



Paraquat Dichloride Use and Benefits in Arizona Agriculture
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Summary

- The EPA is seeking public comments in response to published risk assessments for paraquat dichloride, a non-selective contact herbicide registered for several crops and non-agricultural areas.
- Our goal at this time is to inform the EPA about specific crop practices and paraquat dichloride use patterns on Arizona crops that may have a bearing on estimated levels of potential worker exposure and risk, and environmental risk.
- The most significant uses of paraquat are as a harvest aid in cotton and seed alfalfa, for pre-plant weed control on fallow land, and for post-emergent weed control in tree crops, including pecans and pistachios.
- Paraquat is used as a desiccant to aid in defoliation and harvesting of cotton, and is typically used on 15% to 20% of the crop annually. There are many situations in which paraquat is essential to enabling a timely, successful cotton harvest.
- In alfalfa seed, paraquat is used as a defoliant prior to mechanical harvesting. It is the only available option and is used on all harvested acres at or near the maximum use rate. Note that alfalfa seed production is on a very small scale in Arizona.
- Paraquat is of increasing use and importance in pecan and pistachio production in Arizona. Production acres have increased, and issues such as glyphosate resistant weeds, residue restrictions on European exports of pecans, and concerns about glyphosate liability issues have led to an increase in paraquat use.

Paraquat Dichloride Use in Arizona Agriculture

Paraquat dichloride (“paraquat”) is a non-selective contact herbicide registered for several crops and non-agricultural areas. It can be used in a variety of ways, including pre-plant, pre-emergence, post-emergence treatments, and as a harvest aid. According to the Arizona Pest Management Center (APMC) Pesticide Use Database (Fournier 2017), there is a small amount of use across a variety of crops (e.g., alfalfa, beans, lettuces, cole crops, tree crops); however, the most significant and important uses we identified are in cotton and seed alfalfa as a harvest aid,

on fallow land for pre-plant weed control, and for pre- and post-emergent weed control in pecans and pistachios.

Fallow Land. Between 3,500 and 8,500 acres of fallow land treatments of paraquat were reported annually between 2010 and 2018, at an average of about 5,900 acres per year. Rates vary, but are typically between 0.50 and 1.0 lb. a.i. per acre.

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).

Paraquat dichloride is the active ingredient in a number of desiccant products labelled for use on cotton (e.g., Gramoxone, Firestorm). It is often applied to upland cotton following a defoliation treatment to remove remaining leaves and/or to kill re-growth of new plant tissues prior to harvest. Dr. Peter Ellsworth, Cotton IPM Extension Specialist at the University of Arizona, estimates that as much as 15 to 20% of cotton statewide is typically treated with paraquat annually.

There are many situations in which paraquat is essential to enabling a timely, successful cotton harvest. For example, when weather conditions result in regrowth of leaves prior to harvest, or if there is a freeze after application of the first defoliant. Because paraquat is fast acting, it allows a grower to quickly get on with harvesting in these situations. Multiple weather events impacting harvest can occur in late fall and winter in Arizona, and a paraquat application can make the difference between a grower turning a profit on the crop or taking a loss.

Pecans and Pistachios. Tree crop acres in Arizona have expanded in recent years, particularly for pecans, which are largely grown in the Southeast portion of the state. In 2018, Arizona ranked 4th in national pecan production, harvesting nearly 28mil pounds of pecans, 11.5% of national production, valued at over \$52mil (USDA- NASS 2019).

Paraquat is an increasingly important component of weed control programs in Arizona pecans and pistachios. Growers of both crops use similar weed control practices. Trees are typically planted 25 to 27 ft. apart. Most growers control weeds between tree canopies mechanically. But the area near the base of trees requires multiple herbicide applications each season to eliminate weeds that would otherwise reduce yields. Paraquat is applied for post-emergent weed control, primarily as a "berm spray" from the base of trees to a distance of about 4 ft. on each side. Paraquat is typically used 2 to 3 times per season at maximum label rate, often in rotation with glufosinate, or sometimes, glyphosate. Paraquat provides fast and effective broad spectrum weed control, particularly for challenging weeds that have shown resistance to glyphosate, including *Malva* spp. and hairy fleabane. According to University of Arizona Extension Weed Specialist, Dr. William McCloskey, weed control programs in pecans and pistachios have greatly improved in recent years, with increasing adoption of pre-emergent herbicides by growers, which have reduced the total number of "clean up" (post-emergent) applications required.

Three factors have contributed to increased use of paraquat in pecans and pistachios. (1) resistance of some key weeds to glyphosate as mentioned above; (2) production of pecans for export to European markets, which will not accept nuts with glyphosate residues; and (3) some large-scale growers have decided to completely ban the use of glyphosate in pecan production, due to public perceptions of glyphosate as an alleged cancer-causing hazard and/or because of liability concerns stemming from this perception. This is ironic, because by limiting, or in some cases discontinuing, the use of glyphosate in favor of paraquat and glufosinate, growers are shifting away from what is, by scientific measures, a lower-risk herbicide to chemicals with higher toxicity with more significant human health and environmental risks. However, this has been a trend among some of our large acre growers.

Alfalfa Seed. While Arizona is not a large-scale producer of alfalfa seed (it represents about 1% of statewide alfalfa production annually), the use of paraquat is critical in this industry. Seed alfalfa is a high-value market. Paraquat is applied as a desiccant / defoliation treatment as growers prepare for mechanical harvesting. There are currently no effective alternatives to paraquat for this use. In the past, some growers have used sodium chlorate, but, according to pest control advisors, that chemistry has gotten very expensive and difficult to obtain in recent years, and is far less effective. Paraquat is efficacious, economical and fast-acting. Much of our seed production occurs on alfalfa production acres near the end of a crop's multi-year life cycle, before alfalfa is taken out, and possibly replanted. Harvest often is targeted to occur prior to the intensification of the summer monsoon season. This is to prevent large losses due to shattering stimulated by rains on ready-to-harvest seed alfalfa fields. Paraquat applications allow growers to better prepare a timely harvest of their crop before rains come. Applications are made in spring or early summer on all harvested acres, at or near the maximum use rate.

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. William McCloskey is an Associate Professor and Extension Specialist in Weed Science, with experience in field crops, including alfalfa, cotton, and tree fruit and nut crops. 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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