Sugarcane Aphid Damage Potential to Yield and Silage Quality from Different Infestation Levels on Forage Sorghum for the Texas High Plains

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Summary

A field trial was conducted at the Texas A&M AgriLife Research and Extension facilities at Bushland, TX to evaluate the damage potential of sugarcane aphid (SCA) to yield and silage quality. A commercial forage sorghum hybrid Pioneer 841F, that is a commonly grown for silage on the Texas High Plains, was utilized for this trial. Different insecticides were used to create different SCA infestations and damage levels. SCA began to infest sorghum plots during the flowering growth stages and continued up to harvest at the soft dough growth stage. The best linear relationship (R^2 = 0.81) between damage and yield loss occurred at the beginning milk stage and showed a 2.28 ton/A loss in yield for each increase in damage rating, based on a 1 to 10 rating scale, when ratings ranged from 2 to 8. These results indicate substantial losses in yield and economic return can occur when SCA infestation cause heavy damage during the early grain filling growth stages before soft dough.

Introduction

Dairy and feedlot beef cattle operations across the Texas High Plains and into Kansas have a high demand for large quantities and quality of silages annually. Historically, corn silage has been the predominant silage crop, but due to declining well capacities and pumping restrictions, there are increased opportunities for sorghum to take a greater share of the silage acres. Unfortunately, the sugarcane aphid (SCA) has become a severe pest of forage and grain sorghums in the last three years on the Texas High Plains. Research studies have primarily concentrated efforts on understanding the damage potential of SCAs and how to manage them on grain sorghum. SCA infestations in forage silage sorghums the past three years have been extremely heavy causing problems when cutting, but data on the actual amount of damage to silage yield and quality from these infestations are nonexistent. We often take the information from the damage potential of SCAs on yield reductions to grain sorghums and infer that the damage will be the same to forage silage sorghums. However, with forage sorghums there is a need to determine the impact SCAs have on forage tonnage and silage quality at harvest and on feed quality after being ensiled. We expect SCA damage to adversely impact forage tonnage, but the ensilage quality may or may not be affected. For example, a study on the impact of spider mite damage to corn grown for silage showed that as spider mite infestations increase, plant damage increases resulting in declining silage yields, but the spider mite infestation levels did not detrimentally affect the nutritional quality of the corn for silage (Bynum et al. 2015). Research addressing these questions and concerns about SCA damage to forage sorghums will end the speculations that currently exists.

Relevance to Sorghum Producers

Knowledge of the impact SCA feeding damage to forage yields and silage quality will provide growers and end-users needed information for better management options for SCAs. Understanding the potential for SCA damage to forage sorghum should mitigate unsubstantiated concerns for using forage sorghums for silage.

Goal and Objective: Our primary goal is to understand the relationship of SCA infestation levels to the damage potential for forage yield loss and silage quality. Our objective was to create different levels of SCA infestations and correlate the subsequent level of damage to forage sorghum yields and silage quality.

Methods and Materials

The trial was located at the Texas A&M AgriLife Research and Extension Bush Farm, Bushland, TX. The field is a Pullman clay loam soil with a pH 7.8. It was previously planted to wheat in 2016. One week prior to planting, the field was sprayed with Brawl II atz®, a mixture of atrazine and s-metolachlor, for weed control. The field was fertilized with 178 lb N/A, 62 lb P2O5/A, and 28 lb sulfur/A. On June 9, 2017 Pioneer 841F forage sorghum hybrid was planted at 60,000 seeds per acre. The test area was spot sprayed with Facet L at 32 fl oz/A using a SOLO backpack sprayer for bind weed control on June 30 and July 13. The field was furrow irrigated on June 13, July 18 and September 12 with approximately 5 to 6 A/in of water. In season precipitation totaled 19.51 inches between May 1 to Sept. 20. On July 2, the field was damaged by hail, but plants grew out of the damage before sugarcane aphid infestations.

Prior to sugarcane aphid infestations field plots (six – 30 in. wide rows by 40 ft. long) were setup and arranged in a randomized design with 4 replications. Insecticides that have different levels of efficacy against sugarcane aphids and an untreated check were used to create different sugarcane aphid infestation. Each insecticide and the untreated check were designated as treatments and applied to the randomized replicated plots. The insecticides utilized were Warrior II with Zeon technology at 1.92 fl oz./A, Lorsban Advance at 16 fl oz./A, Intruder at 1.0 oz/A, and Sivanto Prime at 5, 7, and 10 fl oz./A rates. Warrior II, a pyrethroid insecticide, does not control sugarcane aphids, but does kill beneficial insects and is known to flare aphid infestations. Previous insecticide trials with Lorsban Advance, an organophosphate insecticide, has been shown to provide short residual activity and 50%

control of SCA. Also, Intruder is an insecticide that has short residual activity that allows surviving SCAs to build up to damaging infestations. The Sivanto Prime insecticide was used at different application rates to provide plots with little to no damage from SCAs. On July 21 and July 26, plots were inspected but did not find SCAs. On July 28, the treatment for Sivanto Prime at 10 fl oz./A mixed with 0.25% v/v NIS was sprayed to plots with 4 ft. tall whorl stage sorghum to prevent the establishment of SCAs. The application was sprayed using a 5 nozzle, CO2 hand carried boom with XR8002 VS nozzles at 3 mph and calibrated at 42 psi to deliver 11.26 gpa. The climatic conditions at application was 87.5 F, 45.5% RH, with a 3.1 mph wind from the SSW. The boom treated the center four rows of the six-row plot. Initial infestation of alate SCAs were not found until August 4, but infestations were sporadic across plants. On August 16 at boot and head exertion growth stage, plots were counted for SCA numbers, but infestations were mostly alate females with 1st instar nymphs with no visible damage. On August 24, counts showed that 100% of the plants were infested with SCAs beginning to colonize the lower sampled leaf. The plant growth stage was at 50% bloom. The other insecticide treatments were sprayed August 26 with the same hand carried boom previously used on July 28. All insecticides were mixed with 0.25% v/v NIS. At application, the climatic conditions were 77.5 F, 75.% RH, with a 3.6 mph wind from the SSW. Plots were counted on September 1, 8, and 15 for the remainder of the trial. SCAs were sampled from two leaves per plant and 5 randomly selected plants per plot from the center two rows. The upper leaf was the 1st leaf below the flag leaf and the lower leaf was the 6th or 7th leaf below the flag leaf until SCAs damaged the lower leaves. When this occurred, the lower leaf became the leaf that had at least 70% green leaf material. Plots were rated for SCA infestation/damage using the Texas A&M AgriLife High Plains rating scale at each of the SCA sample dates and on Sept 20 when plots were harvested (Table 1). Plots were rated for damage and lodging.

Table 1. Texas A&M AgriLife High Plains Sugarcane Aphid/Damage Rating Scale

0: no aphids or honey dew found
1: ≤10% of leaf area infested or damaged, colonies establishing on lower leaves or some honey dew visible on 2 or less leaves
2: 11-20% of leaf area infested or damaged
3: 21-30% of leaf area infested, damaged or dead
4: 31-40% of leaf area infested, damaged or dead
5: 41-50% of leaf area infested, damaged or dead
6: 51-60% of leaf area infested, damaged or dead
7: 61-70% of leaf area infested, damaged or dead
8: 71-80% of leaf area infested, damaged or dead
9: 81-90% of leaf area infested, damaged or dead
10: 91% of leaf area damaged to dead

Plots were hand harvested on September 20 when grain reached soft dough to estimate forage yields. Yield was determined from 1 - 10 ft. long row section from within the center of each plot. Plant height measurements were taken, stalks were chopped with a Cub Cadet CS3310 chipper shredder, and the biomass weighed. A 50 gm aliquot sample was collected for dry weight. The sample was dried at 60º F in a force air oven for 72 hrs or until there was no change in weight. Also, three 600 gm samples of chopped forage were collect for forage nutrient quality to simulate ensiled periods of 0, 30, and 60 days after harvest. Each 600 gm sample was vacuum sealed in polyethylene bags and held in a storage facility until the designated ensiled period. At the designated ensiled period samples were dried at 60º F for ca. 7 days and then ground through a Wiley mill with a 2 ml screen. A 200 gm subsample of the ground ensiled forage from each plot for each of the ensiled periods was shipped to Dairyland Laboratories, Arcadia, WI for forage analysis using near infrared reflectancy spectroscopy (NIR) for all samples. Forage constituents are reported on a dry matter (DM) basis (Table 2).

Table 2. Forage Analyses definitions

CP:	Crude Protein
ADF:	Acid Detergent Fiber; a fraction of the cell wall includes cellulose and lignin, which is inversely related to energy availability.
Lignin:	An indigestible fiber that has no energy value and restricts digestibility of other fiber components.
Starch:	A source of energy in silage and is a function of the proportion of grain in the silage. Digestibility can decrease as grain becomes hard and dryer.
aNDF:	Neutral Detergent Fiber; cell wall fraction of the forage.
IVTDMD:	In Vitro Dry Matter Digestibility; estimate of forage disappearance in the digestive tract.
NDFD:	NDF digestibility; estimated fiber digestibility after the specified length of time (48 hrs.).
uNDFom:	Undigested NDF after fermentation for the specified length of time (240 hrs.) expressed on an organic matter basis (om) in order to account for the ash.
TDN:	Total Digestible Nutrients (by Weiss equation) an index of energy concentration.
Milk/ton:	An index based on several variables that influence intake and nutritive value. These are applied to a standard dairy cow to project milk produced per ton of forage.
RFQ:	Relative Forage Quality - an index for comparing forages, not just alfalfa. RFQ is based on the same scoring system as RFV with an average score of 100; higher scores indicate better feeding value.
pH:	A measure of silage acidity, high or low levels can affect fermentation.

Results and Discussion

Sugarcane aphid Infestations and Damage

The forage sorghum plots were checked weekly during July for initial infestations of SCAs. By the last week of July, no SCAs were found in the test plots, but SCAs had been found in a producer's forage sorghum trial that was ca. 1 mile east of this forage sorghum field trial. Since SCAs were close by, a decision was made to spray the Sivanto 10 fl oz/A treatment plots on July 28 to prevent establishment of SCA for possible aphid and damage free plots. By August 4 a few alate aphids with small numbers of nymphs were starting to be found on sporadically across plants. On Aug 16, SCA counts were taken to determine the variability of SCA numbers among the plots. Since the objective of this trial was to evaluate the damage potential of SCA infestations, the insecticide treatments were used to create different infestation levels. Therefore, after counting on Aug 16, plots were arranged within each replicated block so that the untreated and the Warrior treatments contained plots with the highest numbers of SCA. Then the other insecticide treatments, besides Sivanto at 10 fl oz/A, were applied on Aug. 26. Even before the insecticide applications on Aug. 26 plots, the different treatments were starting to develop different SCA infestation (Table 3 and Fig. 1). SCA numbers were statistically different for Warrior treatment compared to the other treatments on Aug. 24. The Sivanto application at 10 fl oz/A on July 28 provided effective control of SCA up to harvest. Also, both applications of Sivanto at 5 fl oz/A and 7 fl oz/A on Aug. 26 provided effective control of SCA. The Sivanto treatments basically prevented SCA from surviving and developing colonies with all life stages on both the upper and lower leaves. By Sept. 15 the early application of Sivanto at 10 fl oz/A was starting to have a few aphid colonies with all life stages. Following the insecticide applications on Aug. 26 sugarcane aphid densities increased to high levels in the Warrior II treatment each week and were statistically similar to the SCA densities in the untreated plots.

The applications of Intruder and Lorsban Advanced initially prevented SCA from increasing substantially for one week. There was a greater increase following the Intruder application than for the Lorsban Advanced treatment. By September 15, there were definite statistical difference among the insecticide treatments and the untreated check. These differences in SCA numbers created different SCA/damage levels over time to when the forage plots were harvested (Table 4 and Fig. 2). SCA density levels did not begin to cause significant increases in SCA/Damage levels until Sept 1 in the untreated and Warrior treated plots, 5.75 and 4.5, respectively. The SCA/Damage levels in these two treatments continued to increase and remained significantly higher from the other treatments through Sept. 8 to Sept. 20. As the SCA densities increased in the Intruder and Lorsban Advanced treatments the SCA/Damage ratings also increased more than ratings in the Sivanto treatments, but not as high as the untreated and Warrior ratings. All of the Sivanto treatments equally prevented SCA densities from causing significant damage to the forage

Table 3. Average number of sugarcane aphids for sampled leaves.

	Boot	50% Bloom	Beginning Milk	Milk	Soft Dough
Treatment and Rate/A	Aug 16	Aug 24	Sept 1	Sept 8	Sept 15
Intruder 1.0 oz	6.7 a	57.8 b	90.9 b	1159.9 abc	1096.8 b
Lorsban Advanced 16 fl oz	7.1 a	103.0 b	18.3 b	428.8 bc	982.4 b
Sivanto 10 fl oz	0.3 a	20.7 b	4.3 b	35.8 c	42.3 c
Sivanto 5 fl oz	16.6 a	71.3 b	23.3 b	7.4 c	22.5 c
Sivanto 7 fl oz	8.2 a	61.2 b	9.7 b	1.7 c	18.3 c
Untreated	61.8 a	47.2 b	1387.8 a	2065.6 ab	2273.3 a
Warrior II 1.92 fl oz	124.4 a	333.2 a	870.4 a	2560.3 a	2591.5 a
Treatment P>F	0.3807	0.0046	<.0001	0.0004	<0.0001

Means within a column followed by the same letter are not significantly different. Tukey-Kramer HSD (*P*>0.05).

sorghum.

Table 4. Average High Plains SCA/Damage rating.

	Boot	50% Bloom	Beginning Milk	Milk	Soft Dough	Soft Dough
Treatment and Rate/A	Aug 16	Aug 24	Sept 1	Sept 8	Sept 15	Sept 20
Intruder 1.0 oz	1.00 a	1.00 a	1.50 b	4.50 b	6.25 b	6.25 b
Lorsban Advanced 16 fl oz	1.00 a	1.25 a	1.00 b	3.25 bc	5.75 b	5.75 b
Sivanto 10 fl oz	0.25 b	1.00 a	1.00 b	1.00 c	1.00 c	1.00 c
Sivanto 5 fl oz	1.00 a	1.25 a	1.25 b	1.00 c	1.25 c	1.25 c
Sivanto 7 fl oz	1.00 a	1.25 a	1.00 b	1.00 c	1.00 c	1.00 c
Untreated	1.00 a	1.25 a	5.75 a	8.00 a	9.00 a	9.25 a
Warrior II 1.92 fl oz	1.00 a	1.75 a	4.50 a	8.50 a	8.75 a	8.75 a
Treatment P>F	0.0001	0.2001	<0.0001	<0.0001	<0.0001	<0.0001

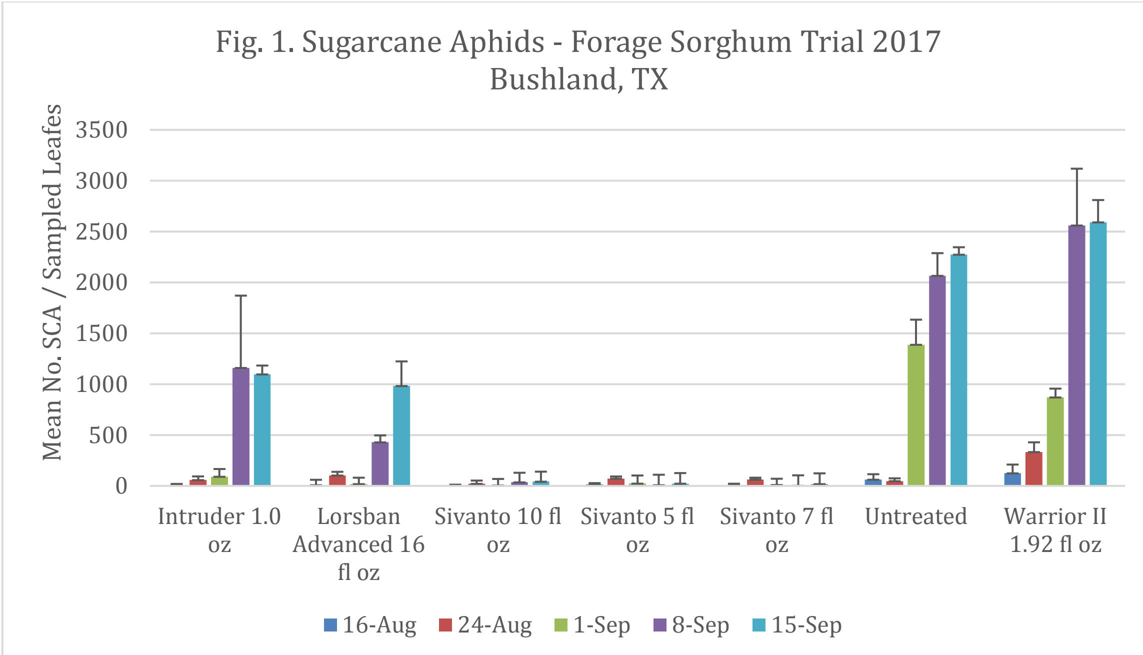
Means within a column followed by the same letter are not significantly different. Tukey-Kramer HSD (*P*>0.05).

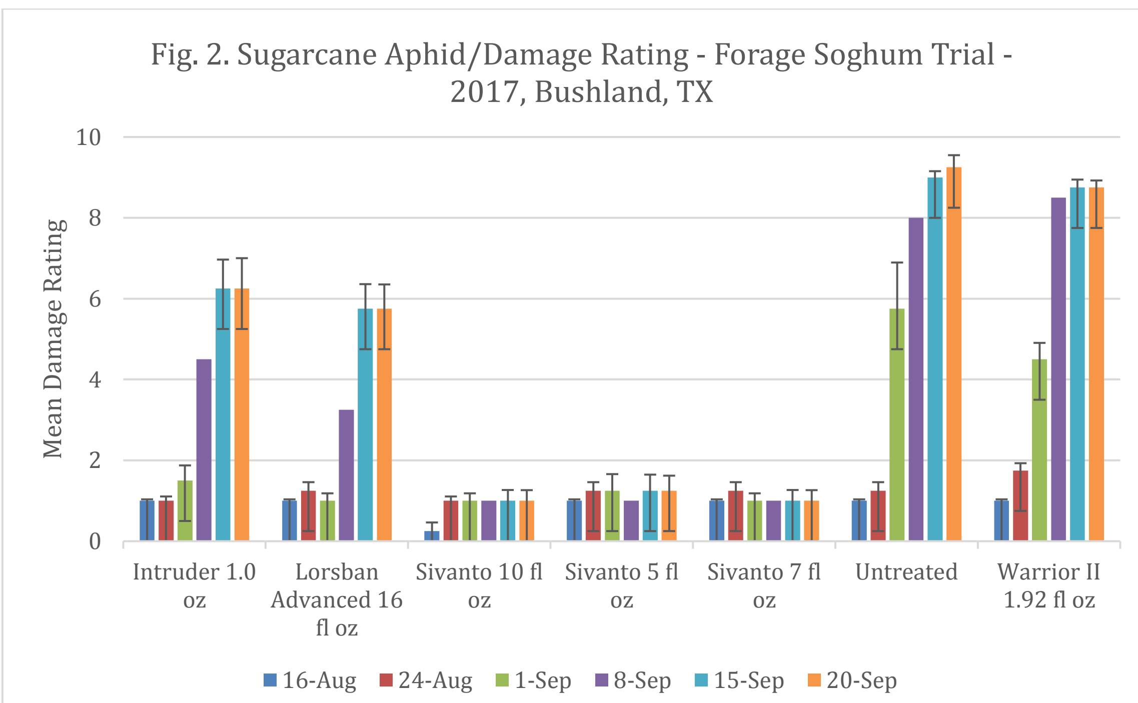
The heavy infestations and damage from SCA in the untreated and the Warrior treatment were the only treatments that had significant reduction in yield and percentage of plants lodged when compared among all of the treatments (Table 5). It is understandable why there were no statistical differences in yield and percentage of plants lodged within the three Sivanto treatments when seeing their low infestation levels and low damage levels. Although SCA infestations and damage levels began to be significant in the milk and soft dough growth stages in the Intruder and Lorsban treatments, these infestations and damage levels may not have occurred long enough to effect yield prior to harvesting on Sept. 20. None of the SCA infestations and damage among any of the treatments affected plant height and the % dry matter.

Table 5. Yield, plant height, % dry matter, and % lodged plants infested with sugarcane aphids and harvested September 20, 2017.

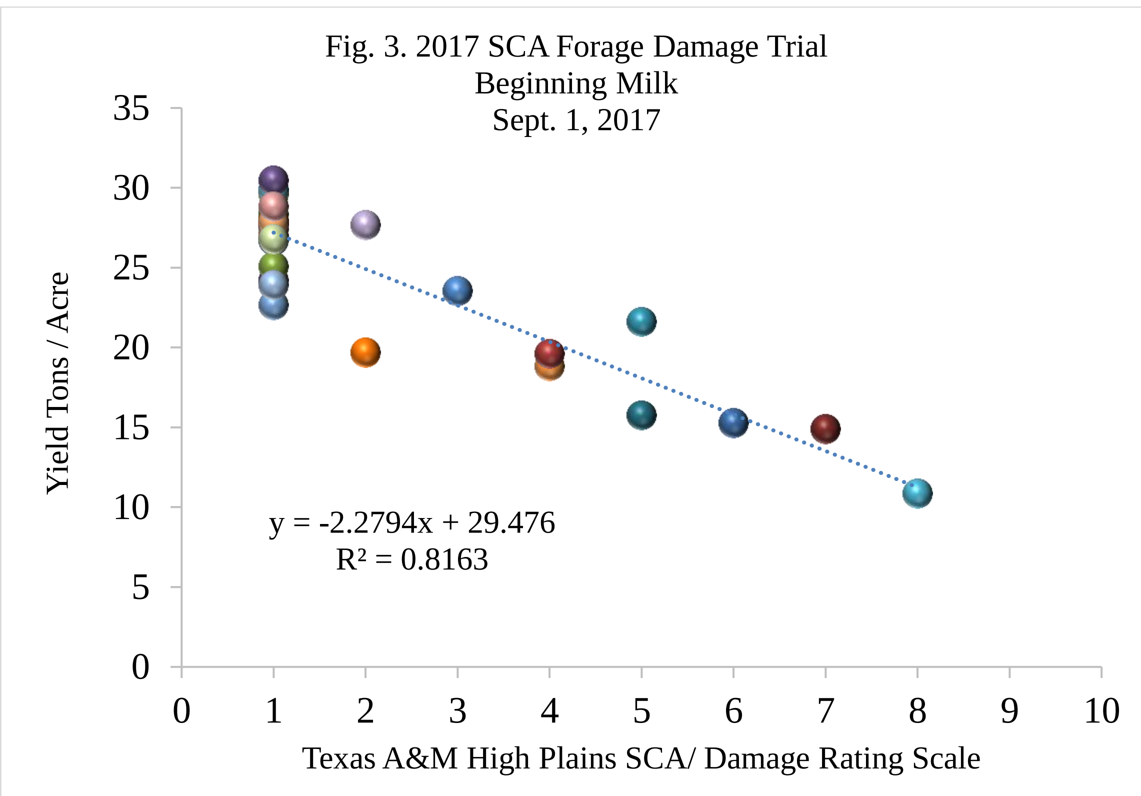
Treatment and Rate/A	Yield (tons/acre)	Plant Height (in)	% Dry Matter	% Lodged Plants
Intruder 1.0 oz	27.03 a	68.00 a	27.56 a	0 b
Lorsban Advanced 16 fl oz	27.75 a	72.75 a	26.05 a	0 b
Sivanto 10 fl oz	26.48 a	68.75 a	29.08 a	0 b
Sivanto 5 fl oz	27.11 a	69.50 a	29.15 a	0 b
Sivanto 7 fl oz	27.37 a	66.25 a	27.24 a	0 b
Untreated	15.17 b	68.50 a	31.38 a	38.8 a
Warrior II 1.92 fl oz	18.94 b	70.50 a	28.98 a	6.3 ab
Treatment P>F	<0.0001	0.4508	0.7091	0.0316

Means within a column followed by the same letter are not significantly different. Tukey-Kramer HSD (*P*>0.05 for yield, plant height, and % dry matter. *P*>0.1 for % lodged plants).





The following series of figures demonstrate the relationship of SCA/Damage levels to yield over time from the beginning milk stage to the soft dough stage at harvest. Data for forage yield and SCA/Damage rating from each experimental plot from the treatments were used to for regression analysis. Prior to the milk stage the SCA infestation and damage levels were too low be correlated to yield losses. The strongest linear relationship ($R^2 = 0.81$) between SCA/Damage and yield loss occurred on Sept. 1 when the forage sorghum was at the beginning milk growth stage (Fig. 3). The SCA/Damage levels above 1 represent variability in damage from plots within the untreated and Warrior treatments. This was prior to infestations building up in the Intruder and Lorsban plots. The linear regression indicate there is a 2.28 ton/A loss in yield for each unit increase in damage when the forage sorghum was initiating the milk growth stage. In Figures 4 to 6, damage levels in the untreated and Warrior treatment plots increased and shifted to the higher damage levels and damage levels from plots in the Intruder and Lorsban treatments began to increase. As mentioned previously, these damage levels may not have occurred long enough prior to harvesting to cause significant yield losses. This may explain why there were not strong linear relationships on Sept. 8 to Sept. 20 sample dates. Yield losses may have been higher if the forage sorghum had been harvested at later growth stages (hard dough to physiological maturity). These results indicate SCA infestations should be controlled to prevent high levels of damage when the forage sorghum is in the beginning milk stage.



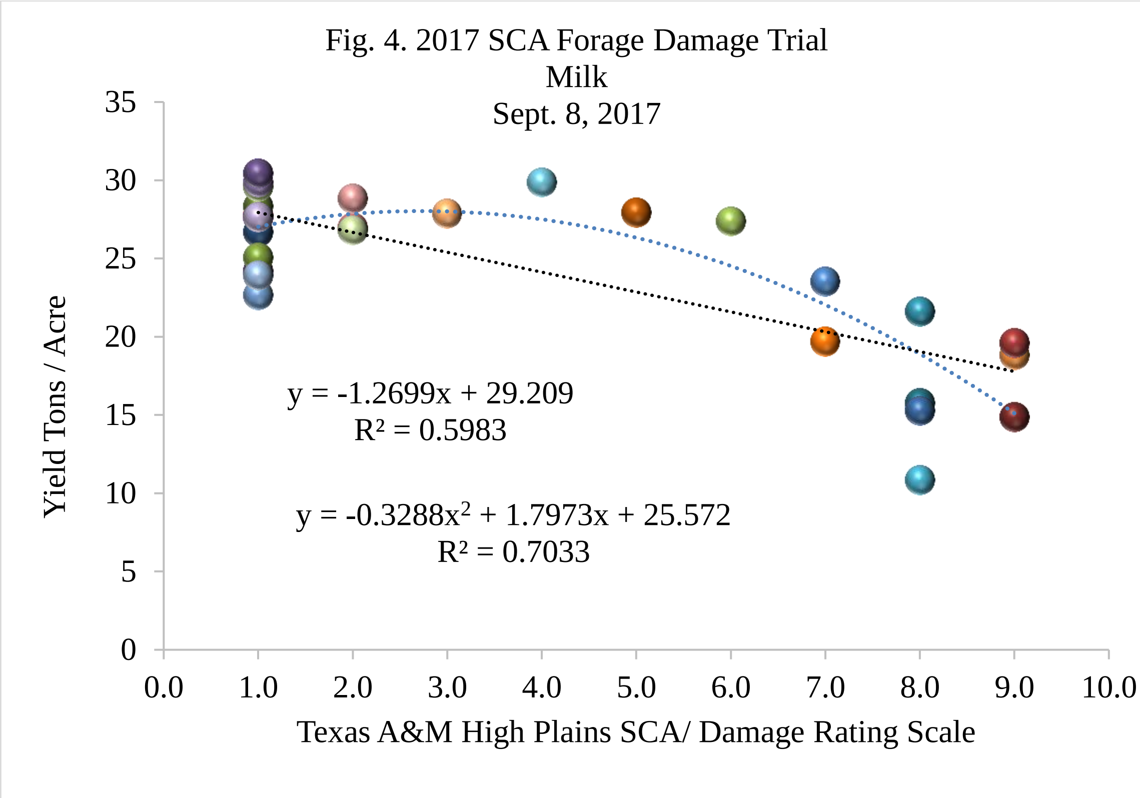


Fig. 4. 2017 SCA Forage Damage Trial
Milk
Sept. 8, 2017
Yield Tons / Acre
Texas A&M High Plains SCA/ Damage Rating Scale
y = -1.2699x + 29.209
R² = 0.5983
y = -0.3288x² + 1.7973x + 25.572
R² = 0.7033
0
5
10
15
20
25
30
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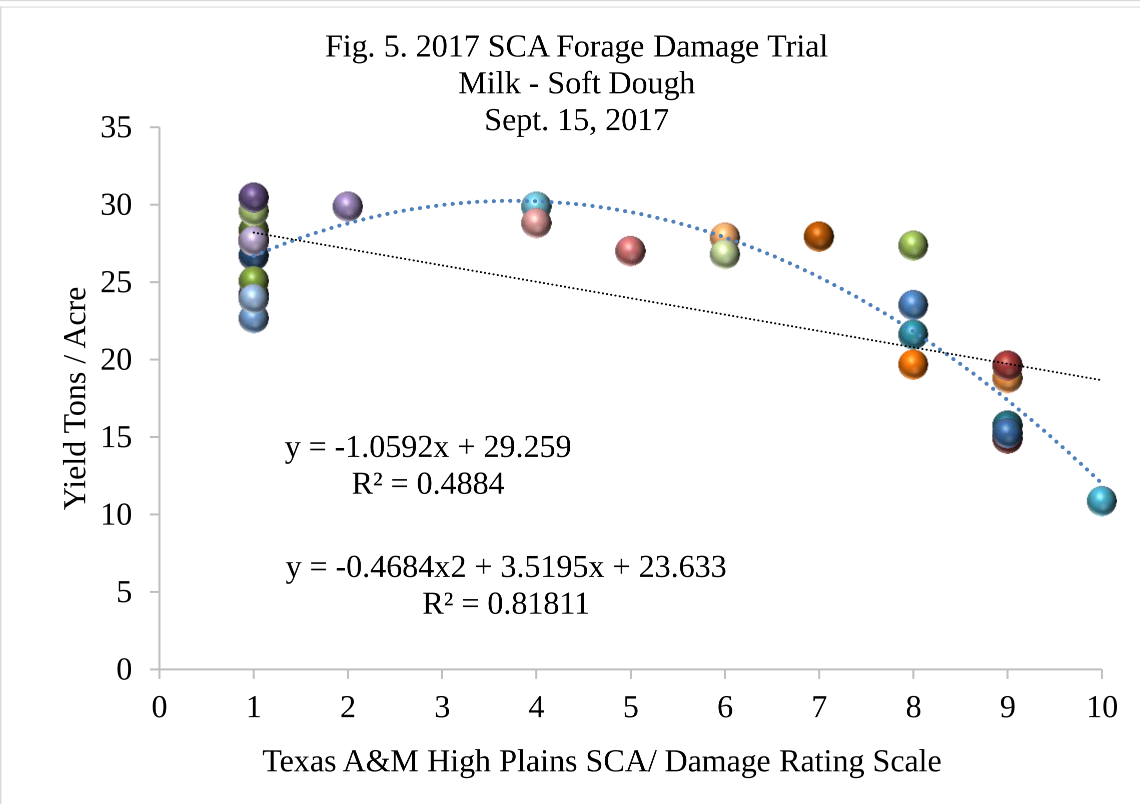
Fig. 5. 2017 SCA Forage Damage Trial
Milk - Soft Dough
Sept. 15, 2017
Yield Tons / Acre
Texas A&M High Plains SCA/ Damage Rating Scale
y = -1.0592x + 29.259
R² = 0.4884
y = -0.4684x2 + 3.5195x + 23.633
R² = 0.81811
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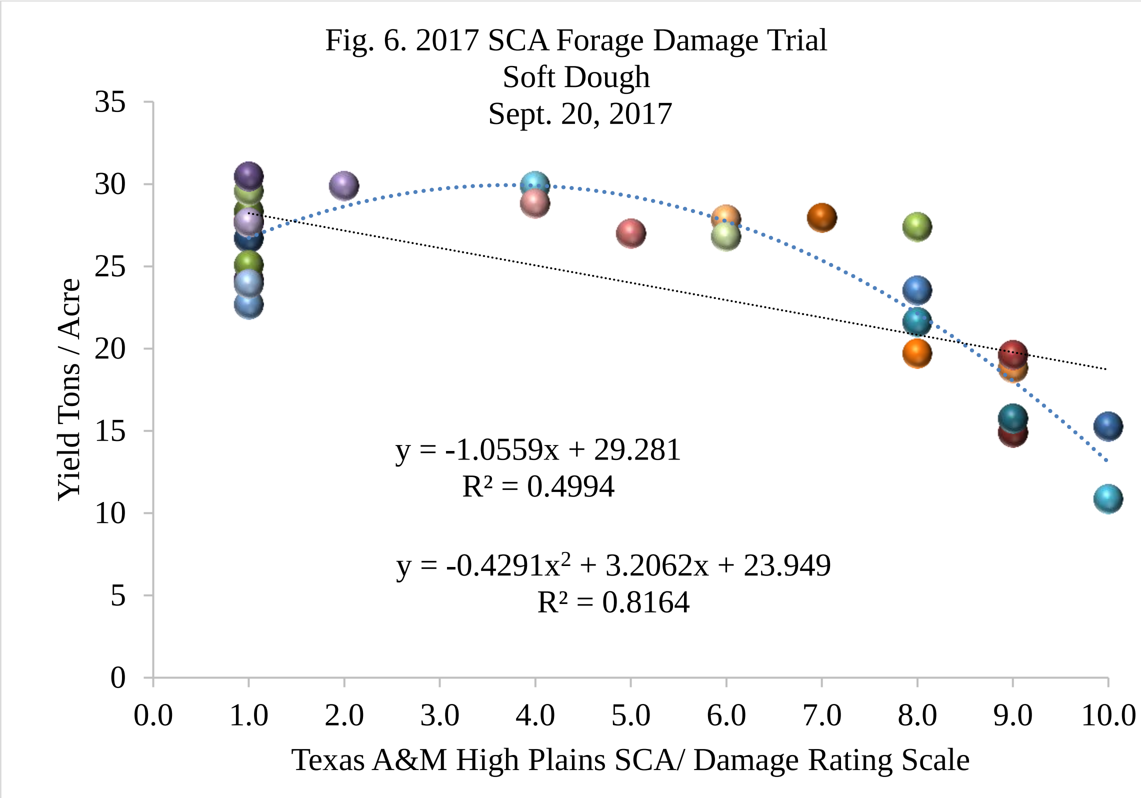

Using the silage yield for each level of SCA damage, when calculated using the non-linear regression formula for damage rating to yield (tons/ac) at soft dough in figure 6, an estimate of gross economic gain or loss per acre was calculated (Table 6).

Table 6. Economic estimate of gross return based on silage yield per level of SCA damage at harvest, September 20, 2017.

Silage Price = 10.5 * December 2017 corn board price ($38/ton delivered)					
		Price per Ton			
Damage	Yield ton/Ac	$30.00	$35.00	$40.00	$45.00
1	26.73	$801.78	$935.41	$1,069.04	$1,202.67
2	28.65	$859.35	$1,002.58	$1,145.80	$1,289.03
3	29.71	$891.17	$1,039.70	$1,188.23	$1,336.76
4	29.91	$897.25	$1,046.79	$1,196.33	$1,345.87
5	29.25	$877.58	$1,023.84	$1,170.10	$1,316.36
6	27.74	$832.16	$970.85	$1,109.54	$1,248.24
7	25.37	$761.00	$887.83	$1,014.66	$1,141.49
8	22.14	$664.09	$774.77	$885.45	$996.13
9	18.05	$541.43	$631.67	$721.91	$812.15
10	13.10	$393.03	$458.54	$524.04	$589.55

The sale price of silage paid to a local farmer was based on a 10.5 factor * the December 2017 corn board price or $38 per ton deliver. We used this value to obtain a range of prices for silage ($30.00 to $45.00 per ton) for our estimates of dollar return based on yield / damage level. If damage from SCA reached levels had reached between 7 and 10 the loss in yield would have caused a significant loss the economic return per acre.

Silage Quality Analysis

The impact of sugarcane aphid feeding damage to the forage silage quality components were similar to the losses related to yield. The forage quality in the untreated and Warrior treatments had statistically significant levels of differences for all of the ensiled components, except crude protein and pH, when compared to the other insecticide treatments (Table 7). When comparing forage quality differences from being freshly harvested (0 Day Ensiled) to being ensiled for 60 days there were statistical difference between these two dates for each of the ensiled components, except for ADF, TDN, Milk/Ton, and RFQ (Table 7). However, there were no interaction between treatment and days ensiled. There was a similar linear relationship between SCA damage at the beginning milk stage to the silage quality components as there was to yield loss (Fig. 7). Therefore, these data indicate the level of damage SCA cause to yield during the milk developmental stages impacts the quality of the forage sorghum at harvest.

Conclusion

For this commercial forage sorghum hybrid, the insecticide application of Sivanto Prime provided excellent control of SCA when the 10 fl oz/A rate was applied before SCA began to infest the field and when the 5 and 7 fl oz/A rates were applied at flowering before heavy aphid infestations. Both Lorsban Advance (16 fl oz/A) and Intruder (10 oz/A) delayed SCA populations from building for a week. This delay in population flare-up prevented substantial yield losses when sorghum was harvested at the soft dough stage. If the harvest date had been at a later growth stage the yield losses may have been substantial. When SCA infestations were high enough to cause damage levels from ratings of 4.5 to 8 at the beginning milk stage and were allowed to continue to increase to harvest, there were significant losses in yield (tons/A), a higher percentage of plants lodging, and poorer quality of forage that would be ensiled. If damage levels were ≤ 6.0 by the soft dough growth stage there was no losses in yield or economic return. However, when damage levels were between rating of 7 to 10 there was a progressive loss in yield and a substantial loss in the economic return. Since SCA populations can develop rapidly, SCA should be controlled to prevent damage during the flowering and early grain developmental growth stages.

Acknowledgement

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TEXAS A&M AGRILIFE EXTENSION

Table 7. Mean value for each forage quality component when analyzed by a factorial design for treatment by ensiled days.

	% (Dry Matter Basis)															
Treatment	CP		Lignin		Starch		ADF		aNDF		uNDFom240		NDFD240		IVTDMD48	
Untreated	8.4	c	6.10	a	11.6	b	41.4	a	59	a	19.9	a	67.7	ab	70.2	b
Warrior II 1.92 fl oz	8.7	bc	5.72	a	13.6	b	39.6	a	56.9	a	19.1	ab	68.6	a	72.8	b
Lorsban Advanced 16 floz	9.2	abc	5.11	b	22.7	a	33.5	b	49.7	b	18.2	bc	64.4	abc	77.9	a
Intruder 1.0 oz	9.1	abc	5.10	b	25.0	a	32.6	b	47.6	b	18.3	bc	62.8	c	80.3	a
Sivanto 5 floz	9.2	abc	5.10	b	25.2	a	31.8	b	46.9	b	17.4	c	63.6	bc	78.8	a
Sivanto 7 floz	9.6	a	5.07	b	21.6	a	32.9	b	48.5	b	17.3	c	65.6	abc	79.3	a
Sivanto 10 floz	9.4	ab	4.98	b	22.8	a	32.2	b	48.1	b	17.7	c	64.4	bc	79.7	a
LSD	0.8		0.5		6.9		4.6		6.0		1.4		4.3		4.8	
Treatment P>F Values	0.0015		<.0001		<.0001		<.0001		<.0001		<.0001		0.006		<.0001	

	% (Dry Matter Basis)															
Ensiled Days	CP		Lignin		Starch		ADF		aNDF		uNDFom240		NDFD240		IVTDMD48	
0	9.4	a	5.5	a	23.3	a	35.6	a	52.4	a	19.8	a	63.7	b	77.9	a
60	8.7	b	5.1	b	17.43	b	34.1	a	49.5	b	16.8	b	66.8	a	76.1	b
LSD	0.3		0.2		2.4		1.6		2.1		0.5		1.5		1.7	
Ensiled P>F Values	<.0001		0.0001		<.0001		0.0769		0.065		<.0001		0.0002		0.0374	
TRT*Ensiled P>F Values	0.5061		0.6736		0.6184		0.9426		0.8255		0.344		0.7691		0.1862	

[a] Means in each column for treatment and ensiled days with the same letter are not significantly different, Tukey-Kramer method for multiple mean separation (P>0.05).

Table 7. continued

TRT	TDN		Milk/Ton		RFQ		pH	
Untreated	48.5	b	2625	b	76.9	b	4.82	a
Warrior II 1.92 fl oz	51.0	b	2782	b	85.2	b	4.77	ab
Lorsban Advanced 16 floz	57.4	a	3189	a	111.4	a	4.77	ab
Intruder 1.0 oz	58.9	a	3278	a	121.7	a	4.66	ab
Sivanto 5 floz	58.8	a	3274	a	118.5	a	4.66	ab
Sivanto 7 floz	58.4	a	3243	a	118.1	a	4.58	b
Sivanto 10 floz	59.5	a	3327	a	122.4	a	4.63	ab
LSD	5.3		345		24.1		0.24	
Treatment P>F Values	<.0001		<.0001		<.0001		0.0227	

Ensiled Days	TDN		Milk/Ton		RFQ		pH	
0	55.9	a	3089	a	108.1	a	5.77	a
60	56.2	a	3116	a	107.4	a	3.62	b
LSD	1.86		120		8.406		0.08	
Ensiled P>F Values	0.7666		0.6603		0.8653		<.0001	
TRT*Ensiled P>F Values	0.6419		0.6775		0.4494		0.2376	

[a] Means in each column for treatment and ensiled days with the same letter are not significantly different, Tukey-Kramer method for multiple mean separation (P>0.05).

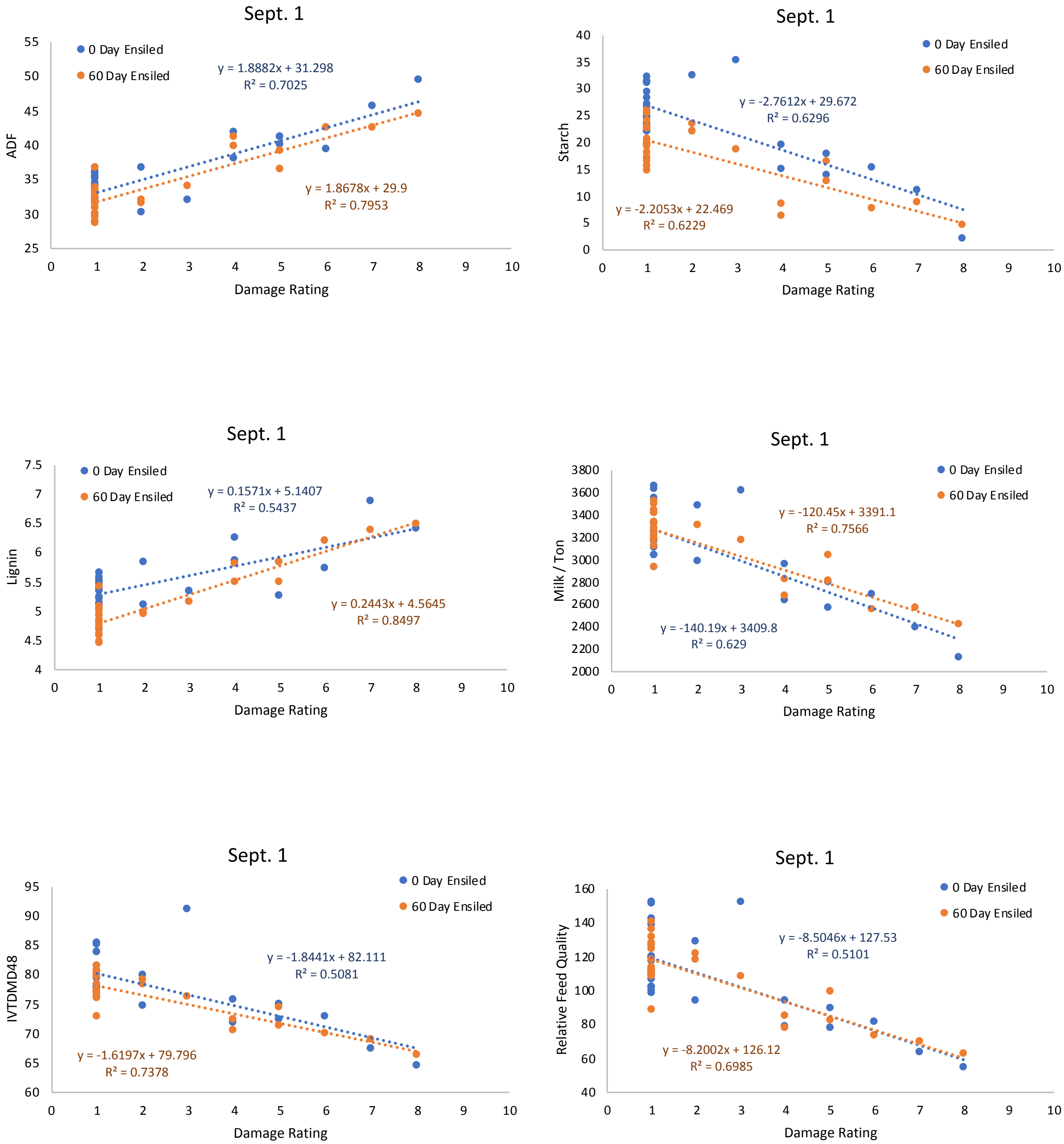

Figure 7. Relationship of silage quality components at 0 Day Ensiled and 60 Days Ensiled to sugarcane aphid damage ratings at beginning milk stage on September 1, 2017. Silage quality components based on % dry matter are AFD (acid detergent fiber), Lignin, IVTDMD48 (In vitro dry matter digestibility at 48 hours). Other silage quality components are starch, milk per ton (gallons of milk per ton of silage), and relative feed quality.