AgInfomatics

The Value of Neonicotinoids in North American Agriculture:

A Case Study of Neonicotinoid Use in Mid-South Cotton

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

Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers

A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids

An Economic Assessment of the Benefits of Nitroguanidine Neonicotinoid Insecticides in U.S. Crops

A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada

A Case Study of Neonicotinoid Use in Florida Citrus

A Case Study of Neonicotinoid Use in Mid-South Cotton

Executive Summary

The Value of Neonicotinoids in Turf and Ornamentals

Reports include:

Estimating the Economic Value of Neonicotinoid Insecticides on Flowers, Shrubs, Home Lawns and Trees in the Homescape

The Value of Neonicotinoids to Turf and Ornamental Professionals

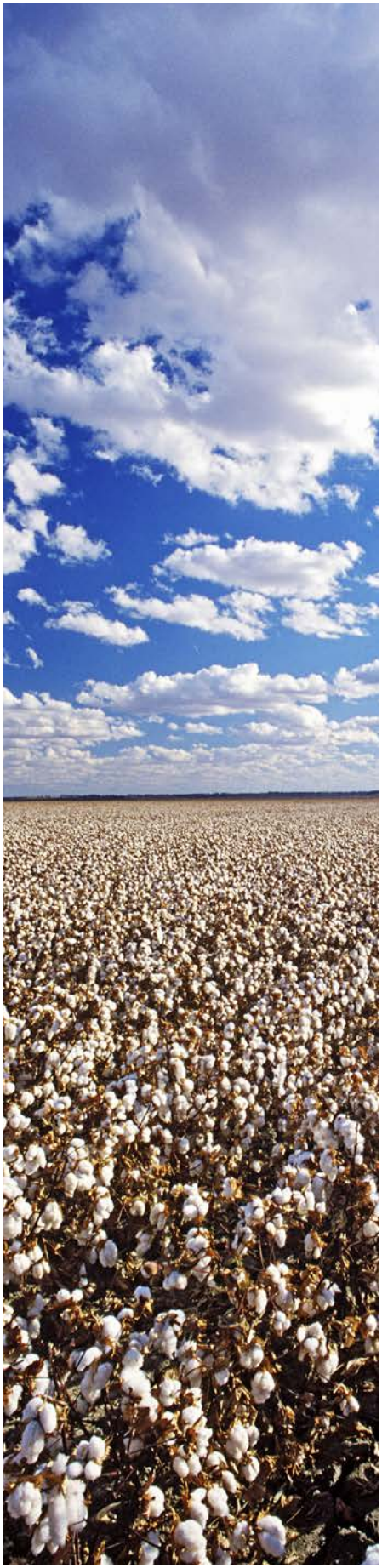
A Case Study of Neonicotinoid Use for Controlling Chinch Bug in Florida St. Augustinegrass

A Case Study of Neonicotinoid Use for Controlling Emerald Ash Borer—The Naperville, Illinois, Experience

A Case Study of Neonicotinoid Use for Controlling Silverleaf Whitefly in Ornamentals

Executive Summary

For more information, please contact
AgInfomatics@gmail.com



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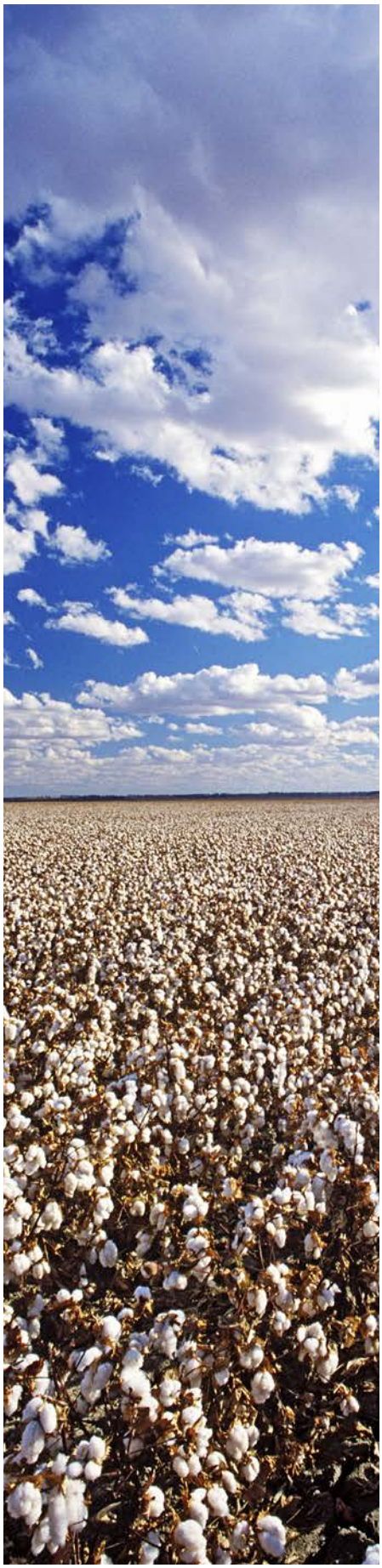
As part of a project to understand the benefits and value of neonicotinoids in North American agriculture, AgInfomatics conducted case studies of two growers in different production systems. Citrus in Florida and cotton in the Mid-South were selected as the focus for these cases in order to explore more 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. (See *A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada*). 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.

1.0 Context and Background

Cotton is a significant crop in the U.S. The United States Department of Agriculture (USDA) estimates $6 billion in sales for cotton, of which $250 million is from Tennessee. The U.S. cotton industry accounts for more than $25 billion in products and services annually, generating about 200,000 jobs in the industry sectors, from farm to textile mill. The USDA June 2014 acreage report estimated there were 11.4 million acres of cotton planted in the U.S., and 250,000 of those were in Tennessee.[1] In general, there has been a downward trend for planted acreage of cotton in the U.S. since the mid-1990s, as relative crop prices favored the planting of alternative crops. However, cotton prices have been higher recently, encouraging an increase in cotton acres planted over the past year. Growing and processing cotton remain crucial economic drivers in northwestern Tennessee and the other Mid-South cotton-growing states (Arkansas, Louisiana, Mississippi and Missouri). There are also other products in addition to the fiber derived from cotton (e.g., cottonseed oil, lint and trash fed to cattle), adding additional economic value to the crop.

Growing cotton provides a significant economic boost to local economies because it is more labor intensive than other crops and involves more businesses and intermediaries in the supply chain before it is shipped to customers. For example, cotton must be harvested, trucked to the gin, processed, trucked to another warehouse and then shipped out to customers. As a result, dollars earned from cotton production can recirculate and ripple through the local economy more than other crops, such as corn or soybean. About 12 million bales of cotton are shipped overseas accounting for over 30 percent of the total world export market.[2] These exports help reduce the nation's trade deficit and support employment of truck drivers, dockworkers, longshoremen, shippers, warehouse workers and others.



2.0 Grower Introduction

John Lindamood is a third-generation cotton grower, and the family business was founded by his paternal grandfather. The Lindamood family's operations are based around Tiptonville in Lake County, which is located in far northwest Tennessee. Lake County is the poorest county in the state and the 19th poorest in the nation. Lindamood has been farming cotton, corn, wheat and soybean for 30 years, and his family has been farming some of the same land for over 75 years. They farm approximately 4,200 diversified acres, which is about half cotton. The others acres are planted with soybean, corn and wheat. Lindamood's family also owns the Phoenix Gin, which is the only gin in a 45-mile radius and the last remaining cotton gin in the county. Numerous cotton gins have closed down in the area due to economic conditions favoring alternative crops and excess ginning capacity. As a result, some major employers have left the county. The Lindamood family businesses employ 18 people year-round (10 at the farm and eight at the gin) and 20 additional workers on a seasonal basis.

Lindamood has served in leadership roles for a variety of organizations related to agriculture and cotton production, including the following: National Cotton Council, serving on the Farm Policy & Economic Development Committee, the Environmental Task Force and the Bale/Packaging Committee; Cotton Incorporated, serving on the Board of Directors as well as the Research and Development and Governance Pension committees; Tennessee's Boll Weevil Eradication Program as vice chairman; and the Tennessee Farm Bureau's Cotton Advisory Board as chairman and member of the Agricultural Steering Committee for the state.

3.0 Use of Neonicotinoids in the Production System

Lindamood relies heavily on neonicotinoids in his farming operations. All the seeds he uses for growing cotton, corn and soybean are treated with neonicotinoids (e.g., Cruiser®, Gaucho®). Additionally, he uses neonicotinoids, such as Trimax® and Centric® for early-season foliar treatments and pyrethroids, organophosphates, Transform® (sulfoxaflor) and Diamond® (novaluron) later in the season and after bloom. The neonicotinoids control wireworms, thrips and plant bugs. He rotates his use of pesticides to improve their efficacy and reduce pest resistance problems.

Neonicotinoids provide a number of tangible benefits compared to alternatives he could use. Lindamood used to employ multiple applications of broad-spectrum insecticides that would kill beneficial insects as well as the target pests. Neonicotinoids changed that by allowing for less frequent spraying and selective targeting of pests. He also observes better health and vigor of seedlings since neonicotinoids were introduced. This translates to lower seeding rates along with healthier emergence, reducing his costs while increasing the yield. Prior to using neonicotinoids, he had used the carbamate, Temik® (aldicarb), as an in-furrow, granular insecticide treatment to protect seedlings during emergence. He initially switched to neonicotinoids because he was told they provided similar protection while being safer for human health than aldicarb, which is now a Restricted Use Pesticide in the United States. He said neonicotinoids are more effective for pest control during early emergence compared to cur-

rent alternatives and anticipated a significant increase in problems from insect pressure on seedlings if neonicotinoids were not available.

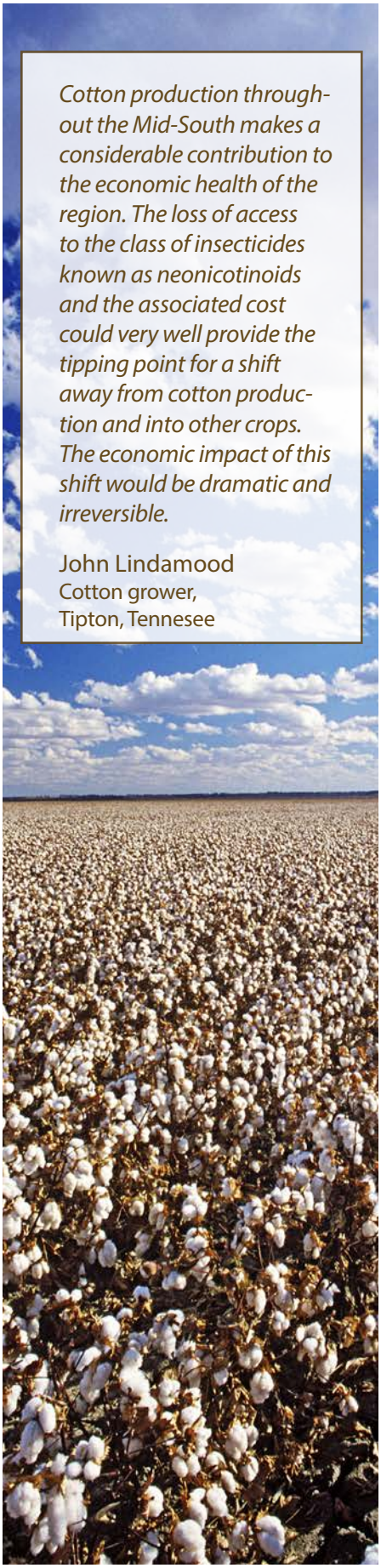
Lindamood expressed several times that neonicotinoids are safer for human health compared to other options that are available, both in terms of toxicity to people and the reduced amount of spraying, which offers reduced exposure to workers, family and neighbors. He also said that neonicotinoids are more cost-effective for controlling pests than currently available foliar alternatives (e.g., pyrethroids, organophosphates). Neonicotinoids are considered environmentally preferable, since alternative chemicals would be sprayed more often and in higher quantities. Lindamood explained farmers are always looking for the most environmentally friendly crop protection materials and methods, in part because he and other farmers in his area live, work and recreate in this same environment. He knows farmers who are anglers and hunters, and they are very conscientious about potential environmental impacts. Farmers do not want to put herbicides, fungicides and insecticides on their crops unnecessarily.

4.0 Interactions Between Cotton Production and Pollinators

Cotton crops are not dependent on honeybees for pollination. All varieties of cotton grown in the U.S. are self-pollinating although some varieties may respond to cross-pollination. Research suggests that bee pollination can increase earliness of seed set, seed set per boll and cotton yield.[3] However, cotton growers do not typically pay for managed bees for pollination. To understand Lindamood's relationship with honeybees and beekeepers, a local beekeeper was interviewed who places hives on or around the Lindamood family farmlands for producing honey. The beekeeper, in his 80s, had been keeping hives for over 70 years and currently maintained 75 hives. He emphasized proper care for hives was essential to honey bee health. While he had lost a few hives (<10 percent), he referred to another local beekeeper who lost most of his bees, attributing this to poor care of hives. He blamed the majority of his beehive problems on beetles that lay their eggs in hives, and he had created a solution to protect his hives from this threat. He also believed Varroa mites were a big part of the problem with bee colonies. When prompted, he thought pesticides may contribute to problems with hives, but his awareness of different types of pesticides was limited.

5.0 Implications for Growers if Neonicotinoids Are Lost

Lindamood anticipated a number of negative consequences if neonicotinoids were no longer available for use in growing cotton. One immediate impact would be increased business costs in terms of labor (e.g., scouting, spraying) and inputs (higher volumes of pesticides sprayed more often, higher seeding rates). More time would be needed for scouting required to monitor insect pressure and spraying more often in the fields. Additionally, because he would have to spray more often to control pests, it would cost more for the higher volume of products he would have to buy. Anticipating lower plant emergence, he would also have to use higher seeding rates without neonicotinoid seed treatments to produce a comparable sized crop. His crop would lose protection during the early growing season by losing insecticidal



Cotton production throughout the Mid-South makes a considerable contribution to the economic health of the region. The loss of access to the class of insecticides known as neonicotinoids and the associated cost could very well provide the tipping point for a shift away from cotton production and into other crops. The economic impact of this shift would be dramatic and irreversible.

John Lindamood
Cotton grower,
Tipton, Tennesee

seed treatments. This would negatively impact yield and income.

If neonicotinoids were not available, he would switch to more foliar spraying of organophosphates, which he said are broader spectrum, harsher on the environment and need to be sprayed more frequently. Switching to currently available alternatives would be worse for beneficial insects, such as assassin bugs, ladybugs, ants and minute pirates bugs[4], which are natural predators of some harmful pests, such as spider mites, boll worms, fleahoppers, stink bugs, aphids, thrips and plant bugs. Losing the systemic protection of neonicotinoids would set back his integrated pest management (IPM) efforts because alternative pesticide options do not provide the advantage of selectively targeting harmful pests without damaging the beneficial insects.

One repeated concern was about the "cascading" negative effects of increased foliar spraying with other pesticides currently available, in terms of building resistance, increasing flare-ups of secondary pests and then spraying pesticides more frequently. Neonicotinoids similarly help control pests on a regional basis that would otherwise flare-up again without this control. He made parallels between neonicotinoids and the successful boll weevil eradication program, which effectively controlled this pest that had been decimating cotton crops. The Boll Weevil Eradication Program, sponsored by the USDA, largely eradicated the boll weevil in cotton-growing areas of the United States. The program started in Tennessee about 2001. This initiative occurred about the same time that Bt cotton was introduced. Bt cotton is genetically modified to produce toxins that control caterpillar pests. Lindamood said that the combination of the Boll Weevil Eradication Program and Bt cotton reduced the use of pesticides on his farm by about 80 percent and increased his yields 10 percent to 15 percent.

Rising costs for growing cotton would create pressure to shift to alternative crops, such as corn or soybean. Because his family owns the county's last remaining cotton gin, Lindamood stated that his family business is particularly dependent on cotton remaining a common crop in the area. Lindamood speculated about what would happen to his business and community if growers decided to move out of cotton production. If cotton ceased to be economically attractive relative to other options, due to loss of effective control for cotton pests offered by neonicotinoids, he might switch to other crops. He might also have to close his gin, which is one of the largest private sector employers in the county. He would have to cut his farm staff of 10 by about a third, the workers at the gin would lose their jobs, and seasonal work would drop significantly. It was noted that cotton is particularly amenable to soil and climate conditions in the Mid-South (drought combined with humidity), so switching to other crops might be harder for farmers in Tennessee than for growers in other parts of North America. The crops they would turn to (e.g., corn and soybean) are also currently seed treated with neonicotinoids, so if their use was restricted, those crops would become less economically viable as well.

6.0 Implications Beyond the Individual Grower

Additional interviews were conducted with other members of the community surrounding the Lindamood family farm who are dependent on the economic benefits of cotton as a profitable crop. The purpose of these

interviews was to explore potential implications of losing neonicotinoids for growing cotton in northwestern Tennessee. The general sentiment was that the moving away from cotton that may occur with the loss of neonicotinoids would have a "devastating" effect on their struggling local and regional economies. While cotton had a good year in 2013, prices and profitability are highly variable. The price of cotton is expected to drop due to increases in global supply. The anticipated increased costs and reduced yield that would occur from losing neonicotinoids would together present substantial business challenges for cotton growers. It was mentioned by a number of community members (business attorney, insurance salesman, agricultural equipment and supplies salesmen, other growers) that if farmers shifted further from cotton to other crops like corn, associated loss of infrastructure (e.g., specialized equipment, cotton gins, warehouses) would inhibit a return to planting cotton if global prices warranted – so there was a collective sense that a decline in the importance of cotton to the area's economy would likely be permanent.

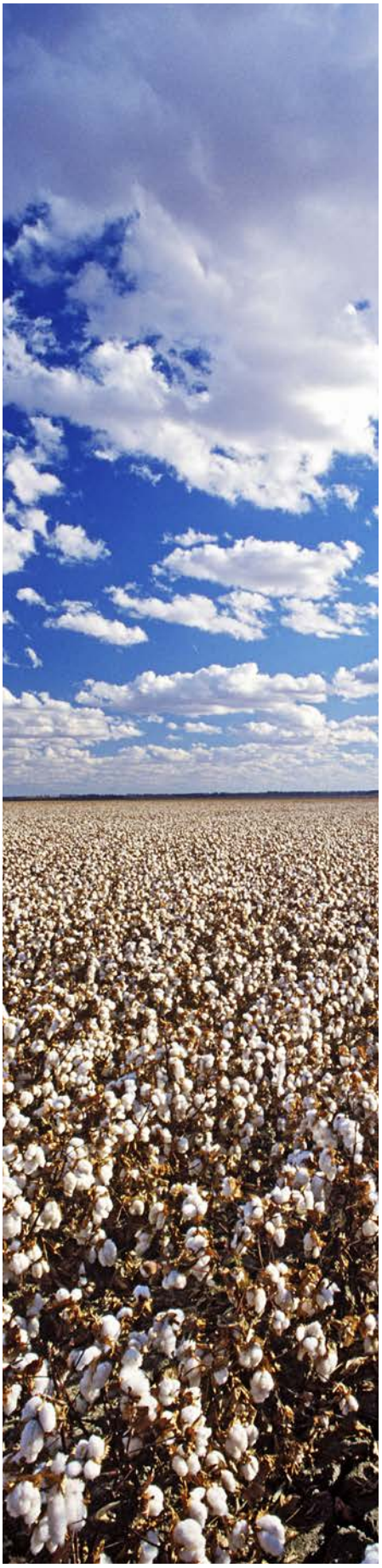
Examples of ways that others in Lindamood's professional network would be affected by a switch from cotton to other less profitable crops follow:

Some impacts could be felt at a very local level. For example, Lindamood's cotton gin operation is one of the two largest property taxpayers in Lake County, and the loss of the gin if farmers switched from cotton to other crops would affect funding of roads, schools and other services. It was also speculated that housing, real estate and land value would go down in the county as less cotton is grown due to the increased costs of pest control.

Another benefit of cotton to local equipment dealers (and American manufacturing) is that cotton equipment is expensive and specialized, unlike combines, which can be used more generally across crop types. Purchasing this additional capital equipment stimulates the local economy, positively affecting a range of stakeholders (e.g., equipment manufacturers, dealerships, salespeople, mechanics, etc.). Lindamood said he regularly buys new capital equipment, with specialized pickers costing up to $750,000. As a result, the used market for cotton equipment is strong. One salesman sold one unit three times in three years, making a commission from the same piece of equipment three times. Similarly, a local car salesman specializing in sales to farmers reiterated that the economic boost from cotton to the community assured higher income for him and his dealership.

Insurance premiums are also higher for cotton than for other crops, benefiting local insurance agents. Lindamood's crop insurance agent emphasized that cotton crop insurance is a specialized business, and he estimated that his local agency makes a $1 million in sales specifically related to growing cotton. Other interviewees, including farmers, agricultural supplies salesmen and a business attorney, reiterated the importance of neonicotinoids for the viability of a healthy cotton industry specifically and agriculture, which is the region's primary economic driver, more generally.

Several interviewees mentioned that during cotton-picking season, cotton farmers and gins significantly expand their seasonal workforce, which is an important source of supplemental income for many in this mostly low-income community. This seasonal surge of around-the-clock work was also said to be a boon for surrounding eateries.



For example, during cotton-picking season, a local restaurant can deliver 2-3 catered meals per day to one farming operation, as workers are needed around-the-clock during the crucial harvest season.

The final point made by Lindamood and others was that a decline in U.S. cotton growing would mean other countries with less stringent regulatory structures and lower emphasis on IPM will fill the demand. Many of these countries don't practice IPM and spray preemptively for insects. Since most U.S. cotton is exported, it was also pointed out that more shipping containers would go back to Asia empty, exacerbating the U.S. trade deficit.

7.0 Main Insights From the Case Study

- Lindamood's cotton-growing operations rely heavily on neonicotinoids. All of his seeds are treated with neonicotinoids, and he also uses them for early-season foliar spraying.
- Neonicotinoids are essential for protecting cotton crops, particularly in the early-growing season.
- Neonicotinoids increase yield, prevent the build-up of resistance to other chemistries and offer selective control of pests not available with alternatives, such as pyrethroids and organophosphates.
- Switching to other insecticide options would be more harmful to the environment and worse for human health.
- Farmers may shift acreage out of cotton if the economics favor the planting of alternative crops.
- A decline in cotton production in northwest Tennessee would have significant, negative impacts for the local economy. Cotton brings in higher income and is more labor-intensive than other crops. It also involves more businesses and intermediaries in the supply chain, so the money circulates through the economy more times than with other crops, such as corn and soybean.
- Since most U.S. cotton is exported, a reduction in cotton growing would exacerbate the trade deficit.

8.0 Footnotes

1. http://www.cotton.org/econ/cropinfo/production/usda-june-acreage.cfm
2. https://www.cotton.org/econ/world/
3. http://www.ent.uga.edu/bees/pollination/crop-pollination.html#other
4. http://cotton.ces.ncsu.edu/2014/06/insecticides-for-plant-bugs/