SUGARCANE APHID AND POTENTIAL STRATEGIES FOR CONTROL

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ABSTRACT

Sugarcane Aphid (SCA) – *Melanophis sacchari* (Zehntner) – is an invasive insect pest of sorghum – *Sorghum bicolor* (L.) Moench – in the United States, and it causes economic losses in all types of sorghum species crops. In California, SCA is particularly damaging to the dairy forage industry for which most CA sorghum is grown. Untreated, SCA can cause total crop loss, and traditional insecticides with effective control of endemic aphids are largely ineffective at controlling SCA. CA research from field trials conducted in 2017-2019 indicated that the use of dimethoate, malathion, and chlorpyrifos can actually inflame SCA populations, and Sivanto Prime (flupyradifurone), Transform WG (sulfoxaflor), and Sefina Inscalis (afidopyropen) all provide adequate control of SCA in forage sorghum when applied as a foliar treatment before SCA populations exceed a treatment threshold. Trial results also showed Sivanto Prime is effective as a systemic treatment when applied to the soil at planting and later. Control of SCA using these insecticides protects yield and improves dairy feed quality. Data suggests that yield and feed quality decline is correlated with aphid-days, or the accumulative exposure of the sorghum crop to actively feeding aphids. Research on insecticidal control of SCA in CA is ongoing, but methods for managing SCA to protect forage sorghum yield and feed quality have become known, and the data will support registration of new insecticides and uses to improve the pest control adviser's toolbox.

Key Words: Sugarcane Aphid, sorghum, insecticide, registration

MANAGING SUGARCANE APHID IN FORAGE SORGHUM

Identifying Sugarcane Aphid

Sugarcane aphid nymph is visually distinct from the common aphid that also infests sorghum, the greenbug aphid, by its paler green to orange color and shorter cornicles (tailpipes) with black tips. They are not known to reproduce or feed on plants outside of the sorghum species. They multiply very rapidly and excrete a lot of honeydew, the sticky glaze that covers leaves beneath where the SCA colonize. Honeydew on lower leaves is usually an early first sign of an SCA population in sorghum. Using a hand lens to inspect the aphid color and the cornicles is sufficient to determine if a SCA population is present.

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Protecting your crop with a seed treatment

Neonicotinoid seed treatments of imidacloprid or clothianidin can protect sorghum from SCA infestation for up to 40 days after planting. Seed treatment is most beneficial when plantings are later in the season and SCA are expected to infest the crop at a young growth stage. The younger a sorghum crop is when SCA infest, the greater the potential for yield loss when populations are not controlled properly. Research from the sorghum belt extension agencies suggest that neonicotinoid seed treatments not only suppress SCA populations in early season compared to an untreated control but in some cases actually protect yield.

Deciding when to treat an SCA population

Treatment thresholds have not been established in CA, but we have recommended a conservative approach recommended by Texas A & M researchers. This approach sets the treatment threshold at 50 aphids per leaf on 25% of plants. To figure out if the threshold has been reached once a population has been identified, a scout should sample 4 locations in the field twice weekly, being sure to stay at least 25 feet away from field edges. The scout must examine 15-20 plants in each area. The lowest green leaf and an upper leaf should be examined from each plant. When 25% of the plants have an average of 50 aphids per leaf, treatment should be scheduled immediately. A cluster of 50 SCA nymphs is about the size of an adult pinky fingernail, well-trimmed. Exceptions can be made if the crop is near harvest and weather is cooling or a population is localized to a small area of the field. In the former case, treatment can usually be skipped because the SCA will not cause measureable damage to yield or quality. In the latter case, a spot treatment can be performed, but the field should continue to be scouted for escapes and new infestations.

Choosing an insecticide and rate to treat for SCA

Foliar insecticide efficacy trials in CA in 2016 and 2017 have compared two products that are commercially available to growers: Sivanto Prime and Transform WG. Transform WG was permitted under a Section 18 Emergency Exemption from Registration, and the recommended rates tested were 1.5 and 2.0 oz/acre. Sivanto Prime was tested at the low label rate of 7 fl oz/acre and the sub-label rate of 4 fl oz/acre. Insecticides were applied once at a dilution volume of 30 gallons per acre with shielded drop nozzles on ground equipment. Our trial results showed that both insecticides are effective at reducing SCA numbers compared to an untreated control, but Sivanto Prime held numbers down at least 2 weeks longer than Transform WG, which began to break at 2-3 weeks after treatment (Tables 1 & 2). The sub-label rate of Sivanto Prime did not bring SCA numbers as low as the bottom label rate, but did keep aphids well below the untreated control. Both products protected yield relative to the untreated control (Figures 1 & 2). Both insecticides were apparently protective of beneficial insect populations compared to treatments that included chlorpyrifos, malathion, or dimethoate (no data collected, observational only). Dimethoate treatment actually elevated SCA populations relative to the untreated control.

Both products have a 7 day pre-harvest interval for forage sorghum, so both products can be used almost through the end of the season. Since Sivanto Prime has a minimum spray interval of 7 days with longer residual activity, while Transform WG has a minimum spray interval of 14 days with shorter residual activity, infestation timing relative to crop growth stage is a good deciding factor. If SCA infest the crop at an early growth stage, Sivanto Prime should be used to protect the crop for the longest period of time during the most vulnerable stages of development. If the infestation is later in the season or at a late stage of crop development, Transform WG is a good choice since the shorter residual activity is less important when the crop is less vulnerable and SCA are reproducing slower and feeding less toward the end of the growing season.

NEW REGISTRATIONS FOR SCA INSECTICE CONTROL?

Products in-line for registration

In trials in 2016 and 2017 in Shafter, CA, we tested efficacy of foliar applied insecticides that are not registered for use in CA, but may be soon. Although Transform WG was granted a Section 18 Exemption, there is not yet a Section 3 Registration for Use label. Sefina Inscalis is also in line for registration for use in CA.

Both of the products above performed well enough to be effective controls of SCA in sorghum. Sivanto Prime kept aphid numbers lower for longer, but all of these products kept aphids below the treatment threshold level for most of the season after treatment. Similar to Transform WG, Sefina Inscalis at 6 fl oz/acre had a relatively short-lived residual control compared to Sivanto. The higher rate of Sefina Inscalis, 12 fl oz/acre, had residual control similar to Sivanto for as long as 4 weeks after treatment. We also tested the efficacy of Sivanto HL which is formulated to have twice the concentration of flupyradifurone than Sivanto Prime. We found no differences in efficacy between Sivanto Prime and Sivanto HL when comparing similar oz/acre of active ingredient.

Data from 2019 trials performed in Five Points, CA, and Shafter, CA, have been collected and is still being analyzed.

The Transform WG mode of action is grouped by Insecticide Resistance Action Committee (IRAC) as a 4C, Sulfoximine. The Sefina Inscalis mode of action is grouped by IRAC as a 9D, Pyropene. If these products are registered for use in CA, growers and pest control advisors will have more tools in their IPM tool belt to mitigate evolution of insecticide resistance in SCA populations.

New uses of Sivanto in-line for registration

In 2018 and 2019 (data for 2019 are still being analyzed), we performed trials to investigate the efficacy of Sivanto applied as a systemic treatment by application to soil. We compared different rates of Sivanto applied to the soil with seed during planting as a drench and different rates applied as an injected side-dress tank mixed with UAN-32 at layby to a foliar application of Sivanto after SCA populations had established. At-planting application of Sivanto imparted season-long protection of the crop from SCA, while the side-dress treatment provided good control as well despite breaking about 2 weeks after foliar treatment timing (Figure 3).

We think that these treatments are effective as a prophylactic control measure to protect sorghum from SCA infestation. They offer the benefit of being easily integrated into normal cultural operations such as planting and side-dress fertilization and/or furrow cultivation, and they side-step the issue of requiring adequate product coverage in a dense plant canopy such as in a foliar application. However, despite imparting shorter residual control than the at-planting application, the side-dress application might be more practical for growers because it allows greater flexibility in time to decide whether or not a prophylactic treatment is warranted. If reports are coming in that SCA infestations are rising in the area, a grower who has not yet performed layby operations might choose at this point to apply Sivanto as a side-dress treatment for several weeks of protection. Monitoring would still be required to determine if a follow-up foliar application of an insecticide is required to control a later season infestation.

CONCLUSION

Several insecticides and alternate methods for application have been tested for their efficacy in controlling SCA in sorghum grown for dairy feed in CA. Several products have shown promise, and growers and pest control advisers have more than enough adequate tools and IPM steps to pursue low-cost, effective control plans. Control of SCA in sorghum in CA will be important for the dairy industry going forward, because sorghum presents dairy farmers with an opportunity to grow a feed crop when irrigation water is short in availability and/or soil and irrigation water quality are marginal. Prudent rotation of chemistries when they become available in CA combined with diligent scouting and treatment decision making will keep growers and pest control advisers ahead of this pest.

TABLES AND FIGURES

Table 1. 2017 Insecticide Efficacy at Reducing SCA Pressure in Forage Sorghum over Time

Treatment	Application rate fl. oz./acre	Aphid-days between observations ± SEM[1]								Cumulative aphid-days
		DAT[2]								
		6	12	15	20	26	29	34	39	
UTC[3]	N/A	11.3 ± 6.4	291.8 ± 176	348.8 ± 245.6	292.2 ± 100.4	647.4 ± 325.7	353.6 ± 234.2	25.2 ± 21.3 ab	28.3 ± 10.3	8942.4 ± 1728.1
Sivanto Prime	4	15.8 ± 15.8	104.8 ± 103.7	101.1 ± 98.1	62.9 ± 55.0	8.0 ± 5.8	53.5 ± 52.1	36.6 ± 33.2 ab	57.1 ± 55.6	1939.9 ± 764.3
Sivanto Prime	7	12.4 ± 12.1	33.8 ± 33.8	67.1 ± 67.1	1.0 ± 1.0	1.6 ± 0.2	29.2 ± 20.4	3.9 ± 1.4 a	7.7 ± 6.1	700.2 ± 431.6
Transform WG	1.5	81.5 ± 74.1	755.8 ± 751.7	461.8 ± 452.7	44.3 ± 38.7	142.9 ± 56.5	256.7 ± 43.6	120.2 ± 7.3 bc	58.6 ± 29.3	8642.9 ± 5256.3
Malathion 57%	24	48.4 ± 39.9	140.7 ± 139.5	231.4 ± 225.1	229.2 ± 179.9	351.6 ± 337.1	732.9 ± 729	265.4 ± 81.7 c	129.4 ± 126.5	9419.4 ± 7402.3
Dimethoate 4EC	16	35.3 ± 19.4	163.5 ± 122.7	336.3 ± 179.2	425.5 ± 363.8	285.2 ± 187.4	87.1 ± 69.9	30.2 ± 24.7 ab	12.6 ± 7.0	6552.8 ± 1786.4
Lorsban Advanced	32	0.8 ± 0.4	25.4 ± 24.7	53.9 ± 50.3	41.9 ± 33.5	78.2 ± 49.1	617.5 ± 388.9	190.9 ± 82.3 c	192.4 ± 19.3	4824.3 ± 2639.3
F statistic[4]		*0.777*	*0.499*	*0.454*	*1.542*	*2.095*	*0.777*	*5.166*	*1.262*	*1.377*
P-value[4]		*0.613*	*0.792*	*0.822*	*0.291*	*0.178*	*0.613*	*0.024*	*0.380*	*0.340*

Means ± SEM within a column followed by identical lowercase letters are not significantly different according to Fisher's LSD[4] at $\alpha = 0.05$.

[1] Standard error of the mean

[2] Days after treatment

[3] Untreated control

[4] Inferential statistics performed and reported after square root transformation of "aphid-days" variable. All means and SEM data presented are non-transformed.

Table 2. 2018 Insecticide Efficacy at Reducing SCA Pressure in Forage Sorghum over Time

Treatment/formulation	Rate form prod/acre[1]	Mean SCA per leaf											
		PRE	5DAT	9DAT	14DAT	19DAT	22DAT	28DAT	34DAT	41DAT	48DAT	54DAT	Aphid-Days
Check	-	7.4a	16.1c	36.0bc	53.1cd	15.0bc	7.0a	13.3a	51.1c	58.1e	79.1d	49.2de	2113cd
Sivanto Prime	7.0 fl oz	15.6a	0.9a	2.2a	1.4a	1.3a	0.3a	1.0a	0.1a	1.1a	4.5ab	4.5a	87a
Sivanto HL	3.5 fl oz	11.9a	2.1ab	5.1a	4.0ab	0.7a	0.6a	0.2a	0.4a	1.3a	0.8a	4.0a	92a
Transform WG	2.0 oz	12.4a	3.8ab	3.1a	19.9bc	7.6abc	5.8a	14.3a	30.1bc	26.2cd	75.0cd	44.9e	1283bc
Sefina	6.0 fl oz	10.0a	6.5b	12.5ab	13.2ab	26.2cd	19.6a	36.4a	22.0bc	28.9cde	20.3abc	17.8abc	1110b
Sefina	12.0 fl oz	9.1a	5.9ab	18.4ab	14.0ab	2.9ab	19.0a	14.5a	36.0bc	15.8bc	10.2ab	26.1cde	866b
Dimethoate	32.0 fl oz	16.3a	20.6c	66.6c	56.9d	47.0d	73.3b	119.5b	25.4bc	51.1de	28.0bcd	61.8e	2853d
Dimethoate + Sivanto HL	32.0 fl oz + 3.5 fl oz	8.9a	2.1ab	3.1a	3.3ab	0.7a	1.0a	1.3a	7.7ab	3.5ab	5.9ab	15.6ab	220a
	F	1.09	9.19	6.35	6.63	5.36	4.07	3.78	3.64	10.27	4.29	6.20	17.17
	P	0.407	<0.001	<0.001	<0.001	0.001	0.006	0.008	0.010	<0.001	0.004	0.001	<0.001

Figure 1. 2017 SCA Insecticide Effect on Forage Sorghum Yield

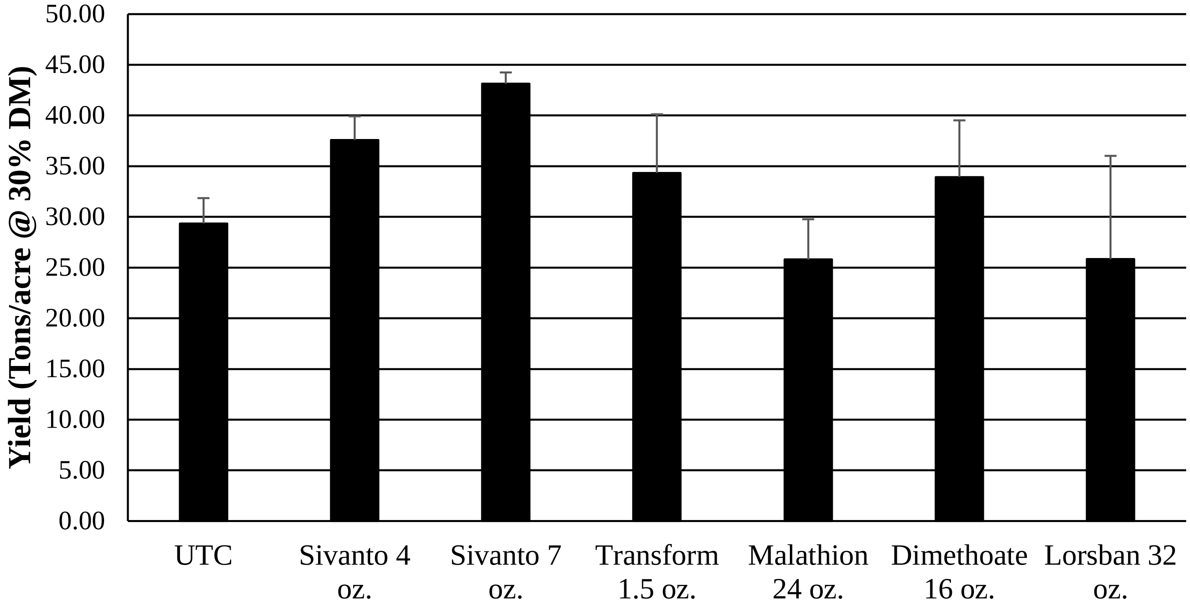

Figure 2. 2018 SCA Insecticide Effect on Forage Sorghum Yield

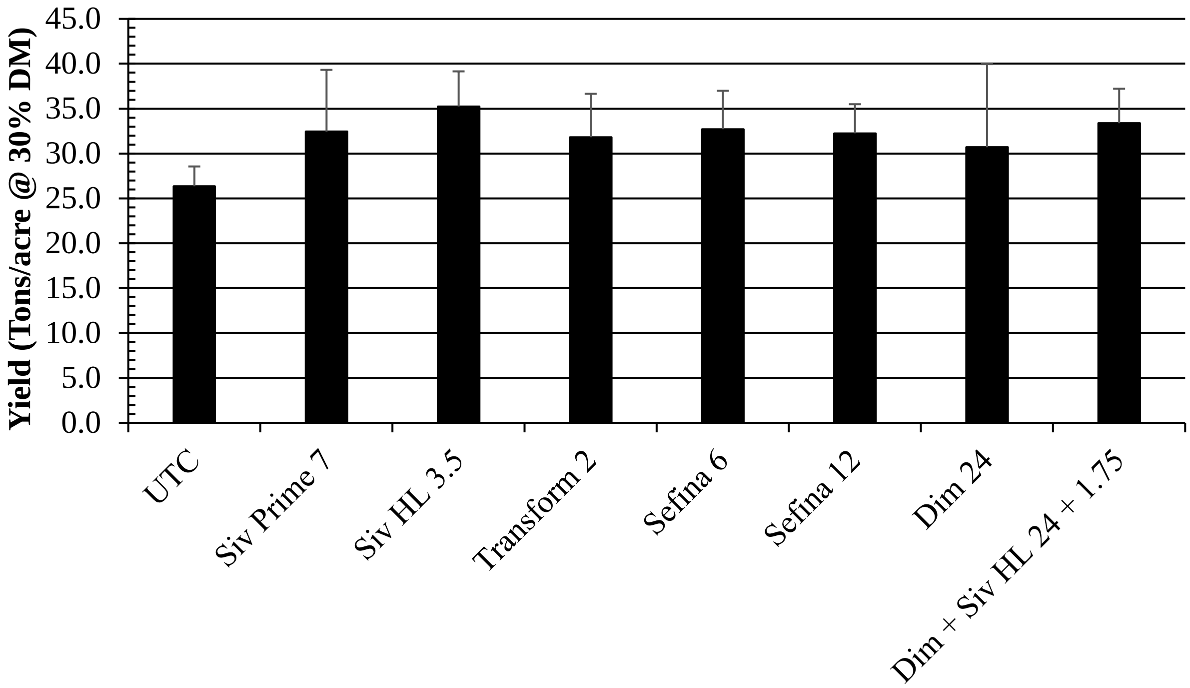

Figure 3. Flupyradifurone rate and application mode treatment effect on mean aphids/leaf over time.