus is down from 52.1 million cartons shipped in 2004 to 28.2 million cartons shipped in 2012-13.[10]

The loss of additional packing and processing would also affect shipping, trucking, distribution, consultants, tractor dealerships, fertilizer sales and other related services in rural communities. One study estimated the direct economic impact of HLB just in the five-year period between 2006-2011 would result in losses of more than 8,000 jobs and $4.5 billion to Florida's economy.[2] If the entire industry lost viability, it could eliminate much of the remaining roughly $9 billion estimated annual economic impact and 76,000 full-time and part-time jobs.

7.0 Main Insights From the Case Study

- Florida citrus growers and the citrus industry have weathered many significant challenges through the years, and they are optimistic about controlling HLB. Working with university, state, federal and non-governmental production researchers, many long-running operations, such as Raley Groves, are pursuing careful and innovative management strategies and seeking workable solutions.
- Growers view neonicotinoids as critically important for protecting young reset trees from Asian citrus psyllids and the HLB pathogen they carry. There are no effective alternatives available to citrus growers for protecting young reset trees from psyllid feeding (a route of transmission for the HLB pathogen). Without neonicotinoids, it is unclear how growers would manage the cost and risk of replacing dead and damaged trees.
- The loss of ability to replant (reset) trees would be expected to lead to a decline in fruit production and challenge the long-term viability of citrus groves.
- Further loss of citrus acreage and declines in fruit production would be expected to further erode the infrastructure for citrus processing and lead to expansive negative statewide and regional economic impacts, especially in communities dependent on citrus.

Citrus tree infected with HLB.

Neonicotinoid application

8.0 Footnotes

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