



Fonicamid Use and Benefits in Arizona Agriculture
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Summary

- The EPA is seeking public comments in response to published risk assessments for flonicamid, a selective feeding-inhibitor insecticide used to control both immature and adult stages of sensitive insects.
- Our goal at this time is to inform the EPA about specific and critical use patterns of flonicamid on Arizona crops.
- Flonicamid is an efficacious selective insecticide with reported treatments across dozens of Arizona crops. The most significant uses of flonicamid are on cotton, lettuces, spinach and other diverse leafy vegetable crops, cole crops and alfalfa grown for seed.
- Flonicamid is selective, and therefore compatible with biological control, making it a critical component of IPM programs in cotton and other crops.
- Flonicamid is one of two selective insecticides targeting Lygus in Arizona cotton (the other is sulfoxaflor). These two active ingredients represent 98% of Lygus applications in cotton. Maintaining registrations of both compounds in cotton is essential for resistance management, sustaining efficacy, and to avoid pest outbreaks and additional sprays that occur following loss of natural controls that when broad-spectrum insecticides are applied in our system.
- In alfalfa seed, flonicamid is effective and critical for control of Lygus, the most significant insect pest impacting seed production. Use of flonicamid is warranted in virtually all low desert production of alfalfa for seed.
- Flonicamid is an important aphid control material in lettuce, spinach, cole crops and other vegetables. It is also used to manage Lygus, particularly in lettuce and brassica seed crops.
- 2019 was an unusual year, with significant outbreaks of Lygus in cantaloupes and other melons. In some cases, growers took yield losses due to Lygus feeding damage on fruit. Flonicamid proved to be an important chemical option for Lygus control in melons, and was used in 2019 to manage this pest.

Flonicamid Use in Arizona Agriculture

Flonicamid is a selective insecticide (feeding inhibitor) with reported treatments across dozens of Arizona crops. The most significant uses of flonicamid are on cotton and alfalfa grown for seed, in lettuces, spinach and other diverse leafy vegetable crops, as well as cole crops for aphid control. Other reported uses include celery, parsley and pecans. Flonicamid is selective, and therefore compatible with biological control, making it a critical component of IPM programs in cotton and other crops. Floniamid is an effective control for lygus and aphids, two very important pests in our cropping systems.

Cotton. Arizona often leads the world in cotton yield per acre (>1550 lbs.), nearly twice the U.S. average, contributing 9,000 jobs and \$700 million to Arizona's economy in 2011 (anonymous 2012). In 2017, Arizona cotton had a value exceeding \$200 million for cotton and cotton seed production combined (USDA-NASS 2019).

Lygus bug, also known as western tarnished plant bug, *Lygus hesperus* (Knight), is a key insect pest of southwest desert cotton. It is the major yield-limiting pest in Arizona cotton, and has the potential to cause severe economic damage. Lygus feed on cotton from earliest squaring through final boll set and cutout. The insects pierce squares and rarely damage developing bolls. Squares damaged in this way often abort, dropping from the plant. These lost fruiting sites can drastically reduce yield potential, especially where and when there is insufficient time left in the season for plant compensation.

Prior to 2006, when the reduced-risk and selective feeding inhibitor flonicamid was registered for use in cotton, only broad-spectrum insecticides were available to manage Lygus. Applications to control Lygus often led to disruptions in populations of natural enemies which, when present in our system, play a major role in management of our two key pests, whiteflies and Lygus. More than two decades of research, integration and implementation of IPM directed at these two pests have resulted in a progressively improved IPM strategy that emphasizes natural enemy conservation through strategic and sparing use of selective chemical control tactics (Ellsworth & Peterson 2017). Rapid adoption of flonicamid by growers in Arizona contributed to the successful integration of chemical and biological control in Arizona cotton, an outcome of which is a reduction from 3.9 insecticide sprays on average in the six years prior (all insecticides) to 1.5 sprays on average between 2006 and 2011 (Ellsworth & Naranjo 2017). Two selective insecticides, flonicamid and sulfoxaflor, represent 98% of all applications in cotton for Lygus control (Ellsworth, unpubl. data). Maintaining active registrations of both of these active ingredients in cotton is essential for resistance management, in order to sustain the efficacy of both compounds. Without these selective insecticides, as history has shown, an increase in overall insecticide use is likely to occur, due to the loss of natural controls that follow applications of broad-spectrum insecticides in our system.

Based on Arizona Cotton Pest Losses Survey data (2005–2016), an average of 25.6–80.5% of Arizona cotton acreage is treated for Lygus bugs annually (Ellsworth, unpubl. data). According to Arizona Pest Management Center Pesticide Use Database (Fournier et al. 2017), an average of 57,159 acre-sprays of flonicamid were made in cotton between 2016 and 2018. Reported use in 2018 represented about 43% of statewide acres (Fournier et al. 2017, USDA-NASS 2019).

While not a major use pattern or target, flonicamid is also an effective aphicide and has been used by pest managers to prevent development of cotton aphid populations in cotton.

Alfalfa Seed. While Arizona is not a large-scale producer of alfalfa seed (it represents about 1% of statewide alfalfa production annually), it is a high-value market. Lygus bugs are the most troublesome insect pest of alfalfa seed production. When present in high numbers, lygus have the ability to prevent seed production. Lygus attack the reproductive plant parts by piercing the plant tissue causing premature bud shed, seed deformation, and reduced seed viability. Control of lygus bugs is warranted in virtually all low desert production of alfalfa for seed (Husman & Ottman 2015). Over the past several years, annual flonicamid sprays in seed alfalfa range from 1,600 to 2,500 treated acres, based on reported sprays.

Lettuce, melons and other vegetable crops. Arizona growers are one of the leading producers of fresh-market vegetables in the U.S., producing vegetables and melons at an estimated total economic contribution of over \$2.5 billion in 2015 (Kerna et al. 2016). This includes over 90% of all fresh lettuce consumed in the U.S. in the winter, valued at over \$891 million (USDA-NASS 2018).

Based on the Lettuce Pest Losses survey of pest control advisors in the 2018-19 season, Beleaf (containing flonicamid) was among the top 10 insecticides used in spring lettuce. Nearly half of responding PCAs used it on 17.7% of head lettuce acres (7,020ac) an average of 1.2 times in spring 2019. In fall head lettuce, it is used to a lesser extent, for example, an average of 1.7 times on about 2% of treated acres in fall 2018. The primary target pest for flonicamid sprays in lettuce and other winter vegetables is aphid. Beleaf is one of several foliar products recommended for use when aphids move onto head lettuce late in the crop season and begin to colonize (Palumbo 2017). But another important target pest in leafy vegetables (particularly head lettuce) and brassica seed crops, is Lygus.

In 2019, there were unusual outbreaks of Lygus in Arizona cantaloupes and other melons. In some cases, growers took yield losses due to Lygus feeding damage on fruit. Based on the Arizona Pest Management Center Pesticide Use Database (Fournier et. al 2017), there was no reported use of flonicamid in melons before 2019. This is because severe Lygus outbreaks were not experienced in melons before 2019 (Dr. John Palumbo, personal communication). It is unclear whether this may continue to be an issue for us in the future.

Who We Are

The Arizona Pest Management Center is host to the University of Arizona's expert IPM scientists including Ph.D. entomologists, weed scientists and plant pathologists with expertise in the strategic tactical use of pesticides within IPM programs that protect economic, environmental and human health interests of stakeholders and the society at large.

Dr. Al Fournier is Associate Director of the APMC / Associate Specialist in Entomology, holds a Ph.D. in Entomology, and has expertise in evaluating adoption and impact of integrated pest management and associated technologies. He works with the Western IPM Center, representing stakeholders in the desert Southwest states in EPA registration reviews. Dr. Peter Ellsworth is

Director of the APMC, State IPM Coordinator for Arizona and Professor of Entomology / Extension IPM Specialist with expertise in developing IPM systems in cotton and other crops and measuring implementation and impact of IPM and pest management practices. Dr. John Palumbo is a Research Scientist in Entomology and an Extension Specialist working with the Arizona vegetable industry. Mr. Wayne Dixon holds a B.S. in Computer Information Systems and develops tools and data used in IPM research, education and evaluation, including management of the APMC Pesticide Use Database.

These comments are the independent assessment of the authors and the Arizona Pest Management Center as part of our role to contribute federal comments on issues of pest management importance and do not imply endorsement by the University of Arizona or USDA of any products, services, or organizations mentioned, shown, or indirectly implied in this document.

Our Data and Expert Information

Through cooperative agreements with Arizona Department of Agriculture, the Arizona Pest Management Center obtains use of, improves upon, and conducts studies with ADA's Form 1080 data. Growers, pest control advisors and applicators complete and submit these forms to the state when required by statute as a record of pesticide use. These data contain information on 100% of custom-applied (i.e., for hire) pesticides in the state of Arizona. Grower self-applied pesticide applications may be under-represented in these data. In addition, the Arizona Pest Management Center is host to scientists in the discipline of IPM, including experts in the usage of this and other compounds in our agricultural systems. We actively solicit input from stakeholders in Arizona including those in the regulated user community, particularly to better understand use patterns, use benefits, and availability and efficacy of alternatives. The comments within are based on the extensive data contained in the Arizona Pest Management Center Pesticide Use Database, collected summary input from stakeholders and the expertise of APMC member faculty.

Through the Crop Pest Losses and Impact Assessment program (WIPMC 2018), partially funded through the Western IPM Center, the Arizona Pest Management Center conducts annual surveys with state-licensed pest control advisors (PCAs), who are the primary pest management decision makers, in consultation with growers. The surveys, conducted at face-to-face meetings, provide detailed information on crop yield losses to specific insect pests, weeds and diseases, control costs, and pesticide use for the key crops, cotton and lettuce. Cotton data have been collected since 1991 and lettuce data since 2005. Data are collected for all of Arizona and neighboring production regions of California, with typical responses representing up to 65% of acres planted in Arizona. These data provide detailed information on shifting pest trends, chemical use and costs, and often compliment and augment information from the APMC Pesticide Use Database, particularly for pesticide uses for which the state does not mandate reporting.

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