Agricultural Experiment Station
Cooperative Extension

Maricopa Agricultural Center
37860 West Smith-Enke Road
Maricopa, Arizona 85138
(520) 374-6200

Response to EPA Notice: Petition to Revoke Tolerances and Cancel Registrations for Certain Organophosphate Uses

Prepared by Alfred Fournier, Peter C. Ellsworth, John C. Palumbo, Marco Peña and Wayne Dixon
Arizona Pest Management Center, University of Arizona

September 25, 2022

EPA Docket ID: EPA-HQ-OPP-2022-0490-0001

To Whom It May Concern:

The Arizona Pest Management Center (APMC) 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. In coordination with the Western Integrated Pest Management Center, we contribute to federal comments on issues of pest management importance to stakeholders throughout the desert southwest including Arizona, New Mexico, Nevada, Colorado, Utah and the southeast desert regions of California.

At this time, we wish to respond to the Agency's call for public comments on the Petition to Revoke Tolerances and Cancel Registrations for Certain Organophosphate Uses, EPA Docket number EPA-HQ-OPP-2022-0490-0001, on behalf of stakeholders in Arizona and other Southwest Desert states. Our comments combine stakeholder input received from university experts, licensed pest management professionals representing growers from Arizona, California and New Mexico, and reported pesticide use data submitted to the Arizona state regulatory agency and captured in the Arizona Pest Management Center Pesticide Use Database. Additional supportive information on the use patterns and benefits of acephate and dicrotophos is referenced in previous comments submitted by the Arizona Pest Management Center to EPA for the appropriate dockets. These prior comments are cited herein and are listed in the references.

Previous Comments
Ellsworth, P.C., L.M. Brown, A.J. Fournier, W.A. Dixon II. 2014. Dicrotophos Use in Arizona. University of Arizona, Arizona Pest Management Center.
http://ag.arizona.edu/apmc/docs/14EPADicrotophosUseinArizonavF.pdf

Fournier A.J., P.C. Ellsworth. 2018. Acephate Use in Several Arizona and New Mexico Crops. University of Arizona, Arizona Pest Management Center. 8/28/18. https://acis.cals.arizona.edu/docs/default-source/ipm-assessment-documents/arid-swpmc-info-requests/acephate_comments_apmc_8-22-18_vf.pdf

We wish as well to voice our support for comments submitted to this docket by the Arizona Farm Bureau Federation. We agree that EPA has an obligation under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to conduct registration reviews based on the best available science and information. The artificial deadlines proposed by the petitioners for EPA to complete this process across the broad range of organophosphate chemistries is arbitrary and unrealistic and undermines scientific integrity. EPAs registration review process is *critical* to ensuring safe and efficient agricultural production and public health pest management, and allows stakeholders to contribute relevant data on use patterns, efficacy, alternatives, benefits and other issues that may impact human health and environmental risk assessments, and the regulatory decisions that follow, which impact growers, public health pest managers, and many other pesticide users.

Key Uses of Organophosphates in Desert Southwest Agriculture

- While organophosphate (OP) use was once prominent in Arizona agriculture, use of OPs and other broad-spectrum pesticides has greatly declined over the past three decades with the availability and adoption of selective, reduced-risk pesticides, genetically modified crops and other technologies. Remaining OP use in modern Arizona agriculture is generally constrained to niche uses that remain important to economic production.
- **Acephate in Cotton.** Applications of acephate-pyrethroid mixtures are applied late-season in cotton to control *Bemisia* whiteflies. This mixture uniquely offers very effective knockdown of whitefly adults while also providing control of Lygus bug, our most yield-limiting pest, when needed. Uncontrolled infestations of whiteflies late in the season can result in contamination leading to "sticky cotton," 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. This use pattern has enabled Arizona cotton growers to prevent any recurrences of sticky cotton since 1995, with treatments of 1% to 5.2% of cotton acres with acephate over the past five seasons.
- **Acephate in Lettuce & Celery.** While there are many other available options for aphid control, acephate remains critical to control of Lygus in head lettuce and celery. The only other option for this pest in these crops is sulfoxaflor. Only two other active ingredients, spinetoram and methomyl, are available for thrips control in lettuce. To sustain resistance management, acephate remains an important option for these uses. A minority of acres are treated with acephate in these crops, e.g., 5% to 6% of acres per season in head lettuce.
- **Acephate in Dry Beans.** Acephate is used to control various stink bug species and Lygus, which cause economic damage in pintos, garbanzos, and black-eyed peas (dry beans). Use has increased in the past few years, as production has expanded. Effective alternatives to acephate for stink bug control include dimethoate (also an OP), bifenthrin (a pyrethroid) and sulfoxaflor, the last of these being the only selective option. Loss of

both acephate and dimethoate would limit available chemistries and may hinder resistance management.

- **Acephate in Chile Peppers and Alfalfa to Control Mosaic Viruses.** Acephate remains a very important tool to control aphids to reduce the impact of mosaic viruses it vectors, which can result in 90% yield loss when aphid populations are high. New Mexico producers apply acephate to adjacent and nearby alfalfa fields prior to cutting to prevent movement of aphids into the peppers. If needed, acephate is used directly on peppers for quick knockdown of aphids. Up to 25% of acres have been treated when aphid populations are high. This strategy has been largely effective. According to sources, other aphid insecticides have not demonstrated sufficiently fast knockdown needed to adequately prevent the spread of the virus. However, in Arizona, alfalfa growers have found great utility in sulfoxaflor sprays for rapid, multi-species aphid control.
- **Bensulide in Lettuce.** Lettuce is Arizona's number 1 or number 2 economic crop annually. Arizona produces 90% of winter lettuce consumed in the U.S. Bensulide is foundational to effective weed control in lettuce and a broad range of other vegetable and melon crops produced in the Yuma County region. Applied prior to germination and watered-in with sprinkler irrigation, the product Prefar provides control of weeds which are not effectively controlled by other herbicides, including redroot pigweed, nettleleaf goosefoot, purslane, lambsquarters, and various grasses, especially goosegrass. Arizona has long maintained a Section 24c label to use Prefar 4-E at broadcast rates up to 9 qt./A, needed for effective control.
- **Bensulide in Other Produce and Guayule.** Bensulide is also used in other vegetable crops and melons to provide control of the same difficult weeds it controls in lettuce. The most commonly treated crops between 2010 and 2020 were melons, arugula, mustard greens, kale, broccoli, parsley, celery and cilantro. Only a portion of acres are treated. Guayule is a desert-adapted perennial currently under development in the desert Southwest as a low water use crop used in the production of rubber. Bensulide is used for pre-emergent weed control in guayule. Bensulide and the few other herbicides used in this crop are all made available through Section 24c labels in Arizona. As a slow-growing weakly competitive plant, guayule cannot be established without these chemical controls.
- **Dimethoate and Malathion in Alfalfa.** Over 64% of all reported organophosphate use in Arizona, and 82.3% of reported *insecticide* OP use (bensulide and tribufos excluded) is for dimethoate and malathion. While both of these active ingredients are used to some extent across a variety of crops, the majority of use for both is in alfalfa. The primary target pests are aphids and alfalfa weevil, and secondary pests include armyworm, three-cornered alfalfa hoppers and other sucking insect pests. These OPs are particularly effective when controlling aphids and weevils together. Use has increased since the loss of chlorpyrifos. Alfalfa can require frequent insecticide sprays to maintain yields and quality, and, apart from sulfoxaflor for aphid control, there are few available selective insecticides. Research is needed to develop additional effective replacements for OPs in alfalfa.
- **Other Organophosphates.** While there are limited uses of tribufos, diazinon, naled and phorate reported in Arizona, we have not identified current critical niche uses that impact a significant percentage of our growers. Dicrotophos was used briefly, from 2013-2015, to control the brown stink bug, *Euschistus servus*. However, subsequent analyses demonstrated that its use in Arizona cotton was not economically advantageous, because

it killed off natural enemies of whiteflies, aphids and mites, leading to the need for additional sprays.

In the balance of this document, we detail the remaining use patterns for organophosphates in Arizona and desert southwest agriculture. Much of our data related to Arizona use patterns comes from one of two sources: The Arizona Pest Management Center Pesticide Use Database, and Crop Pest Losses and Impact Assessment surveys which have been conducted for years in cotton and head lettuce produced in Arizona and adjacent production regions of Imperial and Riverside Counties in California. These resources are described in the following section.

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 user-reported pesticide data. Growers, pest control advisors and applicators complete and submit these data 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, including all aerial applications. In addition, chemicals listed on the Arizona Department of Environmental Quality's Ground Water Protection List also require reporting. Grower self-applied pesticide applications may be under-represented in these data.

Through the Crop Pest Losses and Impact Assessment program, partially funded through a Western IPM Center Signature Program, 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 or online workshops, 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.

In addition, 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 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.

Organophosphate Use in Southwest Agriculture
While organophosphate (OP) use was once prominent in Arizona agriculture, use of OPs and other broad-spectrum pesticides has greatly declined over the past three decades. With the availability of new technologies, including selective, reduced-risk insecticides, uses of OPs have dwindled, for the most part, to specific niche uses described in more detail below. Across all organophosphates, most use is in alfalfa (Figures 1 & 2). Dimethoate and malathion account for 64% of Arizona OP use from 2010 to 2020 and are used primarily in alfalfa for aphid complex and alfalfa weevil control.

We also have significant use of bensulide for pre-emergent weed control in lettuce, a broad range of other vegetable and melon crops, and guayule, a desert-adapted rubber producing plant. Late-season use of acephate in cotton to control whiteflies is a critical niche use, to minimize risks of sticky cotton, a condition with dire economic consequences for growers. Acephate is also critical for Lygus control in head lettuce and celery. Other niche uses of acephate include dry beans for Lygus and stink bug, and New Mexico chile peppers (and adjacent alfalfa), where it is used to limit the impact of mosaic viruses vectored by aphids.

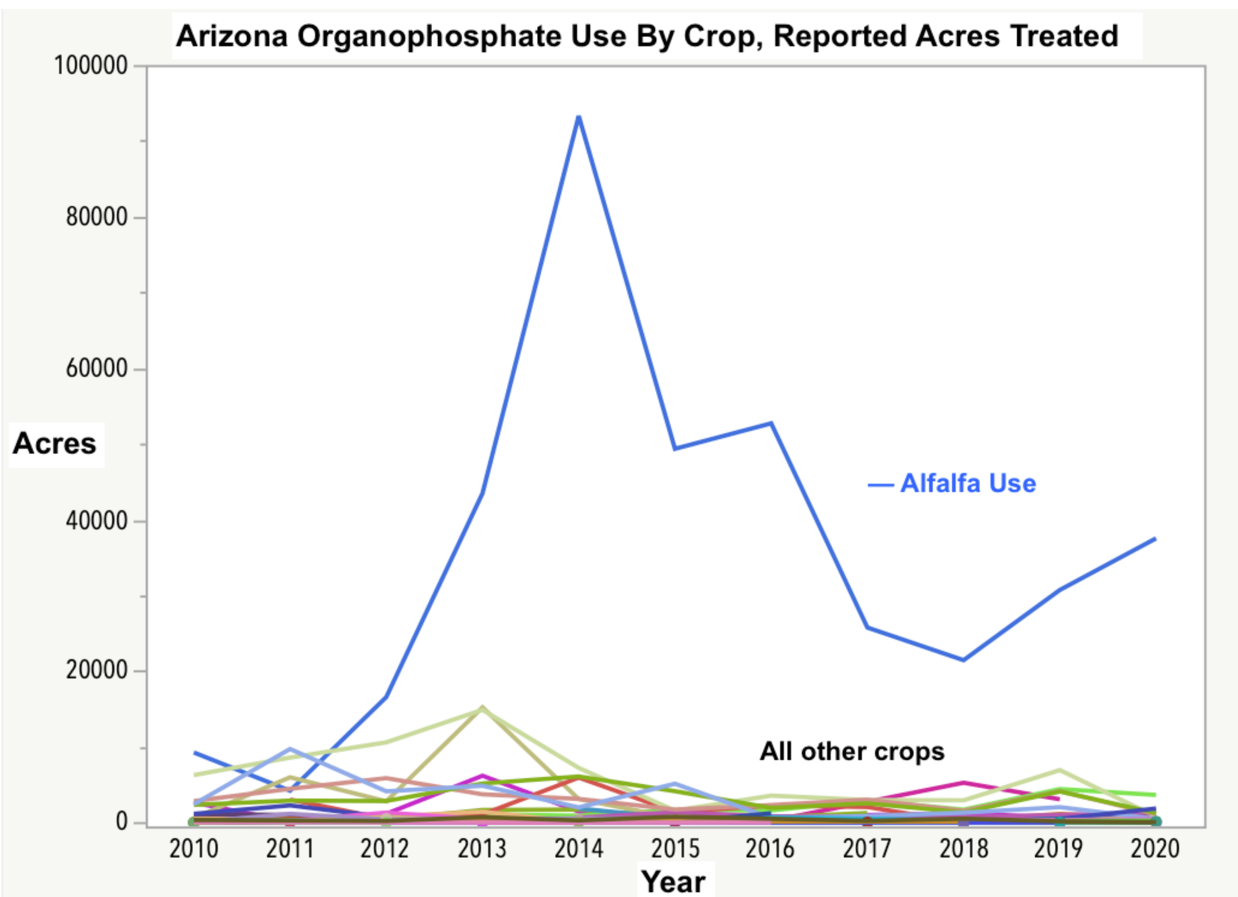

Figure 1. Reported acres treated with all organo-phosphates combined, by crop group from 2010 – 2020. Use in alfalfa dominates, accounting for 64% of all OP use over this time period and 82.3% of insecticide OP use. Source: Arizona Pest Management Center Pesticide Use Database.

According to the Arizona Pest Management Center Pesticide Use Database (Fournier et al, 2017), nine of the fifteen OPs listed in the petition have reported uses in Arizona crops over the past several years (Table 1, Figure 2).

Table 1. Use of organophosphates in Arizona agriculture, reported acres treated by year across all crops[1]. Source: Arizona Pest Management Center Pesticide Use Database.

ACTIVE INGREDIENT	2013	2014	2015	2016	2017	2018	2019	2020
ACEPHATE	42,807	31,880	7,806	14,977	7,391	9,837	8,651	1,903
BENSULIDE	28,061	31,476	31,782	17,686	21,140	20,794	28,775	13,309
DIAZINON	169	42	2,271	1,882	73	34	31	
DICROTOPHOS	19,222	1,671	30					
DIMETHOATE	68,099	183,739	101,349	64,885	34,617	43,395	58,139	43,151
MALATHION	58,443	117,040	58,921	52,424	27,629	50,367	27,778	41,177
NALED	88	86	20	2,437	1,643	488	81	
PHORATE	1,269	207	590	753	742	1,297	1,712	318
TRIBUFOS	8,272	8,033	1,895	2,946	7,087	11,933	6,326	401

[1] Note that not all uses require reporting. See section titled "Our Data and Expert Information."

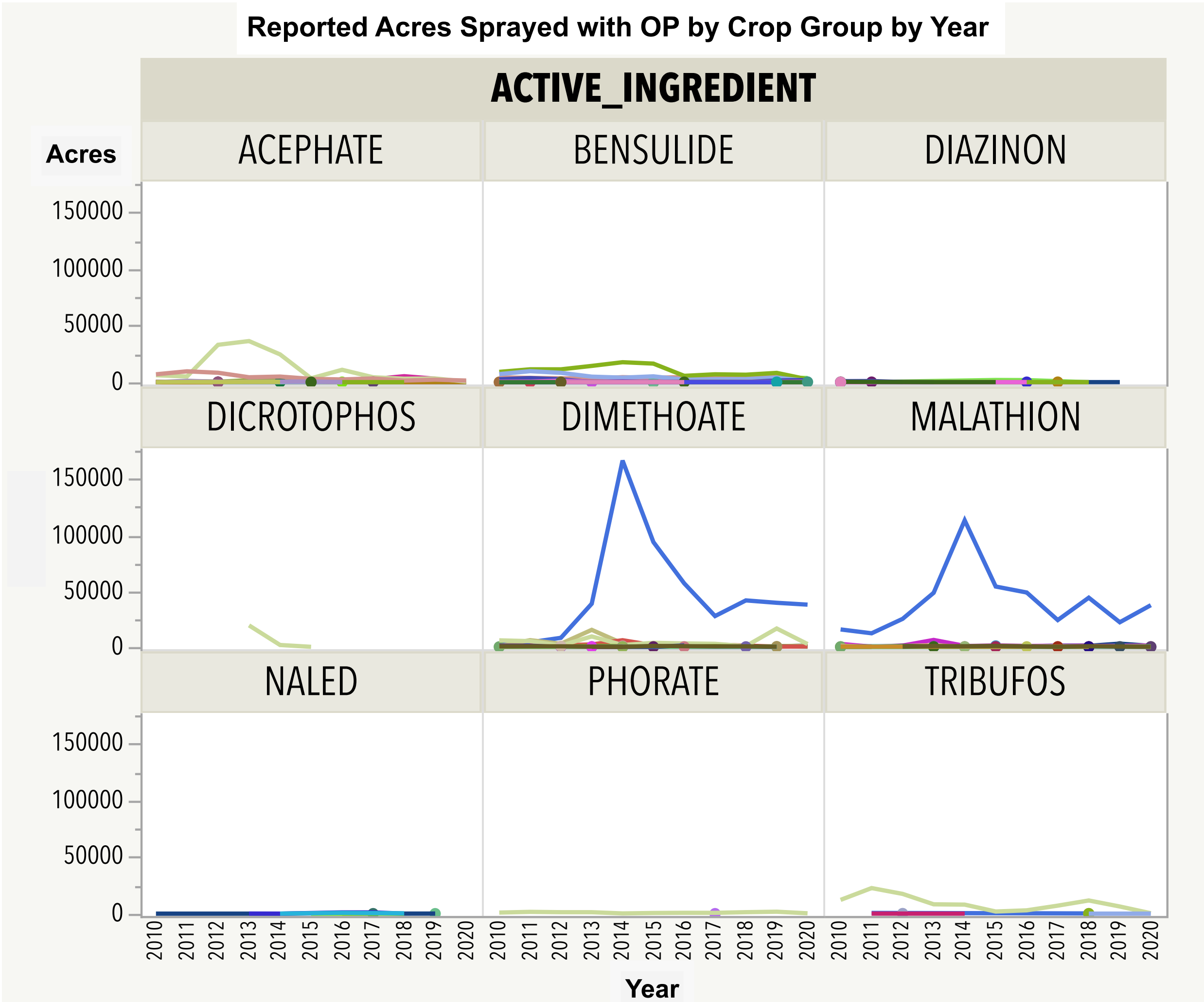

Figure 2. Reported acres treated with all organophosphates combined, 2010 – 2020, by crop group (colors). Use in alfalfa (blue) dominates, accounting for 64% of all OP use over this timeframe and 82.3% of insecticide OP use (bensulide and tribufos omitted). Source: Arizona Pest Management Center Pesticide Use Database.

Acephate

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. Based on information from the APMC Pesticide Use Database from 2010 to 2019, there is regular reported annual use of acephate on cotton, head lettuce, and various beans and peas, although use represents only a small percentage of crop acres. Reported uses in other crops tend to be on a small number of acres and fluctuate from year to year. The most significant use, in cotton, has declined over this period from a peak of 36,122 acres treated in 2013 to 3,287 in 2019. Head lettuce use has also declined, from 9,559 acres treated in 2011 to 2,212 in 2019. Reported acres treated and percent of sprays with acephate for cotton and head lettuce from 2010 – 2017 are shown in Table 2 (Fournier et al. 2018).

Table 2. 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. Fournier et al. 2018.

<u>Cotton</u>

In 2021, Arizona produced 129,000 acres of upland cotton with a value exceeding $142 million for cotton and cotton seed production combined (USDA- NASS 2022a). Upland cotton in Arizona produces per acre yields larger than that of any other state or region of the world, while contributing over $700M annually to our state's economy (Ellsworth et al. 2016). Since the introduction of key technologies and IPM programs to support their use in 1996, we estimate cotton growers in our state have cumulatively saved over $600 million (Ellsworth & Fournier 2022).

According to Dr. Peter Ellsworth, Extension IPM Specialist with University of Arizona, acephate has been used in cotton historically mainly to control two key pests, silverleaf whitefly (*B. argentifolii*) and Lygus bug (*Lygus hesperus*). Acephate use in cotton has greatly declined over the past two decades with increased availability of reduced-risk insecticides to control these pests, and acephate is no longer recommended as a first line of defense for either whitefly or Lygus control. However, there are situations where it is important. Acephate or pyrethroids as stand-alone insecticides are ineffective for 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 quickly control whiteflies, while providing additional control of Lygus bugs where needed. This provides effective knockdown of whitefly adults 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. This use pattern, only when needed and on a small percentage of cotton acres, has enabled Arizona cotton growers to prevent any recurrences of sticky cotton since 1995 (Fournier et al. 2018). Based on the Cotton Pest Losses

Survey database, between <1% and 5.2% of cotton acres were sprayed with acephate from 2017 through 2021.

Acephate is not often a recommended insecticide for Lygus control because its broad spectrum of activity is disruptive to natural enemies, leading to whitefly resurgence and secondary pest outbreaks, especially of mites (Ellsworth & Peterson 2017). However, should current reduce risk options for Lygus control, including flonicamid and sulfoxaflor, become unavailable, acephate would become a much more important control option in addition to its ongoing role in supporting resistance management (Fournier et al. 2018).

Produce

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. In Fall 2021, lettuce surveys indicate 6% of head lettuce acres were treated with acephate, and in spring 2022, only 5.4% of acres (Palumbo 2022). According to Dr. John Palumbo, Professor, Extension IPM Specialist, and Endowed Chair in Integrated Pest Management at University of Arizona, the key uses of acephate 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 infest fall crops. Use of acephate in head lettuce has been declining since 2015, likely due to registration of Sivanto (flupyradifurone) and Sequoia (sulfoxaflor), which are excellent alternatives for aphid (both) and Lygus (Sequoia). There are a number of effective alternative active ingredients against aphids (spirotetramat, flupyradifurone, sulfoxaflor, flonicamid and acetamiprid), but only limited alternatives for thrips (spinetoram and methomyl) and Lygus (sulfoxaflor) (Fournier et al. 2018). According to Dr. Palumbo, given the alternatives available for control of aphids and thrips, loss of acephate would have minimal impact on produce growers. However, acephate remains critically important for Lygus control in celery and lettuce, where alternatives are lacking (Fournier et al. 2018).

Dry Beans

There are consistent reported annual uses of acephate in dry beans and peas in Arizona. Acephate is used to control various stink bug species and Lygus, which can cause economic damage in pintos, garbanzos, and black-eyed peas. Notably, reported use of acephate recently increased in pinto beans compared to prior years, from around 240 acres (not every year) to roughly 5,270 acres and 3,086 acres in 2018 and 2019 respectively. A knowledgeable pest control advisor attributes increased use to a recent expansion in pinto bean acres. Based on his estimates of acreages, reported use represents over 100% of pinto bean acres in 2018 (suggesting multiple sprays to some fields) and 64% in 2019. Effective alternatives to acephate for stink bug control include dimethoate, bifenthrin and sulfoxaflor. In Southeast Arizona, acephate and dimethoate are often used in rotation or tank-mixed for resistance management. Acephate is inexpensive to use. In other parts of the state, some PCAs have shifted to sulfoxaflor for Lygus control in beans. This reduced-risk chemistry has proven effective for them, though it is more expensive than acephate (Fournier et al. 2018).

Chile Peppers
In 2021, New Mexico produced 8,500 acres of chile peppers valued at over $44.9 million (USDA-NASS 2022b). Nearly all peppers are drip irrigated, and given the desert environment, there is little chance of surface water contamination with acephate. According to a pest management advisor who works with the NM chile industry, acephate use remains an important tactic to control aphids that vector alfalfa mosaic virus and tobacco mosaic virus. The mosaic viruses can result in 90% yield loss when aphid populations are high. New Mexico growers use an areawide IPM approach to managing the viruses, which is critical to successful economic production of chile peppers. This involves applications of acephate to all adjacent alfalfa fields and non-adjacent nearby alfalfa fields with high aphid populations prior to each cutting, to prevent the spread of aphids into the pepper crop (Fournier et al. 2018). A single infected aphid can transmit the virus, leading to losses in the pepper crop. If needed, acephate may be used directly on chile peppers for quick knockdown of aphids. Up to 25% of acres have been treated when aphid populations are high. This strategy has been largely effective. Other aphid insecticides have not demonstrated sufficiently fast knockdown needed to effectively limit the spread of the virus into chile peppers.

Bensulide
Bensulide is unusual, as an organophosphate herbicide. According to the Arizona Pest Management Center Pesticide Use Database, bensulide sees regular use across a broad range of vegetable and melon crops, including lettuces, arugula, mustards, celery, cilantro, fennel, cauliflower, broccoli, and cantaloupe and other melons. One of the most critical uses is in lettuces (head, leaf and Romaine). Bensulide can provide between 0 and 100% weed control, depending on the weeds present. It is good on annual grasses, red root pigweed, and purslane and fair on goosefoot and lambsquarters. It is inconsistent on most other local weeds (Tickes 2018).

Lettuces
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 about 90% of all fresh lettuce consumed in the U.S. in the winter (Satran 2015). In 2021, the combined value of production for head lettuce, leaf lettuce and romaine exceeded $651 million, with production on 63,900 acres (USDA-NASS 2022a).

Prefar (bensulide) has been a standard herbicide used on lettuce in Arizona for more than 19 years (Tickes 2018). According to data from the Lettuce Pest Losses annual survey, with high participation among Pest Control Advisors (PCAs) who work with lettuce growers in Arizona and the adjacent region of Imperial County, CA, 52% of head lettuce acres were treated with bensulide (Prefar) in the 2018-2019 season. Its use is second only to pronamide (Kerb) in lettuce, which the same season was used on 89% of lettuce acres (Tickes 2019, Figure 3). An earlier survey in 2017 indicated that 58% of the planted lettuce acres in Yuma County were treated with Prefar (Tickes 2018). These estimates are expected to be more accurate than pesticide use reporting data. Because bensulide is not on the Arizona Ground Water Protection List, applications made by growers using ground equipment do not require reporting.

Prefar is applied under a Section 24C Special Local Needs registration for Arizona lettuce (Head or Leaf) which allows a broadcast rate of 5-9 qt./A (https://s3-us-west-1.amazonaws.com/agrian-cg-fs1-production/pdfs/Prefar_4-E_Section1m_24c.pdf). These higher use rates help reduce some of the variability in weed control that is characteristic of Prefar, but also increase the possibility of crop injury. However, lettuce has a good tolerance to Prefar at even higher rates than 9 qts. under ideal growing conditions (Tickes 2012).

Timing of application is critical to the performance of Prefer. Prefar works on the roots of developing seedlings, stopping cell division at the tip of the roots it contacts. The chemical must be in the soil prior to weed germination (Tickes 2012). It is incorporated into the top inch or two of soil with sprinkler irrigation. Incorporation with water is more effective than mechanical incorporation and maintains a more concentrated layer of herbicide where the weed seeds are germinating. Furrow and drip irrigation do not push Prefar down into the soil and do not work well for incorporation. High volumes of water applied by sprinkler irrigation is most effective (Tickes 2013). Prefar works best in coarse textured soils such as found in the Coachella Valley, CA (Tickes 2013). Because Prefar is active on a relatively small spectrum of weeds, it is typically used in combination with other herbicides to broaden this spectrum (Tickes 2012).

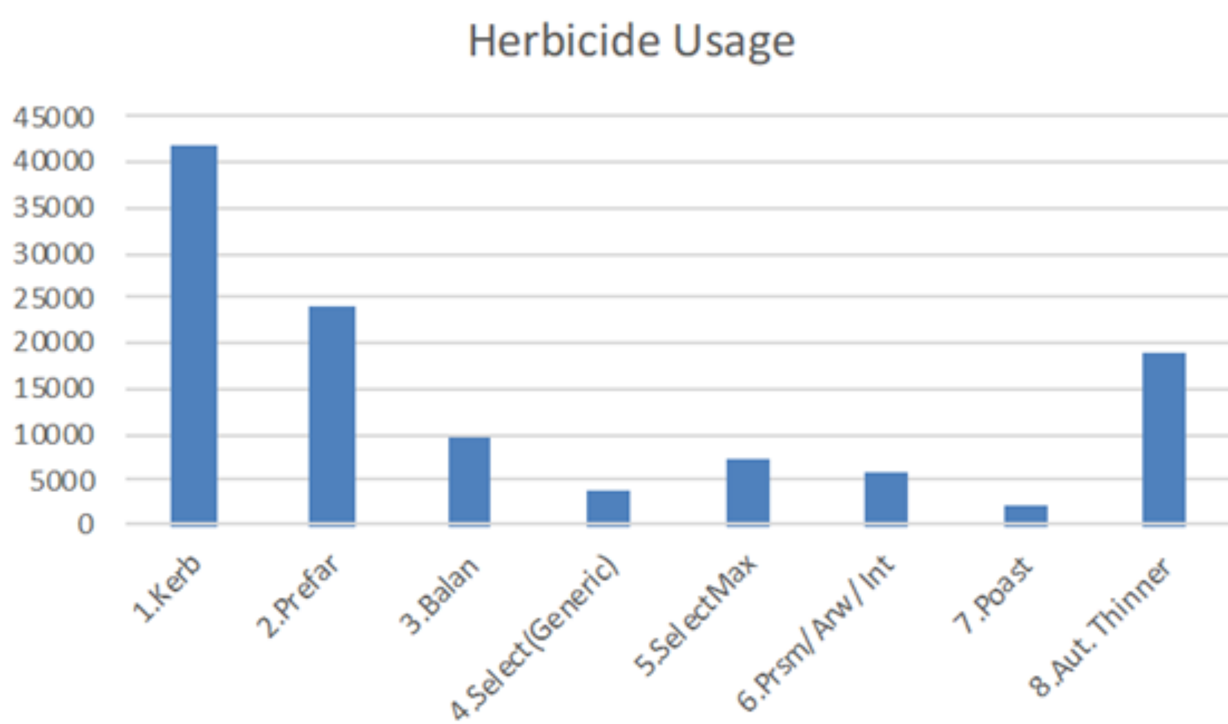

Figure 3. Use of herbicides on Arizona head lettuce during the 2018-2019 growing season. Source: Lettuce Pest Losses Survey, 2019 (Tickes 2019).

Melons and Other Produce

The same soil incorporation application method described for Prefar in lettuce is used in other vegetable crops and melons, to provide control of the same difficult weeds. In most if not all cases, similar to lettuce, it is only a portion of acres being treated, and many of these are small acreage crops. After lettuce, the most commonly treated crops based on number of reported sprays between 2010 and 2020 are melons, arugula, mustard greens, kale, broccoli, parsley, celery and cilantro. According to Marco Peña, Associate in Extension and weed management expert who works with Yuma County growers, any vegetable crops on the Prefar label that are planted by seed in areas where target weeds are problematic may be treated. According to one PCA, bensulide is a go-to herbicide at establishment for melons, in any situation where melons are sprinkler irrigated so that the herbicide can be incorporated. He indicated that losing access to bensulide "would be a big loss" for some melon growers. Although only a portion of acres are treated for most of these crops, loss of bensulide as a control option for weeds would be a significant setback for our growers.

Guayule

Guayule is a desert-adapted perennial currently under development in the desert Southwest as a low water use crop used for the production of rubber. Bensulide is used for pre-emergent weed control in guayule. The biggest challenges with guayule production are at stand establishment. Bensulide has demonstrated effective control of difficult weeds during stand establishment.

Dimethoate and Malathion Use

According to the Arizona Pest Management Center Pesticide Use Database, the majority of uses for both dimethoate and malathion are in alfalfa. While both active ingredients are registered in, and used on a variety of other crops, reported acreages are small and in most cases, applications are not reported every year. The most significant non-alfalfa uses of dimethoate are in cotton and corn, on a small percent of acres. Use in cotton is not recommended, as there are effective selective control options for most insect pests and situations. However, according to Cotton Pest Losses survey data, from 2017 through 2021, an average of 13.85% of Arizona cotton acres were treated with dimethoate. For malathion, a few crops like broccoli, cauliflower, barley, wheat, and bermudagrass have fairly regular use, but again on a small percentage of acres. We suspect these applications are for niche situations, unusual pests, etc. Our comments will focus on the use of these two organophosphates in alfalfa.

Alfalfa

Alfalfa is one of Arizona's top crops annually, in terms of acreage and value. In 2021, Arizona produced 275,000 acres of alfalfa hay valued at over $468 million (USDA-NASS 2022a). Arizona has the highest alfalfa yields in the nation, with 8.4 tons per acre on average, compared to about 6.4 tons per acre in California. The national average is 3.4 tons per acre (Blake 2019).

Malathion is used primarily for control of alfalfa weevil and various species of aphids. It provides another mode of action (apart from pyrethroids) that has activity on weevil, which is good for resistance management. Another advantage for malathion is the zero days-to-harvest provision on the label, which makes it one of the most important insecticides in alfalfa, where it can be necessary to spray for insects prior to cutting or other field activities. Malathion is the standard application for weevil and also controls aphids when they occur at the same time in early spring. This dual effectiveness is helpful, allowing growers to forego a second spray for aphids. According to more than one PCA, this is a very important use pattern for our alfalfa producers.

Dimethoate is used first and foremost to control aphids, but it is commonly applied to control aphids and weevils together (similar to malathion). Its use is becoming even more important following the de-registration of chlorpyrifos, as well as recent supply chain issues for some of the other pesticides. An advantage of dimethoate compared to other broad-spectrum chemistries is that it doesn't flare mites, which can lead to the need for additional sprays. Dimethoate provides another rotational chemistry, important to maintaining resistance management. Aphid control has become increasingly difficult over the past ten years, especially more recently after losing access to chlorpyrifos.

Secondary target pests for these insecticides include armyworm, three-cornered alfalfa hoppers and other sucking insect pests. Alfalfa can require frequent insecticide sprays to maintain yields and quality, and, apart from sulfoxaflor for aphid control, there are few selective insecticides available. Additional research may be needed to screen and develop a better suite of effective, selective chemistries for the control of alfalfa's key pests, including alfalfa weevil, aphids, and Lygus (for seed alfalfa).

Following the loss of chlorpyrifos, which growers and PCAs are still adapting to, the potential to lose both malathion and dimethoate would put alfalfa production at serious risk in the short term. If dimethoate and malathion were to be considered for de-registration on alfalfa, we would urge EPA to consider gradual phaseouts of these chemistries to allow adequate time for research into effective alternative insect management options.

Other Uses

Malathion is also sometimes used for fumigation of (empty) grain storage beds, and for early-season thrips control in chile peppers.

Tribufos

Tribufos is a defoliant. It is the active ingredient in the Folex 6 EC, a cotton defoliant with a low level of use in Arizona. Based on pesticide use data, we estimate about 1% to 2% of acres are treated annually. There are other, more popular options for defoliation. We do not that anticipate that discontinuation of access to tribufos would be problematic for our growers.

Dicrotophos

The Arizona Pest Management Center previously commented on dicrotophos in response to EPA draft risk assessments (Ellsworth et al. 2014). At the time of those comments, Arizona was experiencing a resurgence of the brown stink bug, *Euschistus servus*, and dicrotophos (Bidrin) was one of the few control options available. Stink bugs use their piercing-sucking mouthparts to pierce the boll and feed on the seeds and can do significant damage (Ellsworth & Brown 2013). When brown stink bug populations unexpectedly exploded in 2013, dicrotophos was the fourth most commonly used insecticide for its treatment, based on reported pesticide use data, accounting for 19.4% of pesticide use reports targeting this pest (Ellsworth et al. 2014).

Prior to 2013, there had been no reported uses of dicrotophos in cotton or other crops for many years. Bidrin is difficult to safely apply in the field, and most growers would prefer not to use it. Subsequent research by Dr. Peter Ellsworth, University of Arizona Entomologist and Extension IPM Specialist, and his graduate student, Lydia Brown, later demonstrated that the broad-spectrum insecticides being used to control the brown stink bug, even when effective, led to overall economic losses in cotton, when considering all pests and all insecticide applications (Brown, L. 2017). This is due to the destructive effect of Bidrin and other broad-spectrum chemistries on the natural enemy complex in cotton, which released whiteflies and/or mites from natural controls. The cost of additional sprays for controlling whitefly resulting from treatments for the brown stink bug outweighed the value gained in levels of control achieved for that pest using Bidrin and other broad-spectrum insecticides. Following presentation and teaching of these research results to our growers, all have subsequently stopped using Bidrin to control the brown stink bug. This is borne out in Arizona pesticide use data, which has reported applications of dicrotophos in cotton only for 2013, 2014 and 2015. We do not anticipate that discontinuation of access to dicrotophos would be problematic for our growers.

Diazinon, Naled, Phorate

While there is nominal use of diazinon, naled and phorate in Arizona, these uses are uncommon and represent a very small fraction of acres across registered crops. We do not anticipate that discontinuation of access to these chemistries would be problematic for our growers.

In Conclusion

Organophosphate use has greatly declined over the past three decades with the availability and adoption of selective, reduced-risk pesticides, genetically modified crops and other technologies. Remaining OP use in modern Arizona agriculture is for the most part reserved to targeted niche uses that remain important to economic production, as outlined above. We have tried to highlight the most important remaining uses in this document, based on available data and input from experts and pest control advisors.

More broadly, we feel strongly that EPA is obligated to complete pesticide registration reviews according to its mandate, and to conduct the necessary research to scientifically assess risks of these chemicals, as well as benefits to growers. The timeline proposed by petitioners is unrealistic. In our view, a broad decision to revoke all OP tolerances based on litigation and not science would represent a failure of EPA to address its obligations to both end-users and the environment.

Thank you for the opportunity to comment. Please contact me if you have any questions.

Sincerely,

Dr. Alfred Fournier, Associate Director,
Arizona Pest Management Center
Maricopa Agricultural Center
University of Arizona
37865 Smith-Enke Rd., Maricopa, AZ 85138
fournier@cals.arizona.edu

References

Blake, Cary. "Alfalfa: High cutworm damage, gains made in TRR control in Arizona." Western Farm Press, August 17, 2016. Available online at: http://www.westernfarmpress.com/alfalfa/alfalfa-high-cutworm-damage-gains-made-trr-control-arizona. Accessed June 7, 2021.

Brown, L. 2017. Biology, Ecology, and Economics of Brown Stink Bug, *Euschistus servus* (Heteroptera: Pentatomidae), in Desert Cotton Agroecosystems. Master's Thesis, University of Arizona Department of Entomology. http://hdl.handle.net/10150/625340

Ellsworth, P.C. and L.M. Brown. 2013. Frequently Asked Questions: Brown Stink Bugs. Arizona Agriculture. University of Arizona, Cooperative Extension. (blog post) https://arizonaag.com/2013/07/02/frequently-asked-questions-brown-stink-bugs/

Ellsworth, P.C., L.M. Brown, A.J. Fournier, W.A. Dixon II. 2014. Dicrotophos Use in Arizona. University of Arizona, Arizona Pest Management Center. http://ag.arizona.edu/apmc/docs/14EPADicrotophosUseinArizonavF.pdf

Ellsworth, P.C., A.J. Fournier. 2022. Sulfoxaflor Use in Arizona Cotton. Responses to National Cotton Council Request for Information. https://acis.cals.arizona.edu/docs/default-source/home/2022_response_to_ncc_sulfoxaflor.pdf

Ellsworth, P.C., A.J. Fournier, W.A. Dixon II. 2016. Sulfoxaflor Uses Utility and Benefits in Arizona Agriculture., University of Arizona, Arizona Pest Management Center. http://ag.arizona.edu/apmc/docs/16EPA-Sulfoxaflor-In-ArizonavFv2.pdf

Ellsworth & Peterson, J. 2017. Request for Section 18 emergency use of Sulfoxaflor (Transform® WG Insecticide) to control western tarnished plant bug (Lygus hesperus) in cotton fields in the state of Arizona. Arizona Department of Agriculture. https://cals.arizona.edu/apmc/docs/2017TransformCottonSection18ArizonavF4lo.pdf

Fournier, A., W. Dixon, P.C. Ellsworth. 2017. Arizona Pest Management Center Pesticide Use Database. University of Arizona Cooperative Extension.

Fournier A.J., P.C. Ellsworth. 2018. Acephate Use in Several Arizona and New Mexico Crops. University of Arizona, Arizona Pest Management Center. Comments submitted to EPA docket EPA-HQ-OPP-2008-0915. 8/28/18. https://www.regulations.gov/comment/EPA-HQ-OPP-2008-0915-0037

Kerna, A., D. Duval, G. Frisvold, A. Uddin. 2016. The Contribution of Arizona's Vegetable and Melon Industry Cluster to the State Economy. University of Arizona, College of Agriculture and Life Sciences, Cooperative Extension. https://cals.arizona.edu/arec/sites/cals.arizona.edu.arec/files/publications/AZ%20Vegetable%20and%20Melon%20Economic%20Contribution.pdf

Palumbo, J. 2022. Insecticide Usage on Conventional and Organic Lettuce in the Desert, 2021-2022. University of Arizona Vegetable IPM Update, Vol. 13, No. 13. University of Arizona Cooperative Extension. https://acis.cals.arizona.edu/docs/default-source/agricultural-ipm-documents/vegetable-ipm-updates/2022/220713-insecticide-usage-on-desert-lettuce-2021-22.pdf

Satran, J. 2015. This Is Where America Gets Almost All Its Winter Lettuce. Huffpost. https://www.huffpost.com/entry/yuma-lettuce_n_6796398

Tickes, B. 2012. Prefar SLN for Arizona Lettuce. University of Arizona Vegetable IPM Update, Vol. 3, No. 19. University of Arizona Cooperative Extension. https://cals.arizona.edu/crop/vegetables/advisories/more/weed71.html

Tickes, B. 2013. Prefar (Bensulide) Needs Lots of Water 2013. University of Arizona Vegetable IPM Update, Vol. 4, No. 3. University of Arizona Cooperative Extension. https://acis.cals.arizona.edu/agricultural-ipm/vegetables/vipm-archive/vipm-weeds-view/prefar-(bensulide)-needs-lots-of-water-2013

Tickes, B. 2018. Prefar (Bensulide) on Lettuce 2018. University of Arizona Vegetable IPM Update, Vol. 9, No. 2. University of Arizona Cooperative Extension. https://acis.cals.arizona.edu/agricultural-ipm/vegetables/vipm-archive/vipm-weeds-view/prefar-(bensulide)-on-lettuce-2018

Tickes, B. 2019. Purslane. University of Arizona Vegetable IPM Update, Vol. 10, No. 11. University of Arizona Cooperative Extension. https://cals.arizona.edu/crop/vegetables/advisories/more/weed235.html

USDA NASS 2022a. 2021 State Agricultural Overview: Arizona. United States Department of Agriculture, National Agricultural Statistics Service. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=ARIZONA

USDA NASS 2022b 2021 State Agricultural Overview: New Mexico. United States Department of Agriculture, National Agricultural Statistics Service. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NEW%20MEXICO