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# Acephate Use in Several Arizona and New Mexico Crops

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**Comments submitted by the Arizona Pest Management Center**
**University of Arizona**

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These comments are submitted on behalf of our stakeholders in response to EPA's request for public comments on draft human health, occupational, and ecological risk assessments for acephate. Acephate is the active ingredient in a number of insecticides registered for use on several agricultural crops in the desert southwest, and for use in outdoor non-agricultural settings, indoor treatment of commercial and industrial buildings and greenhouses. Our response focuses primarily on key agricultural uses in Arizona and New Mexico.

University of Arizona County Agent, Kai Umeda, who works extensively with the turf industry in the Phoenix metro area confirmed there is not much use of acephate for commercial turf management.

## Acephate use in Arizona Agriculture

Where once it was a commonly used insecticide in cotton and other crops, acephate use has sharply declined in Arizona over the past two decades (Fournier 2017). Based on information from the Arizona Pest Management Center (APMC) Pesticide Use Database from 2009 to 2017 (Fournier et al. 2017), there is regular annual use of acephate in cotton and head lettuce, although acres treated represent only a small percentage of insecticide use in these crops (Table 1). Reported use in other crops, including beans, cole crops and peas, tends to be on a small number of acres and fluctuates from year to year.

### 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 2016, cotton was ranked third for production value in Arizona, after lettuce and alfalfa hay, with a combined value of over $162 million for cotton and cotton seed production (USDA-NASS 2017).

According to Dr. Peter Ellsworth, Cotton IPM Extension Specialist with University of Arizona, acephate has been used in cotton historically mainly to control two key pests, silverleaf whitefly (*Bemisia tabaci = B. argentifolii*) and Lygus bug (*Lygus hesperus*). In general, acephate use in

cotton has greatly declined over the past two decades with increased availability of reduced-risk insecticides to control these pests. As a broad-spectrum insecticide, acephate is no longer recommended as a first line of defense for either whitefly or Lygus control. However, there are some situations where it is important. Acephate or pyrethroids as stand-alone insecticides are ineffective at controlling whiteflies. However, the addition of acephate to a pyrethroid in mixture disables the resistances present in whiteflies, making the mixture very effective especially in knockdown of whitefly adults. Thus, acephate is sometimes mixed with pyrethroids as a late-season application to control whiteflies, while providing additional control of Lygus bugs where needed. This provides effective knockdown of whitefly adult prior to harvest, which helps to minimize risks of sticky cotton, a condition caused by accumulation of honeydew residues excreted by whiteflies. Contaminated cotton is a significant concern, as it reduces the quality and value of cotton lint. More importantly, earning a "reputation" as an area that produces cotton at high risk for "stickiness" results in broad, regional market penalties in the value of local lint production. Arizona cotton growers have been prevented any such occurrences since 1995.

Pyrethroids alone do not offer sufficient control of whiteflies due to widespread pyrethroid resistance in our whitefly populations. Addition of an organophosphate (OP) insecticide has a synergizing effect, and acephate is the most effect OP available for this use. Other control options, such as insect growth regulators (pyriproxifen or buprofezin) or acetamiprid, so important for providing good whitefly control throughout most of the season while maintaining natural enemies, are not sufficiently effective against whitefly adults late in the season. Plus, there are documented resistances to pyriproxyfen and neonicotinoids, including acetamiprid, which are compromising efficacy of these compounds. This acephate-pyrethroid mixture is also more effective against Lygus on late season cotton plants than other available control options, making it a good treatment option when both pests are present late in the season. This is not a standard practice of all growers, but is an extremely effective approach when needed.

Acephate is a good Lygus control chemistry; however, efficacy has declined in recent years, likely due to resistance. The insecticide is disruptive to natural enemies, leading to whitefly resurgence and secondary pest outbreaks, especially of mites (Ellsworth & Peterson 2017). Acephate has largely been replaced by the selective insecticides flonicamid and sulfoxaflor for Lygus control (98% of all uses against Lygus in 2017; Cotton Pest Losses data, Ellsworth, unpubl. data). These chemistries are effective against Lygus while helping to preserve beneficial insects that help to control both Lygus and whitefly. However, without one or both of these selective controls, growers would likely resort to use of broad-spectrum applications, including acephate, for Lygus control, because of the need to rotate insecticides for resistance management. This is exactly what happened in 2016, when acephate use increased as a result of the deregistration of sulfoxaflor (Transform) in cotton (Table 1). The approval of a Section 18 Exemption in 2017 for the use of Transform to control Lygus in cotton (Ellsworth & Peterson 2017) helped to restore acephate use to more standard levels in 2017 (Fournier et al. 2017).

Severe outbreaks of the brown stink bug (*Euschistus servus*) starting in 2012 led to dramatic increases in acephate use over previous years, particularly from 2012 through 2014 (Fournier et al. 2017). Because there are no available registered selective insecticides for brown stink bug, many growers relied on acephate and other broad-spectrum insecticides in attempts to control this pest. However, following extensive outreach highlighting University of Arizona research

which demonstrated negative economic outcomes of broad-spectrum treatments for brown stink bug, most growers have stopped spraying for this pest (Brown, L.M. 2017). As a result, acephate use has declined back to lower levels in 2015 (Table 1).

Current acephate use levels in cotton for all other pests (excluding a few brown stink bug applications, which are not recommended) average between 3,000 and 4,000 acres treated annually, about 2% of all cotton acres statewide. This is consistent with analyses from Cotton Pest Losses surveys (Western IPM Center 2018) that show 98% of all Lygus sprays in 2017 were either flonicamid or sulfoxaflor. 2% were other insecticides, of which acephate is prominent. This is consistent with an analysis of reported acephate uses from the APMC Pesticide Use Database (Table 1).

**Table 1. Reported acres treated and percent of sprays with acephate for cotton and head lettuce, 2010 - 2017.**

| Year | Cotton acres treated | %Cotton sprays | Head Lettuce acres treated | %Head Lettuce Sprays |
|---|---|---|---|---|
| 2010 | 6,153 | 3.05% | 6,932 | 20.09% |
| 2011 | 4,980 | 1.87% | 9,595 | 26.29% |
| 2012 | 32,860 | 16.23% | 8,238 | 22.51% |
| 2013 | 36,122 | 21.66% | 4,360 | 13.21% |
| 2014 | 24,583 | 14.64% | 5,009 | 14.52% |
| 2015 | 3,377 | 3.20% | 2,818 | 8.67% |
| 2016 | 10,886 | 8.45% | 2,586 | 7.96% |
| 2017 | 3,789 | 2.19% | 1,416 | 4.36% |

*Source: The Arizona Pest Management Center Pesticide Use Database, unpubl. This database captures only reported usage, which may reflect a fraction of total actual use (see narrative).*

Produce

Head Lettuce

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 $920 million in the 2015–2016 season (USDA-NASS 2017).

Acephate is labeled on head lettuce but not leaf lettuce or romaine. Based on data from Head Lettuce Pest Losses and Impact Assessment surveys conducted with pest control advisors annually, acephate is among the lesser-used insecticides in head lettuce (Palumbo 2018). In 2017 For example, lettuce surveys indicate only 3.6% of fall head lettuce acres were treated, and in spring 2018, only 4.8% of acres. Calculations based on the APMC Pesticide Use Database vary from these numbers somewhat, but still indicate a low use pattern. According to Dr. John

Palumbo, University of Arizona Extension Entomologist, the key uses are for control of the western flower thrips, the aphid complex and Lygus. Acephate is relatively effective against each of these pests, but has a long pre-harvest interval (PHI) of 21 days, which limits its use beyond the first side-dress stage. Western flower thrips and aphids are economically important during the spring growing season and Lygus occasionally occurs on fall crops. Use in head lettuce has been declining since 2015, likely due to registration of Sivanto and Sequoia, which are excellent alternatives for aphid and Lygus (Sequoia). There are a number of effective alternative products against aphids (Movento, Sivanto, Sequoia, Beleaf and Assail), but only limited alternatives for thrips (Radiant and Lannate) and Lygus (Sequoia).

Celery
Acephate is primarily used for control of Lygus, and secondarily used for aphid control when Lygus are present. Lygus is a key pest that occurs season long, but only occasionally occurs in economic numbers, whereas aphids are occur in economic numbers each season on spring crops. The alternatives are limited for Lygus (Vydate, Sequoia), but numerous for aphids (Movento, Sivanto, Sequoia, Beleaf and Assail).

Cauliflower
Acephate is almost exclusively used for control of aphids, which are a key pest on spring crops. Numerous alternatives are available for aphid control (Movento, Sivanto, Sequoia, Beleaf and Assail).

According to Dr. Palumbo, given the alternatives available for aphids and thrips, loss of acephate would have minimal impact on produce growers. However, an important exception would be for Lygus control in celery and lettuce where alternatives are lacking.

<u>Beans</u>
Arizona produces several kinds of dry beans, including pintos, garbanzos and blackeye peas. A pest control advisor in southeast Arizona who manages over 2,000 acres of beans annually emphasized the importance of acephate for stink bug management. A mix of species, including brown stink bug, Say's stink bug and other stink bugs (e.g., Thyanta spp.), and Lygus, cause economic damage in beans. Acephate is highly effective against this complex. Most years, a single application of acephate is used at the 0.5 to 1.0 lb. product rate, generally tank-mixed with a pyrethroid early in the season. This same application is helpful for controlling corn earworm and western bean cutworm. Pyrethroids alone are sometimes used and have been shown time and again to be less efficacious against these target pests than the tank mix with acephate. Bifenthin is the most effective stand-alone pyrethroid against some stink bug species, but because it has a shorter pre-harvest interval than other pyrethroids (14 days), they preserve use of bifenthrin for late in the season. This also helps to clean up worm infestations prior to harvest. If acephate were not available, they would likely replace it with bifenthrin, the only effective alternative, and risk development of resistance because of repeated uses.

Another pest control advisor in southwest Arizona has used acephate up until a few years ago in black-eyed peas, to control the stink bug complex (i.e., Say's stink bug and Thyanta spp.), only if needed, when populations levels are high. Black-eyed peas are very sensitive to damage from stink bug, which impacts both yield and quality, both of which result in economic losses for

growers if stink bugs are not controlled. Acephate is applied as a tank mix with bifenthrin, which provides excellent control. In most cases, a single application at full label rate provides effective control, but in severe instances, two applications are used. This acephate tank mix was the only effective control for stink bugs prior to registration of Transform (sulfoxaflor) for stink bug control in this crop. Use has shifted to the newer chemistry, which is also effective and much softer on beneficial insects. If sulfoxaflor were no longer available for any reason, the loss of acephate would likely result in significant economic losses for growers when stink bug populations are high, because no other labeled chemistries provide effective control.

Chile Peppers

Chile pepper acreage has greatly decreased in Arizona in recent years, although we still have a few producers. A long-time pest control advisor who works with that industry indicated that acephate, once used to control leaf hoppers that transmit curly top virus, is no longer used in Arizona pepper production. The primary alternative insecticide for that use is imidacloprid.

## Acephate use in New Mexico

While acephate is registered for many crop and non-crop uses in New Mexico, our comments are limited to its use relative to control of key insect pests in production of chile peppers.

Chile Peppers

In 2016, New Mexico produced 8,700 acres of chile peppers valued at over $50.5 million (USDA-NASS 2017b). Nearly all peppers are drip irrigated, and given the desert environment, there is little if any chance of surface water contamination with acephate. According to a pest management advisor who works with the NM Chile industry, acephate is rarely used directly on chile peppers for insect control, though it remains on the list of potentially recommended insecticides as a "last resort." He described the importance of acephate as part of their areawide integrated pest management approach, which he said is critical to successful economic production of chile peppers. One of the key economic pests of chiles are aphids, because of their ability to transmit alfalfa mosaic virus and tobacco mosaic virus. The main source of transmission of the virus to peppers is the migration of infected aphids from alfalfa (Goldberg 1995). The primary strategy is to treat aphids with acephate in surrounding host crops, such as in alfalfa prior to cutting, to minimize the migration of virus-transmitting aphid populations into peppers. This can be effective, and certainly helps. This past season, aphid populations have been very high, and despite these kinds of control efforts, some fields experienced up to 90% losses to mosaic viruses. This can be catastrophic for individual growers. Acephate remains a very important tool to help control aphids and reduce losses to viruses.

## 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. Peter Ellsworth is Director of the APMC, State IPM and Pesticide 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. Al Fournier is Associate Director of the APMC / Adjunct 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 serves as a Regional Integrated Pest Management Network Coordinator for the Western IPM Center, representing stakeholders in the desert Southwest states. Dr. John Palumbo is the University of Arizona Extension Entomologist with many years of experience working on integrated pest management of insect pests for vegetable crops in Arizona, particularly for leafy greens, cole crops and melons. 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 L-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 compound 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, 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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