



**Etoxazole Use and Benefits in Arizona Corn and Cotton**  
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**Summary**

- The EPA is seeking public comments in response to newly published risk assessments for etoxazole, an acaricide/miticide growth inhibitor registered for foliar use on several crop groups.
- Our goal at this time is to inform the EPA about specific crop practices and etoxazole use patterns on Arizona crops that have bearing on estimated levels of potential worker exposure and risk.
- Nearly all reported etoxazole use in Arizona agriculture is limited to two crops: corn and cotton. Only a few scattered uses outside of these crops have been reported in the past eight years.
- Etoxazole is a very important mite “growth regulator” used in these crops, with documented efficacy, and is important in mite management and resistance management.
- Etoxazole is relatively selective in controlling mite species and generally supportive of conservation biological control in the systems where it is used, compared to alternatives (e.g., abamectin).

**Etoxazole use in Arizona Agriculture**

Etoxazole is an acaricide/miticide growth inhibitor registered for foliar use on several crop groups. Marketed as Zeal for mite control in agricultural crops, etoxazole is a very important mite “growth regulator” used in corn and cotton and other crops. Based on data from the Arizona Pest Management Center (APMC) pesticide use database (Fournier et al. 2017), the primary reported uses in Arizona agriculture are in corn (mainly field, grain, silage) and, to a lesser extent, cotton.

Mites, especially the two-spotted spider mite, *Tetranychus urticae*, can be serious corn pests in Arizona, and occasional pests of cotton. Mite populations favor hot, dry conditions, which characterize corn and cotton production areas in the state. The feeding of mites on the undersides of leaves can cause a burned appearance and eventually kill the leaves, leading to yield losses and reduce silage and cotton fiber quality, affecting price. Given the rapid reproduction of mites, natural enemies can be overwhelmed by mite populations.

Mites (mainly *Tetranychus urticae*) are not considered key pests of cotton in Arizona, though they are present in many fields. In 2018, 38% of cotton acres were reported as having the pest present. When conditions are optimal and natural enemy levels sufficient, most growers do not experience economic levels of mites in their cotton production. However, under conditions conducive to mite population development (high temperatures, dusty conditions, and/or diminished populations of natural enemies), mite secondary pest outbreaks can become common. Generally, mites in cotton are considered a disrupted pest, usually associated with depleted populations of the facultative predator thrips, *Frankliniella occidentalis*. In 2018, 18.8% of cotton acres were treated for mites (equivalent to 0.188 sprays per acre).

Reported use of etoxazole from the APMC Pesticide Use Database in cotton represented a small and declining percentage of acres between 2012 and 2018 (e.g., less than 1% of 2018 acres). Actual user reports (an estimate of the total use patterns for cotton pesticides) showed usage of etoxazole in 2018 at 0.15 to 0.23 sprays per acre for Bt and non-Bt upland cotton, respectively. Other miticides in use in 2018 included abamectin (0.07 sprays in Bt cotton), spiromesifen (0.07 in Bt cotton), and sulfur (0.02 sprays in Bt cotton). Abamectin and sulfur are broader spectrum than etoxazole, and potentially damaging to natural enemy populations. Spiromesifen use also targets whitefly populations and when used at moderate rates is fully selective and safe to natural enemy populations (Ellsworth et al. 2006). In general, conditions for mite outbreaks have been at historic lows over the past 6 years. However, when pest control advisors (PCAs) elect to spray for mites in cotton, etoxazole is used about half the time (53.6% in 2018).

Conversely, reported etoxazole use in Arizona corn increased between 2012 and 2018, to a high of 36,740 acres of reported use in 2018, or 52% of acres. These may be conservative estimates of its use, because growers are not required by state rule to report applications made using their own equipment. Three central Arizona pest control advisors (PCAs) interviewed about this pesticide provided their own estimates of use, which ranged from 80% to 100% of spring/summer corn acres and up to 50% of fall corn acres. Statewide estimates provided by Dr. Ayman Mostafa, Area Agent & Regional Specialist with University of Arizona Cooperative Extension, were similar: 75% of statewide acres in summer silage corn, and 40-50% for fall acres.

In efficacy trials conducted since 2014 in corn by Dr. Ayman Mostafa, etoxazole showed 60–90% efficacy against different stages of spider mite for 21–28 days after treatment. This is backed up by field experiences of three licensed pest control advisors (PCAs) interviewed about this pesticide. All three indicated that Zeal provides effective control of mites, or, as one PCA put it, “the best efficacy for the price.” Another PCA said Zeal was his first choice “go to” product for mite control in cotton and corn. In both crops, PCAs indicated etoxazole performed favorably compared with available alternatives, particularly in the consistency of control achieved. Etoxazole has not been included in efficacy research trials for cotton for many years, because its efficacy has been established and is well known to growers.

Etoxazole is applied to corn or cotton, based on the presence of mites or their symptoms, or on historical populations in an area. (Mites tend to recur in the same fields year after year.) A 2 oz. rate of Zeal (0.09 lb. ai/A) is used in cotton, and often in corn, though some growers will

increase to a 3 oz. product rate (0.135 lb. ai/A) in corn. In most cases, a single application is used per crop season. In some cases, when early treatments are applied, a second application of Zeal may be used. But in most such instances, growers will rotate to a different mode of action. The preferred method of application in both crops is by ground. This has to do with both cost and efficacy. Applications made by ground, before the crop is too large to do so, tend to provide better coverage and therefore better efficacy than aerial applications. However, limitations of time and equipment to get around to all fields needing treatment result in some acres being treated by air. Also, infestations that develop later in the season will require aerial treatments.

Rotation among different groups of miticides is essential for resistance management. Zeal provides a mode of action affecting different stages of mites which is distinct from alternative pesticides. This is helpful in both pest management and resistant management. There is a soluble concentrate formulation of this product available, which helps to reduce potential risk to workers during handling and mixing.

### **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. Ayman Mostafa is an entomologist, Area Agent & Regional Specialist with University of Arizona Cooperative Extension, with responsibility for field crops and over 10 years of integrated pest management research experience in Arizona. 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. 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.

## **References**

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