



Mepiquat Chloride and Mepiquat Pentaborate Use in Arizona
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Comments submitted by the Arizona Pest Management Center
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Summary

- Mepiquat-based plant growth regulators (PGR) are critical management tools for Arizona cotton growers. These PGRs have several benefits for Arizona cotton production: they control cotton plant height without inducing crop stress, resulting in a more balanced vegetative and reproductive growth pattern, a more open canopy, better spray penetration for pesticides, improved defoliation, and a plant structure more favorable to efficient harvest.
- Mepiquat chloride is commonly used annually on a high percentage of Arizona cotton acres, 69% on average over the past 9 years, but as high as 89%. Mepiquat pentaborate is used to a lesser extent, on 2 to 8 percent of acres planted over the past 9 years.
- In our assessment, use of the mepiquat-based PGRs in Arizona cotton production provides great benefits to growers with very minimal risk to non-target organisms of concern in EPA's draft Ecological Risk Assessment. We would recommend that EPA maintain ongoing registrations for the use of these critical PGRs in cotton.

EPA's Request for Comments

Mepiquat chloride and mepiquat pentaborate are plant growth regulators used in cotton. We have prepared these comments on behalf of Arizona cotton growers and other stakeholders in response to EPA's call for open comments on their draft risk assessments. The draft Occupational Uses Risk Assessment revealed no concerns for workers. EPA's draft ecological risk assessment indicated, "mepiquat chloride is at most slightly toxic (dietary based) to birds, moderately toxic to mammals, and practically non-toxic to honeybees (contact). Reproductive effects were seen in birds, while there is limited data on the chronic effects to aquatic organisms." Our goal is to document actual use patterns for these chemistries in Arizona and to discuss their important role in cotton production in the desert southwest, which includes Arizona, New Mexico and the Southeastern desert region of California.

Mepiquat use in Arizona

Arizona 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).

Mepiquat-based plant growth regulators (PGR) have been critical management tools for Arizona cotton growers since their introduction in the in the 1980s. These PGRs suppress growth hormones in the plant, reducing plant height and encouraging earlier fruiting. Mepiquat-based PGRs have several benefits for Arizona cotton production: they control cotton plant height without inducing crop stress, resulting in a more balanced vegetative and reproductive growth pattern, a more open canopy, better spray penetration for pesticides and improved defoliation (Wang & Norton 2012). The improved crop canopy and plant architecture results in more efficient harvest, saving resources such as those that would otherwise be needed to conduct a second picking (i.e., additional fuel, labor, equipment). Research conducted in Arizona and across the cotton belt has confirmed the ability of these PGRs to consistently control plant height, but lint yield response to PGRs has been shown to be more variable and dependent on other factors besides PGRs, including crop vigor and fruit retention rates (Wang & Norton 2012). Because of cotton's growth habit and the challenges of effectively targeting insect pests, particularly during later stages of plant growth when many of our key pests reach threshold levels, the benefits of using these PGRs can extend to improved chemical control of insect pests, which in turn can improve cotton yields and grower profits.

The desert southwest region typically grows crops with the irrigation water. In Arizona, cotton leads the world in yield because conditions of abundant sunshine and water are available. As a result, we grow cotton that is structurally far larger than anywhere else in the world. This structure provides us additional fruiting sites not available to other regions. But this "vigor" contributes to conditions of excess height and canopy density that can reduce the effectiveness of all crop chemicals including pesticides and defoliants. These PGRs have allowed growers to manage plant structure, especially plant heights, so that an efficient harvest is insured.

Mepiquat chloride is available to Arizona growers in several registered products, including Mepstar, Mepex, Pix Plus and a variety of generics. Mepiquat pentaborate is registered in Arizona as Pentia Plant Growth Regulator. Tables 1 and 2 provide summaries of reported statewide use from 2008 through 2016 for each active ingredient. Growers do not use these PGRs on every acre of cotton, but rather on an as-needed basis, making decisions based on patterns of plant growth (Silvertooth 2001). If PGRs are needed, one or, more often, two sprays will be applied. Dr. Randy Norton, University of Arizona Cooperative Extension Agent and Regional Specialist based in Southeastern Arizona, estimates that up to 90% of cotton acres statewide can receive at least one application per year, but this can be influenced by many factors, including cotton variety, amount of fruit loss due to insect pests, and heat stress. Under conditions of increased fruit loss and heat stress, there is an increased need for PGRs to control plant growth, so there are fluctuations in use from year to year.

Based on information from the Arizona Pest Management Center Pesticide Use Database (Fournier et al. 2017), mepiquat chloride use ranges from year to year, but generally, reported application-acres represent 42–90% of acres planted. Mepiquat pentaborate use is much lower, with reported application-acres ranging from about 2–8% annually. These estimates are potentially somewhat conservative, because some grower-applied ground applications are under-represented in our database, since these applications do not require reporting under Arizona statute. Median application rates for most of these products (both AIs) in Arizona is around 16 fl. oz. per acre, but is in the 20 – 24 fl. oz. range in a few cases.

Table 1: Reported statewide **mepiquat chloride** use on cotton in Arizona, 2008 – 2016. Source: APMC Pesticide Use Database (Fournier et al. 2017).

Year	Reported Applications	Reported Acres Treated	Acres Planted	% Treated
2008	780	74,079	141,527	52.3
2009	732	62,086	148,246	41.9
2010	1462	141,049	201,458	70.0
2011	2038	165,710	266,422	62.2
2012	1941	175,766	202,468	86.8
2013	1538	148,909	166,789	89.3
2014	2146	124,119	167,874	73.9
2015	1170	70,437	105,538	66.7
2016	1662	97,442	128,887	75.6

Table 2: Reported statewide **mepiquat pentaborate** use on cotton in Arizona, 2008 – 2016. Source: APMC Pesticide Use Database (Fournier et al. 2017).

Year	Applications	Acres Treated	Acres Planted	% Treated
2008	78	3,996	141,527	2.8
2009	153	10,362	148,246	7.0
2010	170	9,605	201,458	4.8
2011	395	18,505	266,422	7.0
2012	361	13,088	202,468	6.5
2013	187	10,620	166,789	6.4
2014	233	7,296	167,874	4.4
2015	57	2,525	105,538	2.4
2016	271	10,576	128,887	8.2

Based on EPA’s draft Ecological Risk Assessment, mepiquat chloride is “at most slightly toxic” to birds when consumed as part of their diet, although there are indications also of possible reproductive effects on birds; “moderately toxic” to mammals; and “practically non-toxic” to bees. In our desert cotton production system, birds and mammals are not generally a pest concern, and we would expect exposure rates for these animals to be extremely low. While

cotton is self-pollinated, bees can visit cotton and so the lack of bee toxicity is certainly good news. Although EPA indicated they have limited data on the chronic effects to aquatic organisms, we should point out that our desert production systems rely on laser-leveled fields with controlled irrigation systems and extremely limited runoff. Water is a precious resource in desert agriculture, and is very carefully managed by our growers to maximize crop yields and minimize waste.

In our assessment, use of the mepiquat-based PGRs in Arizona cotton production provides great benefits to growers with very minimal risk to non-target organisms of concern. We would recommend that EPA maintain ongoing registrations for the use of these critical PGRs in cotton.

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 Comment Coordinator for the Western IPM Center, representing stakeholders in the desert Southwest states. Dr. Randy Norton, University of Arizona Cooperative Extension Agent and Regional Specialist based in Southeastern Arizona, conducts agronomic and pest management research on cotton throughout Arizona and works with growers and pest managers. 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.

References Cited

Anonymous. 2012. Research-Based Integrated Pest Management (IPM) Programs Impact People, Communities and the Economy of Arizona. University of Arizona Cooperative Extension, Arizona Pest Management Center.

https://cals.arizona.edu/apmc/docs/APMC%20Impact%20narrativep1-4_4-29-14.pdf

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

Silvertooth. 2001. Mepiquat Chloride (MC) Application Guidelines for Arizona Cotton.

https://cals.arizona.edu/crops/cotton/cropmgt/pix_application.html

USDA NASS 2017. 2016 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

Wang, G. & R. Norton. 2012. Commercially Available Cotton Height-Controlling PGRs in Arizona. University of Arizona Cooperative Extension. Publication number AZ1555.

<https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1555.pdf>