VALUE OF NEONICOTINOID INSECTICIDES IN MID-SOUTH COTTON

Jeff Gore
Don Cook
Larry Falconer
Mississippi State University, Delta Research and Extension Center
Stoneville, MS
Angus Catchot
Mississippi State University Extension Service
Starkville, MS

Abstract

The neonicotinoid insecticides have recently come under considerable scrutiny about their impact on pollinator health. These insecticides are important for the management of multiple insect pests in agricultural production systems. In cotton, they are critical for the management of selected insect pests, especially in areas where the tarnished plant bug is the primary pest. An experiment was conducted at the Delta Research and Extension Center in Stoneville, MS to quantify the value of neonicotinoid insecticides in cotton. A Bollgard II Roundup Ready Flex variety was planted May 20, 2013. The treatments included cotton grown with neonicotinoids, with neonicotinoids plus Transform, and cotton grown without the use of any neonicotinoids. Plots were scouted twice per week and sprayed as needed for all insect pests. A complete economic analysis was done for each treatment based on yields and total input costs. Overall, the treatment that did not include neonicotinoids needed more than twice as much active ingredient throughout the season. This resulted in higher insecticide costs in the no neonicotinoid treatment. Overall, the treatments where neonicotinoids were used had net economic returns of around $42.00 per acre. In contrast, the treatment where no neonicotinoids were used resulted in a loss of -$21.49 per acre. Based on these data, cotton production would not be sustainable in the Mid-South if the neonicotinoids were no longer available. More research needs to be conducted on the value of all insecticides used in agriculture.

Introduction

Protection of pollinators has become an important concern throughout the world. Most notably, concerns over declining colony health of managed hives of the European honey bee, *Apis melifera* L., due to multiple causes. Some of the proposed causes of colony decline include the increased incidence of parasites and pathogens, loss of habitat, movement of managed hives over long distances, and exposure to pesticides used in agriculture. The factor that has received the most press recently is the perceived impact of common pesticides used in the production of agronomic crops. Much attention has been given to the neonicotinoid class because those insecticides are nerve poisons that act on the nicotinic acetylcholine receptors and they are systemic within the plants on which they are used. Those characteristics make them ideal for use in IPM programs in cotton as both seed treatments and foliar sprays to control numerous pests. However, their use in agriculture has been challenged because of these properties. In particular, their systemic nature is believed to result in their presence in cotton pollen and nectar over an extended period of time. Considerable research has been conducted in recent years to document the persistence of neonicotinoids in the environment, within cultivated and non-cultivated plants, and in fallow areas around agricultural fields. Similarly, numerous laboratory studies have shown that the neonicotinoids can have an effect on honey bee health. As a result, the European Union recently approved a 2 year ban on this class of insecticides. Environmental groups and bee keeper organizations have proposed similar bans in the United States based only on perceived risks. Although numerous studies are being conducted to document the potential exposure and risks of honey bees to the neonicotinoids, no formal research is being conducted to document their benefits to agricultural production. As a result, the current experiment was initiated to document the benefits of neonicotinoid insecticides as well as the new insecticide sulfoxaflor (Transform WDG™, Dow AgroSciences) in cotton.

Materials and Methods

An experiment was conducted at the Delta Research and Extension Center in Stoneville, MS to quantify the value of neonicotinoid insecticides and sulfoxaflor in cotton production. The treatments included cotton grown with no neonicotinoid insecticides, cotton grown with neonicotinoids, and cotton grown with neonicotinoids and sulfoxaflor. A Bollgard II cotton variety was planted on May 20, 2013. All normal agronomic practices (fertilization, weed management, PGR use, Irrigation, etc.) were followed as recommended by the MSU Extension Service and were the same for all treatments. Plot size was 8 rows by 50 ft. Treatments were in a randomized complete block design with 4 replications. For the treatments that used neonicotinoid insecticides, Aeris (imidacloprid) seed treatment was used for early season thrips control. For the no neonicotinoid treatment, the fungicide and nematicide components of Aeris were used as a seed treatment and acephate was sprayed in furrow at 1 lb ai/A for thrips control. All plots were scouted twice per week throughout the season and insect pests were sprayed based on the MSU Extension Service Insect Control Guide. Foliar thrips applications were made in each treatment based on the presence of immatures. Visual observation and drop cloth samples were used for all other insects. Tarnished plant bugs were sprayed when the average of all four reps from a particular treatment averaged 3 per 5 row ft. Cotton aphid and spider mite densities were rated on a scale of 0-3 where 0=none, 1=low, 2=moderate, and 3=high. Treatments for these pests were made when the average of all four replications was ≥2. Bollworms were scouted based on the presence of eggs and small larvae. Insecticides were selected based on efficacy as well as cost. In general, all insecticide decisions were made to simulate what would be used on a grower's farm. At the end of the season, all plots were harvested and lint yields were determined. A complete economic analysis was conducted based on average insecticide costs and on information from the 2013 Mississippi State University cotton budgets for the Delta region (http://www.agecon.msstate.edu/whatwedo/budgets/docs/MSUDELTA13.pdf).

Results and Discussion

Overall, a total of 7 foliar insecticide applications were made in the treatments that included neonicotinoid insecticides (Table 1). The treatment that did not include neonicotinoids required a total of 10 foliar insecticide sprays. The insecticides used in each treatment are listed in Table 1. The 2 treatments that had Aeris seed treatment only needed 1 foliar spray for thrips (Table 2). In contrast, 3 insecticide sprays were needed for the no neonicotinoid treatment that had acephate sprayed in-furrow. There was a total of 6, 7, and 7 applications made for tarnished plant bug in the neonicotinoid, neonicotinoid + Transform, and no neonicotinoid treatments, respectively (Table 2). No sprays were needed for spider mites or cotton aphids in the treatment that included Transform. One application was needed for cotton aphid and one application was need for spider mites in neonicotinoid treatment. In the no neonicotinoid treatment, 1 application was made for cotton aphid and 2 applications were made for spider mites. Overall, bollworm pressure was extremely low and no insecticide applications were needed. Overall, the total lbs of insecticide active ingredient used in the no neonicotinoid treatment was more than twice as much as that used in the neonicotinoid and neonicotinoid plus Transform treatments (Table 2).

Insecticide costs were higher in the no neonicotinoid treatment compared to the other two treatments (Table 3). Yields ranged from 1487 lbs of lint in the no neonicotinoid treatment to 1514 lbs of lint in the neonicotinoid treatment. There were no differences in yield among treatments (Table 3). Gross returns and net returns are listed in table 3. The no neonicotinoid treatment resulted in an economic loss when all of the agronomic factors are included in the final analysis. The agronomic factors used for this analysis included seed, seed treatment, fertilizer, herbicide, PGR, scouting, eradication, defoliation, diesel and maintenance, equipment, and ginning and hauling costs as well as technology fees associated with using a Bollgard II/Roundup Ready Flex variety.

These data demonstrate the importance of the neonicotinoid class of insecticides for cotton production in the Mid-South. In the Mid-South, the tarnished plant bug is the most important insect pest of cotton. As a result, insect management in this area is heavily influenced by the tarnished plant bug. These results may vary in other regions of the U.S. where the tarnished plant bug is not a key pest. The neonicotinoid insecticides and Transform are critical for tarnished plant bug management. Without these insecticides, cotton production would not be profitable in the Mid-South. In the future, more research needs to be conducted that will quantify the value of different insecticide classes in multiple cropping systems. This type of information will be important for policy makers to make decisions about their registrations and ensure their availability for pest management in agriculture.

Table 1. Insecticides used in each treatment.

Neonics	Neonics + Transform	No Neonics
Aeris	Aeris	Fungicide + Nematicide + Orthene (1.1 lbs)
Bidrin (3.2 oz)	Bidrin (3.2 oz)	Dimethoate (6.4 oz)
Imidacloprid (2.0 oz)	Imidacloprid (2.0 oz)	Acephate (0.22 lbs)
Centric (2.0 oz)	Transform (1.5 oz)	Bidrin (3.2 oz)
Imidacloprid (2) + Diamond (6)	Imidacloprid (2) + Diamond (6)	Acephate (0.55 lbs)
Acephate (1.1) + Bifenthrin (6.4)	Transform (1.5)	Vydate (17 oz)
Endigo (5.5) + Portal (16)	Acephate (1.1) + Bifenthrin (6.4)	Acephate (1.1) + Diamond (6)
Acephate (1.1) + Bifenthrin (6.4)	Acephate (1.1) + Bifenthrin (6.4)	Bidrin (8) + Carbine (2) + Portal (16)
		Zeal (1 oz)
		Acephate (1.1) + Bifenthrin (6.4)
		Bidrin (8) + Diamond (6)

Table 2. Number of foliar insecticide applications for selected pests.

Pest	Neonics	Neonics + Transform	No Neonics
Thrips	1	1	3
Tarnished Plant Bug	6	7	7
Cotton Aphid	1	0	1
Spider Mites	1	0	2
Bollworm	0	0	0
Total lb ai/A	3.01	2.63	6.3

Table 3. Economic analysis of the results.

Pest	Neonics	Neonics + Transform	No Neonics
Insecticide Costs ($/A)[1]	$114.66	$99.22	$186.14
Yield (lbs Lint/A)	1514	1505	1487
Gross Returns ($/A)[2]	$887.15	$896.51	$800.52
Net Returns ($/A)	$42.15	$42.76	-$21.49

[1]Includes application costs.
[2]Based on an average cotton price of $0.7818/lb.