Agricultural Experiment Station
Cooperative Extension

THE UNIVERSITY OF
ARIZONA
MARICOPA
AGRICULTURAL CENTER

37860 West Smith-Enke Road
Maricopa, Arizona 85138
(480) 331-APMC

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Mr. Jack Peterson
Arizona Department of Agriculture
1688 West Adams Street
Phoenix, Arizona 85007
Phone: 602-542-3575
Fax: 602-542-0466
Email: jpeterson@azda.gov

Subject: Section 18 Specific Exemption for Transform Use in *Sorghum spp*. in Arizona

Dear Jack,

Pest Situation & Response

On 23 August of this year, Ellsworth was contacted by a pest control advisory (PCA) concerned by an unusual pest circumstance in sorghum grown in Stanfield, AZ. On 24 August, an assistant and Ellsworth traveled to the site, inspected the infestation, took pictures and made collections. We tentatively identified the insect as sugarcane aphid. Over the course of the next week, we submitted samples to our staff insect diagnostician for Cooperative Extension, Mr. Gene Hall, of the Arizona Pest Management Center at the University of Arizona Insect Collection. As well, we activated our reporting system of the Arizona Plant Diagnostic Network. Mr. Hall confirmed the field identification and corresponded with the state's diagnostician, Mr. Chris Baptista, who confirmed the identification. At the same time, Dr. John Caravetta of the Arizona Department of Agriculture was examining the quarantine significance of this new, invasive pest. After dialog about follow-up field surveys completed by 30 August by Cooperative Extension personnel Dr. Ayman Mostafa and myself, which showed this same aphid species present in all area sorghum fields, Dr. Caravetta concluded on 2 September, "The department will not pursue this pest further as actionable or of quarantine significance."

The condition of the initial field we examined was wildly out of control. Using standard measurements developed by Texas A&M, we estimated that there were well over 1500 aphids per leaf throughout the canopy of this sorghum field. Sustained levels of these aphids were already causing significant leaf symptoms associated with greatly impaired photosynthesis and lost production. There was also copious amounts of honeydew covering the entire plant, further impairing plant productivity and interfering with plant evapotranspiration and therefore cooling, which is so critical in our >100°F desert, summer conditions. Despite an ongoing irrigation at the time, the plants appeared to be under heavy water/heat stress as a result of these aphids' activities. Our judgment was that the field had already lost significant time to maturity as well as

yield potential. Prospects for a high quality forage to supply a nearby dairy were not good. Even if the population could be controlled, the existing honeyew is fouling the forage and a likely source of fungal contamination, which carries with it the very important threat of mycotoxin development. As you know, some mycotoxins are highly carcinogenic and certain levels are prohibited from human and animal food or feed.

Cooperative Extension and the Arizona Pest Management Center responded immediately on 30 August by publishing a blog and alerting stakeholders to this new pest occurrence through a widely distributed electronic newsletter. The resources included a brief description of the problem, a diagnostic photo of the aphid, pictures of infested sorghum fields/plants, and links to the known 2015 distribution of this pest in the U.S. and to important management resources at Texas A&M. Because this pest is new to us, we are completely dependent on the research and Extension produced in other states.

Mostafa, A.M. & Ellsworth, P.C. 30 August 2016. Sugarcane Aphid: A New Threat to Sorghum in Arizona. https://arizonaag.com/2016/08/30/sugarcane-aphid-a-new-threat-to-sorghum-in-arizona/

Mostafa, A.M. 30 August 2016. "AZ-AG" Newsletter. An archived, zipped, text version available here: http://calsmail.arizona.edu/pipermail/azag/2016-August.txt.gz

The next day the Western Farm Press picked up on our communications with stakeholders and alerted their readers (10's of thousands): http://westernfarmpress.com/miscellaneous/pest-alert-heavy-infestation-sugarcane-aphid-arizona-california-sorghum

Ten days later a follow-up article was published in the Western Farm Press and detailed further expansion of this aphid to California: http://westernfarmpress.com/miscellaneous/california-ariz-strategize-sugarcane-aphid-control

On 2 September Ellsworth gave a radio interview to KJZZ on this new challenge to sorghum production:

Kuhn, Casey (Senior Field Correspondent), Ellsworth interview about the sugarcane aphid in Arizona sorghum, aired 5 September 2016. http://kjzz.org/content/359574/sugarcane-aphid-goes-west-arizona-sorghum-fields-infested-crop-pest

Both Mr. Hall and Mr. Baptista had confirmed this as a new state record or occurrence of this invasive pest within our borders. Sorghum historically is grown as a low input forage crop and direct scouting of fields for insects is rather limited and insecticide use there uncommon, except for occasional lepidopteran pests early in the season.

We had been tracking the development of this *Sorghum* damaging biotype since its first occurrence 3 years ago in the southern U.S.. However, we were caught by surprise nonetheless, because we did not expect to see populations this year based on the previous year's known distribution (Figure 1).

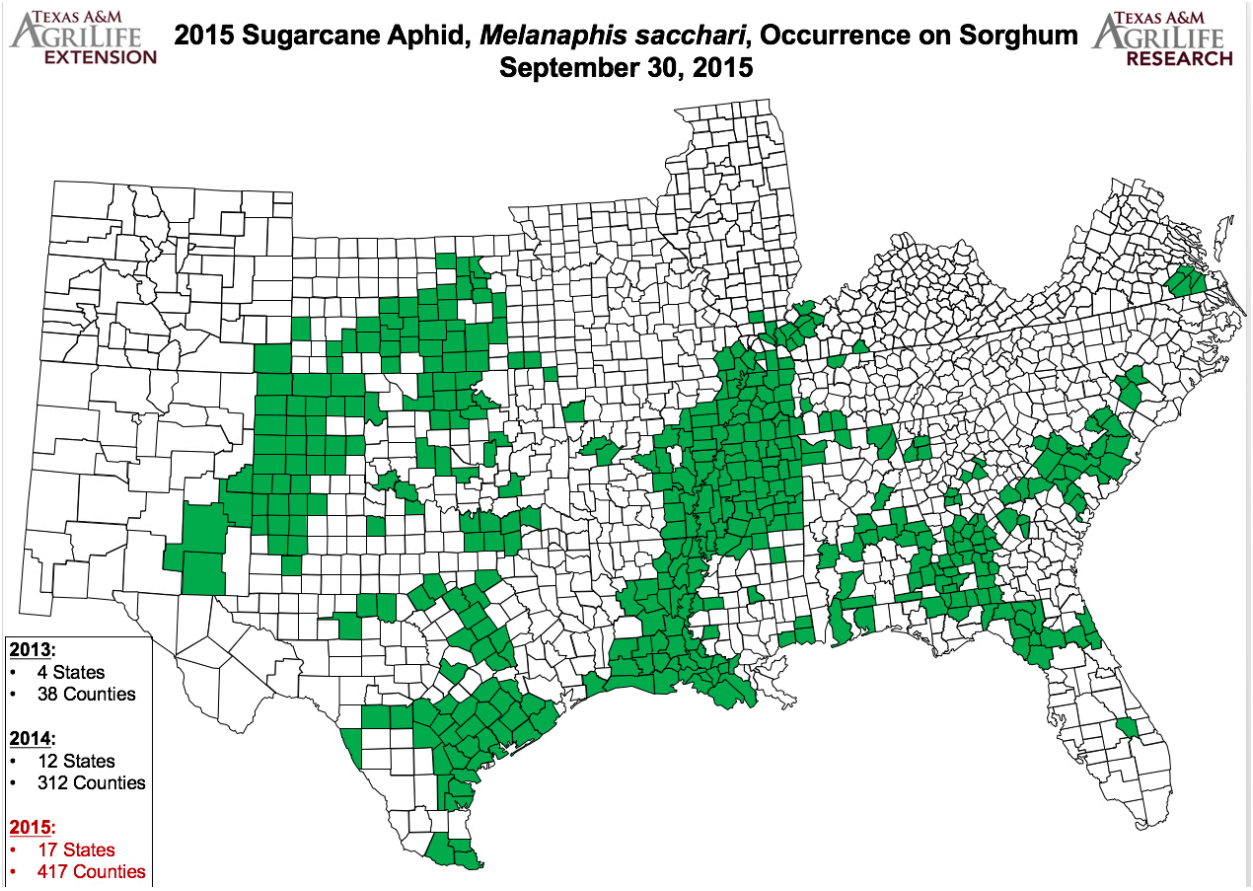

Figure 1. The known distribution of sugarcane aphid on sorghum in the U.S. as of 30 September 2015. The closest populations were in the far eastern counties of NM. From, http://txscan.blogspot.com/p/2015-distribution-map.html

Historical Insecticide Use in Sorghum

Through pesticide use reporting to the State, the APMC captures and analyzes pesticide use patterns. As already mentioned, with the exception of some lepidopteran sprays to sorghum early in the season, most growers do not spray their sorghum for insects and generally manage it as a rapidly maturing crop with lower needs for inputs than the alternatives (e.g., corn). Not all pesticide use is required by the state for reporting. There are about 26,000 acres of sorghum planted in Arizona annually. On average, less than 20% of the sorghum acreage is sprayed for insects (Table 1). 13 active ingredients are used in sorghum against arthropods in Arizona (Table 2).

Very few of these sprays have historically targeted any aphid species (Table 3). These sprays are of just 5 active ingredients, representing pyrethroids and organophosphates. Chlorpyrifos is favored because of its spectrum of activity in controlling lepidopterans and aphids simultaneously. **However, reports from this year suggest that none of these active ingredients are effective against sugarcane aphid**. This is consistent with reports from NM and eastward extending to the 18 states where sugarcane aphid is present.

Table 1. Total number of and acreage of insecticide sprays in sorghum over the last 5 years in Arizona. From, *Arizona Pest Management Center Pesticide Use Database* (Ellsworth, Fournier & Dixon, unpubl. data).

Year	No. of Sprays	Acres
2011	22	1,582
2012	42	6,071
2013	52	5,528
2014	116	6,662
2015	84	4,925
5-yr Average	63	4,954

Table 2. Total number of and acreage of insecticide sprays in sorghum over the last 5 years by active ingredient in Arizona. From, *APMC Pesticide Use Database* (Ellsworth, Fournier & Dixon, unpubl. data).

Active Ingredient	No. of Sprays	2011	2012	2013	2014	2015	Total Acres
Bifenthrin	2	120	217	.	.	.	339
Chlorantraniliprole	1	.	.	.	70	.	71
Chlorpyrifos	71	420	1,887	3,786	1,287	908	8,358
Cyfluthrin, Beta	47	.	806	.	1,472	810	3,135
Dimethoate	9	.	541	268	90	10	918
Esfenvalerate	6	.	5	39	.	502	552
Flubendiamide	83	.	.	414	1,924	1,870	4,292
Lambda-Cyhalothrin	30	90	1,435	735	233	399	2,922
Methoxyfenozide	31	.	640	126	1,396	15	2,207
Novaluron	1	.	.	.	118	.	119
Spinosad	3	.	.	.	.	41	44
Sulfur	2	.	541	.	.	.	543
Zeta-Cypermethrin	13	.	.	161	72	256	503
Totals -->	299	630	6,072	5,528	6,662	4,813	24,004

Table 3. Total number of and acreage of insecticide sprays targeting aphids in sorghum in Arizona. From, *APMC Use Database* (Ellsworth, Fournier & Dixon, unpubl. data).

Active Ingredient	No. of Sprays	2011	2012	2013	2014	2015	Total Acres
Bifenthrin	1	.	217	.	.	.	218
Chlorpyrifos	25	120	247	1,413	884	78	2,767
Dimethoate	2	.	.	.	.	10	12
Lambda-Cyhalothrin	3	.	30	.	.	39	72
Zeta-Cypermethrin	5	.	.	39	.	78	123
Totals -->	36	120	494	1,452	884	206	3,191

Current Recommendations / Prospects for Alternative Practices

Because each of **these active ingredients has already failed** both here in recent weeks and in all areas of the historical distribution of sugarcane aphid in the U.S., we are currently recommending to growers not to use synthetic pyrethroids or organophosphates in attempts to control this species. These products are very broad spectrum with non-target effects on the suite of potential biological control agents that might help to limit population growth. Also clear from our surveys thus far, **biological controls are insufficient to curb or mitigate the dramatic outbreak of this pest in Arizona sorghum**. We have documented syrphid fly larvae and large numbers of lacewing adults. However, neither species are at high enough populations, nor responsive enough in time to mitigate this situation. Cultural controls at this point in the season are not available. Growers can support plant health by decreasing irrigation intervals and supply more water to the crop, while they attempt to address these aphid populations, should new tools come available.

Our hope is through the use of Transform, known to be highly selective in the cotton system on the same suite of predators, this effective aphicide can selectively control the target aphids while permitting the natural enemies to continue contribution to biological control of this pest.

SUMMARY

Sugarcane aphid in Arizona is a new pest detection that just occurred in late August of this year. This represents a **new introduction of a new pest to our area**, where we have very little direct experience with this situation. Infestations are extreme, seriously compromising plant health and quality of sorghum, the majority of which is targeted for animal consumption as silage for dairies. **Some fields my be completely lost** because of rejection of the silage by markets or by animals. **This is a serious, urgent and non-routine, emergency condition facing growers** who elect to grow sorghum as a low-input alternative to corn and other forage crops. **This was an unpredictable occurrence that now requires immediate attention**. In addition to the direct production losses expected due to the pest's feeding and the direct value loss in reduced quality of the feed, we are especially concerned for the potential of fungal development on the carbohydrate rich honeydew that is fouling the foliage. With fungal development comes the very real danger of mycotoxin development with significant human health risks.

There are no cultural controls that will cure or completely avoid the future risk of infestations, though later plantings and more tolerant varieties might help to enhance the effectiveness of chemical and biological controls in the future. **Biological controls alone are insufficent to prevent or cure an infestation**. Lacewings are notoriously late responding to infestations, because they depend on the presence of honeydew in sufficient amounts to stimulate egg-laying. Syrphid larvae have not been abundant enough as yet to significantly impact populations. Parasitoids have not yet been identified in the affected states.

Effective chemical controls are needed immediately to address this urgent situation and to better position growers to selectively control target aphids without harming natural enemy populations in our system. Historic chemical controls are broadly toxic

organophosphates and synthetic pyrethroids. Where they have been tried this year, **these insecticides have failed to control this aphid species**, consistent with 3 years of reports from up to 17 other states impacted by this aphid. Newly registered, Sivanto, provides an expensive option for control of aphids. Unfortunately, our research and experience with this compound is limited and non-target safety has not yet been established for this active ingredient, unlike Transform for which we have a rich database of demonstrated safety. Given the magnitude of the problem, it is clear that a single a.i. like **Sivanto is insufficient to remedy this urgent and non-routine condition**. Furthermore, with populations of this size limited to a single treated host, we have to consider the very real possibility of rapid development of resistance. Clearly this is one reason why organophosphates and pyrethroids don't work against this animal. So having Transform as a unique mode of action, IRAC Mode of Action 4C, to work with Sivanto (IRAC MoA 4D) would greatly increase the chances of developing a more sustainable and rational rotation scheme for growers to use. Transform also has much superior quick knockdown characteristics, killing aphids in hours and arresting the infestation much faster than is possible with Sivanto.

Transform is a very effective aphicide at relatively low and economical rates. This has been confirmed by testing in the other affected states, where it is a preferred option for sugarcane aphid control. **Transform is also known to be highly selective at much higher rates historically deployed in cotton and the natural enemy complex** studied there is similar to what is present in area sorghum fields (Ellsworth & Naranjo, unpubl. data). Thus, there is a very large degree and margin for safety to the natural enemies that we wish to preserve in sorghum fields and that will assist in pest control. **Transform is therefore uniquely positioned as the best alternative for aphid control in sorghum in Arizona**.

We respectfully request your assistance in helping our stakeholders secure a specific exemption Arizona Section 18 for Transform use in sorghum to address this emergency condition of an invading, outbreak pest for which there are insufficient alternatives to mitigate this problem and where catastrophic losses to sorghum growers are otherwise expected.

Please contact us should you wish any further clarification of this important request.

Best Regards,

Peter C. Ellsworth, Ph.D.
Full Specialist / Professor, IPM Coordinator & Director, Arizona Pest Management Center, Department of Entomology, MAC, University of Arizona,
37860 W. Smith-Enke Road
Maricopa, AZ 85138
peterell@ag.arizona.edu

Ayman Mostafa, Ph.D.
Area Agent, Field Crops IPM
Cooperative Extension,
University of Arizona
4341 E. Broadway Rd.,
Phoenix, AZ 85040
ayman@email.arizona.edu