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The Economic Impact of the Sugarcane Aphid Outbreak in Texas

Samuel D. Zapata, Rebekka Dudensing, Danielle Sekula, and Raul Villanueva*

Texas is the second largest producer of grain sorghum in the country (Table 1). In 2016, about 1.9 million acres were planted with an estimated economic value of $607.5 million. However, the Texas sorghum industry is threatened by a new invasive pest, the sugarcane aphid (SCA). This pest is capable of causing substantial damage to crop production (Fig. 1). In fact, due to its rapid population growth, great dispersion capacity, and the limited availability of effective insecticides, the SCA has become the most damaging pest in sorghum since its detection in 2013. The following is an estimate of the overall economic impact of SCA during the 2014–2016 growing seasons in Texas.

Table 1. Top states based on sorghum planted acres, 2016

Rank	State	Acreage
1	Kansas	3,100,000
2	Texas	1,900,000
3	Colorado	450,000
4	Oklahoma	400,000
5	South Dakota	270,000
6	Nebraska	200,000
7	New Mexico	110,000
8	Missouri	65,000
9	Louisiana	52,000
10	Arkansas	47,000

Source: *Quick Stats. USDA*

*Assistant Professor and Extension Economist, Associate Professor and Extension Economist, Extension Agent–Integrated Pest Management, all of the Texas A&M University System; and Assistant Professor, University of Kentucky

Figure 1. Sugarcane aphids feeding on a sorghum leaf.

Sugarcane aphid damage

SCA was first detected in sorghum near Beaumont, Texas in June 2013, and it is now common to encounter large populations of this aphid on sorghum plants in every sorghum producing region of the state. Populations typically increase and become economically important at the boot, heading, and seed maturation stages of crop development. The aphids prefer to feed on the underside (abaxial surface) of sorghum leaves. Aphid feeding produces yellow to red or brown leaf discoloration (Fig. 2). While feeding on sorghum, SCA populations also leave behind a clear, sugary liquid called honeydew, which coats the upper surface of leaves. During the most suscep-

Figure 2. Experimental field severely affected by the SCA.

tible crop stages, small colonies of SCA can grow exponentially. Hot dry weather enables rapid population growth and production of large amounts of sticky honeydew. Honeydew causes indirect damage to the sorghum crop because it supports the growth of a black sooty mold which can inhibit plant development. Infestations on seedling grain sorghum can occur on fall plantings in South Texas and can kill young plants. Infestations during booting or heading—common throughout Texas—can prevent the formation of grain. Additionally, harvest losses occur as sticky leaves impede grain separation from stalks and leaves in the harvester, causing grain to "ride over" and be lost on the ground.

Surveying Texas growers

Texas sorghum producers were surveyed to obtain a representative sample of SCA damage in Texas. The questionnaire gathered detailed information about yearly crop yields, perceived losses, crop acreage, insecticide application decisions, and management and production practices. A total of 57 growers representing 153 sorghum farms participated in this study. Collected data were used to estimate the profit reduction associated with the SCA infestation, as well as the monetary value of prevented loss attributed to control efforts.

SCA control efforts

Sorghum producers indicated that the severity of the SCA infestation has increased over time, from some-degree-of-infestation of 58 percent in 2014 to 92 percent in 2015 to 100 percent in 2016 (Fig. 3). As a result, Texas sorghum growers have adopted control practices including active pest monitoring and tolerant hybrids which have been developed in response to the SCA outbreak, along with targeted insecticide applications (Table 2). No major changes were observed regarding the use of insecticide-treated seeds. However, the sorghum cropland planted with SCA toler-

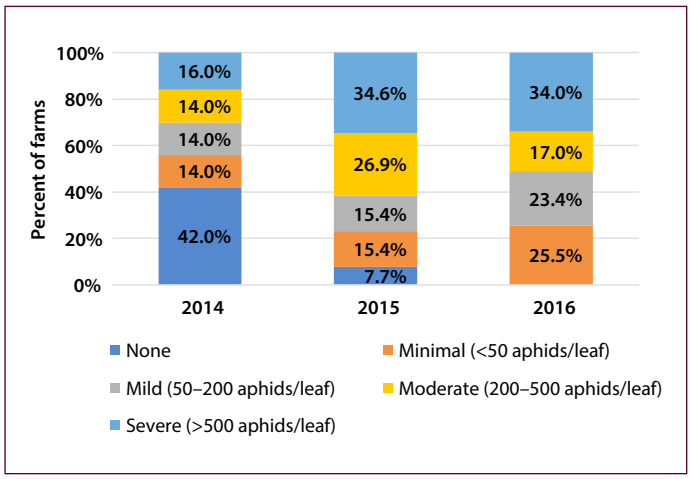

Figure 3. SCA infestation level.

Table 2. SCA control practices adopted by sorghum growers

Control practices	2014	2015	2016
	----------*Percent*----------		
Area planted with insecticide-treated seeds	69.30	67.05	70.16
Area planted with SCA tolerant hybrids	30.04	42.06	50.18
Area sprayed to control the SCA (per application)	9.07	8.20	8.26
Insecticide used to control the SCA			
Sulfoxaflor 50% WG	100.00	81.82	51.43
Flupyradifurone	0.00	18.18	45.71
Other	0.00	0.00	2.86
Additional insecticide applications due to the SCA			
0	52.50	21.74	26.83
1	20.00	41.30	43.90
2	22.50	28.26	29.27
3	5.00	8.70	0.00

ant hybrids increased from 30 percent in 2014 to 50 percent in 2016. In terms of insecticide applications, 8 to 9 percent of the total planted acres were treated on each application to control SCA populations. At the outset of the infestation in 2013 and 2014, there were no effective insecticides labeled for SCA on sorghum. Research determined that *Sulfoxaflor 50% WG* and *Flupyradifurone* were effective and the data from tests supported labeling of these insecticides for grain sorghum. Growers reported *Sulfoxaflor 50% WG* was the most commonly used product, but an increase in the usage of *Flupyradifurone* has been reported in recent years. Lastly, survey results indicate an increase in the number of insecticide applications compared to 2014.

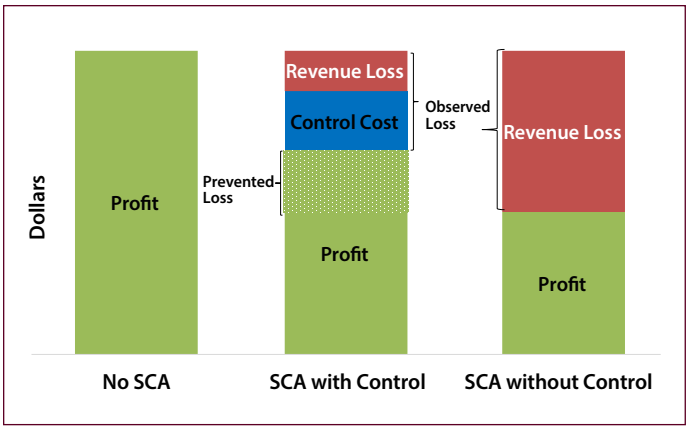

Figure 4. Observed and prevented losses

Observed and prevented losses

The SCA outbreak decreased farmers' profits because monitoring and controlling the pest add to their production costs. SCA also reduced revenue by lowering yields or causing harvest losses. On the other hand, the prevented loss represents the profit saved that can be attributed to private, public, and individual efforts to mitigate the damage caused by the SCA. These impacts can be illustrated by comparing profit levels for the sorghum industry in cases in which 1) no SCA is present, 2) control costs are incurred to reduce revenue losses, and 3) revenue losses occur without control of the SCA (Fig. 4).

Between 2014 and 2016, it is estimated that the SCA caused an average loss of $39.89 per acre, resulting in a total loss of $276.17 million to the Texas sorghum industry. At the same time, producers were able to avoid a potential loss of $25.74 per acre and $179.94 million at the industry level by adopting control practices, including treated seed, tolerant hybrids, pest monitoring, and insecticide applications (Table 3).

Economy-wide impacts

The direct effects given by the reduction in farmers and custom harvesters' profits and additional sales of production inputs and services (i.e., insecticides, surfactant, seeds, and custom application and pest mon-

Table 3. SCA observed and prevented economic impacts

	2014	2015	2016	Total	Average
Economic loss ($/acre)					
Revenue loss	(22.09)	(49.16)	(22.05)	(93.3)	(32.52)
Additional insecticide application cost[1]	(0.87)	(2.04)	(1.00)	(3.91)	(1.36)
Reduced variable harvesting cost	2.29	5.91	3.28	11.48	3.99
Tolerant hybrids cost	(0.90)	(1.22)	(1.51)	(3.63)	(1.21)
Treated seed cost	(3.30)	(3.02)	(3.82)	(10.14)	(3.35)
Pest monitoring cost	(4.22)	(6.00)	(6.00)	(16.22)	(5.44)
Total profit loss	(29.09)	(55.52)	(31.10)	(115.71)	(39.89)
Total profit loss for Texas ($ million)	(72.73)	(144.35)	(59.09)	(276.17)	(95.63)
Prevented economic loss ($/acre)					
Revenue saving	38.33	44.16	44.44	126.93	42.38
Additional control and monitoring cost	(9.29)	(12.28)	(12.33)	(33.9)	(11.36)
Increased variable harvesting cost	(3.97)	(5.31)	(6.61)	(15.89)	(5.28)
Total profit saving	24.96	26.57	25.50	77.03	25.74
Total profit saving for Texas ($ million)	62.40	69.08	48.45	179.94	61.10

[1] This includes the insecticide, surfactant and application costs.
Note: Each value represents the estimated mean over adopters and nonadopters of control practices.

itoring services) caused by the SCA outbreak were magnified in the state economy. Indirect effects represent the impact on local supporting industries, and the induced effects measure the resulting economic impact at the household and government levels. State economy impacts were estimated in terms of overall output value and employment. On average, annual economy-wide losses totaled 513 jobs and $169.83 million in economic output including a direct loss of $78.57 million to farms and farm related industries, $10.02 million in additional output to other supporting industries, and $101.30 million loss due to induced effects which were particularly affected by profit losses among farm households (Table 4). Observed losses in the Texas economy were substantial. However, they would have been greater had farmers not taken measures to control the SCA. Without control efforts, the state economy would have faced annual additional losses of $150.98 million in output and 718 jobs.

For more information

Additional information about the economic impact of the SCA in Texas is available in: *A Comprehensive Assessment of the Economic Impact of the Sugarcane Aphid Outbreak in Texas.* Final Report to Texas Sorghum Producers Association and United Sorghum Checkoff Program. Nov. 2017

Acknowledgments

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Table 4. Economic impacts of SCA in Texas

	2014		2015		2016		Average	
Impact type	Output ($ million)	Employment	Output ($ million)	Employment	Output ($ million)	Employment	Output ($ million)	Employment
Economic loss								
Direct effect	(55.22)	154.4	(127.81)	82.2	(41.9)	140	(78.57)	118.9
Indirect effect	9.86	68.5	10.38	62.9	9.57	59.2	10.02	61.6
Induced effect	(78.52)	(536.5)	(156.78)	(1,073.5)	(59.74)	(408.8)	(101.3)	(693.5)
Total effect	(123.87)	(313.6)	(274.2)	(928.4)	(92.08)	(209.6)	(169.83)	(513)
Prevented economic loss								
Direct effect	72.32	187.3	82.88	218	61.02	198.4	73.18	190.8
Indirect effect	2.61	13.7	3.61	18.1	3.28	16.4	3.16	15.8
Induced effect	77.79	532.5	84.47	578.8	60.66	415.8	74.65	511.6
Total effect	152.72	733.5	170.96	814.9	124.96	630.6	150.98	718.2

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