

Comments to the United States Environmental Protection Agency

Docket No. EPA-HQ-OPP-2015-0746-0031

Diuron Proposed Decision Comment

July 21, 2022

I am the county extension agent for the Bulloch County Extension Office in Georgia. Our office is in full support of grower access to diuron chemistry for cotton production. Bulloch County cotton has a farm gate value of \$35.7 million over 44,122 acres for 2021. Our farmers apply diuron on approximately 80% of the entire acreage. The discontinued use of diuron would place our cotton producers in an agronomic disadvantage for successful weed control.

Bill Tyson, County Extension Agent – Bulloch County

The following Bulloch County cotton growers support this diuron decision comment:



UNIVERSITY OF
GEORGIA

College of Agriculture and Environmental Sciences

Glyphosate-resistant Palmer amaranth is the most problematic pest currently infesting Georgia agriculture. Recently 1737 farmers from across the state completed a survey where they wrote in answers to the question “List Your Most Challenging Pests”. Palmer amaranth was not only determined to be the most challenging pest but it actually was listed more times than the other top 10 pests combined (Fig 1). Ever since the first case of glyphosate resistant Palmer amaranth was confirmed in Georgia, our cotton industry has invested over \$2.1 billion for management.

Fig 1. List Your Most Challenging Pests

Response	Times provided	Points by ranking*
Palmer amaranth, pigweed	1773	4983
Morningglory	238	572
White flies	155	318
Dayflower (spiderwort)	131	254
Sicklepod	113	223
Stink bug	105	226
White mold	61	95
Nutsedge	48	82
Nematodes	47	94
Annual grasses	41	74

*Points were determined by giving 3 points for 1st choice of importance, 2 points for 2nd choice, and 1 point for 3rd choice. All locations – 1737 growers participated

Over the last decade, Georgia farmers have done an exceptional job managing Palmer amaranth but at a tremendous cost, threatening farm sustainability. Crop rotation, cover crops, tillage, hand weeding, and the use of sound herbicide programs are all used in an integrated management approach. Although each of these options is important, the herbicide system is the backbone of a sound effective plan. In fact, without herbicides, Palmer amaranth would not be controlled adequately. Within the herbicide system component of this integrated management system, diuron is one of the most critical components and is used on nearly all of our 1.2 million acres.

Diuron is an extremely unique herbicide in that it controls Palmer amaranth, and other weeds, when emerged but it also provides residual control preventing their establishment. Also unique to diuron and its specific mode of action is that it is only used in cotton and not in rotational crops including peanut, corn, soybean, and vegetables. Applying this herbicide chemistry on our land when only growing cotton allows it to remain an effective and viable tool while also protecting other commonly used herbicides such as glyphosate, glufosinate, dicamba, 2,4-D, ALS herbicides, and the PPO herbicides. Thus, diuron not only provides excellent weed control but also is arguably among the most important resistance management tools used in agronomic weed management programs today. Diuron is also unique

regarding how flexible its use patterns are for cotton farmers. Research by The University of Georgia has confirmed the herbicide can be beneficial applied preplant burndown, preemergence, or as a layby directed application depending on the grower's production system (Appendix 1, bottom of document). Having flexibility to use diuron from preplant burndown through layby allows growers the opportunity to place the herbicide where it has the greatest benefit for farm sustainability.

Specific benefits for diuron use in Georgia cotton production. In the U.S. EPA's assessment of diuron usage and benefits in agricultural/non-agricultural use sites, the following statement was made: *"BEAD concludes that, in general, the benefits of diuron as an herbicidal weed control may be low for most use sites including asparagus, blueberries, citrus, cotton, and pineapple since there are alternative herbicides available that provide effective weed control in each crop."* Unfortunately, this conclusion for cotton is simply not accurate based on nearly 20 years of sound locally developed science, and does not reflect the current situation on our farms. The University of Georgia and Georgia cotton farmers welcome the opportunity for members from U.S. EPA Bead to visit our state to better understand the value of diuron and other tools that are critical to have available during the daily struggles of remaining sustainable.

To be more specific, diuron benefits from each of its application timings are described below. Although data to support these statements are not included in this document, data is provided in the submission made by Dr. Stanley Culpepper, University of Georgia Weed Science.

Burndown Application: Palmer amaranth must not be present at planting or production will be severely impacted. Since Palmer amaranth begins germinating in March, preplant control must be available to not only control emerged plants but also provide residual control, mitigating establishment prior to crop planting. The only effective alternative to burndown herbicide applications is heavy tillage.

1. The only consistently effective residual options to prevent Palmer amaranth from being present at cotton planting include flumioxazin and diuron. Palmer amaranth resistant to PPO herbicides, including flumioxazin, when applied preemergence or postemergence have been confirmed in Georgia, leaving diuron as the only effective option on some fields. Diuron provides far more residual activity than prometryn or fluometuron on Georgia soils.

2. Diuron mixtures with glyphosate, glufosinate, or paraquat are, by far, the most effective tool to control emerged Palmer amaranth plants prior to planting. To control emerged plants, diuron is more effective than any other labeled option including 2,4-D, carfentrazone, dicamba, fluometuron, glyphosate alone, glufosinate alone, paraquat alone, prometryn, pyraflufen, or thifensulfuron + tribenuron. No commercially available herbicide is as effective as diuron for this use pattern.

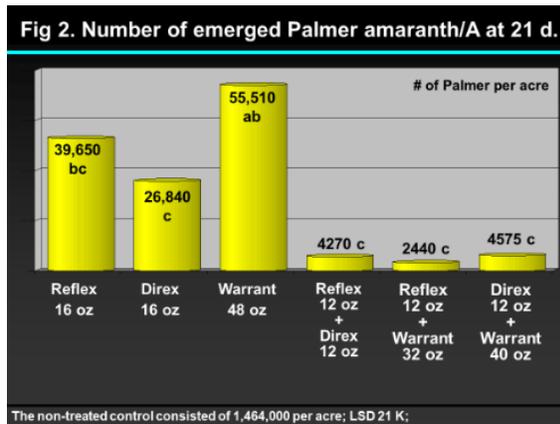
3. A Direx state label allows diuron to be applied 1 day ahead of planting when using reduced-tillage production systems that are now common across Georgia; no other option allows control and flexibility at this level. This is an important tool as Georgia agriculture works to increase the adoption of various reduced tillage and conservation tillage programs. The loss of this tool has the potential to negatively influence the adoption of conservation and reduced tillage systems.

Preemergence Application: Applying residual herbicides at planting is a critical step in successful season-long management. Additionally, if weeds survive the burndown process then this is an opportunity to remove them prior to crop emergence. Applications must include two active ingredients from different

modes of actions with both providing residual activity on Palmer amaranth thereby ensuring sound resistance management plans are in place.

1. Diuron applied immediately following planting offers the most effective option to control emerged Palmer amaranth escaping burndown. At plant herbicides including trifluralin, pendimethalin, and acetochlor provide no control of emerged weeds while 2,4-D, dicamba, fomesafen, fluometuron, fluridone, and pyriithiobac are less effective than diuron.

2. Preemergence herbicides that provide effective and consistent control of Palmer amaranth in cotton on Georgia soils include fomesafen, fluridone, acetochlor (Warrant only), and diuron (Appendix 1). Prometryn and fluometuron are far less effective than any of these options in controlling Palmer amaranth. With four valid herbicide options, growers must combine two of them to achieve 1) maximum weed control, 2) lowest levels of cotton injury, and 3) the best resistance management programs (Figure 2; Appendix 1). For the last five years diuron plus fomesafen, acetochlor plus fomesafen, and diuron plus acetochlor have been the most common



mixtures applied preemergence on Georgia cotton fields. Determining when to use an acetochlor mix and when to use a diuron mix is often influenced by the environment. For example, acetochlor is not an option in fields where soil moisture is not such that guarantees cotton emergence in 5 days; emergence after 5 days with soil treated with acetochlor may lead to unacceptable cotton injury. Additionally, cotton cannot be replanted behind acetochlor for at least 3 weeks compared to 1 day with diuron.

***Layby Directed Application:** The last trip across the field needed to control emerged weeds and provide residual weed control as the cotton crop closes out the row middles requires effective management options. This application is key to managing the soil seedbank.*

1. As noted previously, diuron is one of few tools that offers the ability to control emerged plants while providing residual weed control. For the acres in Georgia receiving a layby, diuron in mixture with MSMA or glyphosate is standard. It effectively provides postemergence and residual control for most of the common and troublesome weeds, including Palmer amaranth. Alternative products including prometryn, fluometuron, flumioxazin, flumioxazin + pyroxasulfone, pyroxasulfone + carfentrazone, trifloxysulfuron, and pyriithiobac are not as effective as diuron when considering control of emerged plants and residual performance. Additionally, there are no weed populations in Georgia with resistance to diuron which is not the case for flumioxazin, carfentrazone, trifloxysulfuron, and pyriithiobac.

Agriculture is threatened by the lack of weed management tools. For decades, the importance of a diversified weed management program that focuses on reducing the weed seed bank through planting into fields free of weeds, rotating crops, maximizing crop competitiveness, integrating non-chemical practices, removing weed escapes, and using herbicide programs focused on diversity of chemistry within and across years have been promoted (Beckie 2006; Walsh and Powles 2007). These methods of

resistance management remain the building blocks for future programs, but farmers must have tools available if they are to remain sustainable. The U.S. EPA is very knowledgeable of this concern (U.S. EPA 2017). On page 12 of PRN 2017-2 (U.S. EPA 2017), the agency promotes the use of diversified herbicide mode of action programs toward weed management, which is a wise statement supported by much research. Thus, the approach of removing tools from a grower's toolbox must be taken extremely seriously with decisions made using sound science, practical pesticide use patterns, and the most recent data generated to address challenges and concerns.

The U.S. EPA's cancer findings. Protecting pollinators, endangered species, the environment, applicators, and consumers when using agricultural pesticide products is a priority for Georgia agriculture. In fact, Georgia has created a flagship program called "Using Pesticides Wisely" to focus on this effort. The initial goal of this program was to improve on-target pesticide applications which has resulted in the training of 14,220 pesticide applicators through 180 in-person classroom trainings, 15 webinars, and over 400 on-farm/county extension office trainings from 2015 through 2022. As a result, pesticide drift complaints made to the University of Georgia Cooperative Extension Service have dropped 90% since the program began. This program also focuses on pesticide safety, covering topics from how to properly wash clothes potentially contaminated with pesticides to understanding the impact of wearing proper PPE has on applicator safety, and the safety of the applicator's family.

Clearly, we are being placed in a very difficult dilemma with diuron. The importance of this herbicide for cotton farmers is immeasurable. However, at the same time, not one of us wants to use a product that is unsafe for our applicators, the environment, or our consumers. The challenge is that the details being provided by the U.S. EPA AND diuron manufacturers is beyond confusing. We implore the U.S. EPA to take this decision very seriously allowing the use of all data currently developed to be considered. Additionally, and important to those in the field and on our farms, we implore the U.S. EPA to confirm modeling assessments with actual field data. If models suggest diuron is in drinking water on Georgia cotton farms then University of Georgia Extension is committed to assisting the U.S. EPA in sampling our farms to confirm this result. This confirmation approach would help farmers and consumers better understand decisions that will not only impact farm sustainability but our ability to feed and clothe humankind.

Literature Cited

Beckie HJ (2006) Herbicide resistant weeds: management tactics and practices. *Weed Technol.* 20:793-814

Walsh MJ, Powles SB (2007) Management strategies for herbicide-resistant weed populations in Australian dryland crop production systems. *Weed Technol.* 2:332-338

US EPA (2017) Herbicide resistance management PRN 2017-2. <https://www.epa.gov/pesticide-registration/prn-2017-2-guidance-herbicide-resistance-management-labeling-education>. Accessed March 16 2021

APPENDIX 1: University of Georgia Cotton Weed Management Program



2022 Cotton Weed Control in Georgia. A. S. Culpepper and J. C. Vance



Herbicide resistance and off-target movement of pesticides threaten our family farms like never before. If farmers, scientists, and regulators do not take this concern seriously, economically effective weed management approaches will rapidly disappear. Growers must implement sound diversified management programs including cultural/mechanical tactics, and when applying pesticides take extreme caution ensuring they remain within the intended target area. *The Georgia Cotton Commission, Cotton Incorporated, and Industry are primary funding sources!!*

STEP 1: Removing weeds before planting is essential, especially Palmer amaranth!

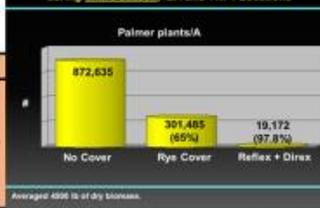
Cover crops, tillage, and herbicides are all potentially important components of farm sustainability. **Cover crops** reduce weed emergence which decreases herbicide selection pressure by lessening the number of weeds needing to be controlled. A recent study noted a 65% reduction in Palmer amaranth emergence for the year with only 4,500 lb of rolled dry matter residue (Fig 1). Similar responses were observed with grasses while **morningglory** was impacted less. **Deep turning** can place many weed seeds at a depth where they cannot emerge. This approach can be extremely effective on Palmer amaranth, ryegrass, and other small-seeded weeds that emerge close to the soil surface. The seed's ability to remain viable while buried should influence timing of subsequent tillage. All weeds and cover crops, with the exception of cereal grains, should be killed at least 14 days before planting. Valor at 2 oz/A and/or Direx at 1 to 2 pt/A are needed for residual control in most fields. Dicamba or 2,4-D would be beneficial to control primrose, horseweed, fleabane, and radish (2,4-D is much more effective on radish). Gramoxone + Direx offers the most effective option for emerged Palmer amaranth while mixtures of glyphosate + 2,4-D + Valor or Direx or glyphosate + dicamba + Valor or Direx would be extremely effective for most weeds infesting Georgia fields.

Plant-back interval for Valor, Direx, dicamba, and 2,4-D.	
Valor	Strip-till (ripper shank) after application and before planting: 1) > 30% ground cover = 7 days; 2) 10-30% ground cover = 14 days + 0.5" rain; 3) <10% ground cover = 21 days + 1.0" rain. In no-till or when the strip is implemented prior to application = 28 days + 0.5" (>10% ground cover) or 1" (<10% ground cover) rain.
Direx	No-till; 10 day; strip-till (ripper shank) after application and before planting; 0 day.
Dicamba	No interval exists for XtendiMax/Engenia in XtendFlex cotton; other cultivars may be planted 30 d after 1" of rain. Restrictions differ on other brands.
2,4-D	No interval exists for Enlist Duo/Enlist One in Enlist cotton; other cultivars may be planted 30 d after application. Restrictions may differ on other brands. Avoid ester formulations if soil temps are above 80 F.

STEP 2: Applying two residual herbicides at planting can keep you farming!

Research during 2018, 2019, and 2020 showed preemergence (PRE) herbicides, if activated, reduced the number of Palmer amaranth needing to be controlled during the ENTIRE season by nearly 98% (Fig 1). At-plant applications using two residual herbicides effective on Palmer amaranth are paramount in reducing resistance to topically applied herbicides like Liberty, 2,4-D choline, and dicamba.

Figure 1. Number of Palmer to kill with POST herbicides during entire season, GA and TN. 4 Locations



PRE'S	HERBICIDE RATES AND COMMENTS
1) Brake + Reflex	1) Brake at 1 pt/A is an effective rate in mixtures but will require significant rain/irrigation to become fully active. 2) Warrant at 32-40 oz/A, for most soils, is in order. Effective on most grasses, pigweeds, and is essential for spiderwort. 3) Direx at 10-16 oz/A is needed for most soils; lower rates on sands or under intense irrigation. 4) Reflex at 10-12 oz/A is ideal for most soils when used in these mixtures; best option for Palmer.
2) Brake + Warrant	
3) Diuron + Warrant	
4) Reflex + Direx	
5) Reflex + Warrant	NOTE: Add paraquat if pigweed emerged; jar test advised if mixing with Brake.

The University of Georgia and The Valley State University, the U.S. Department of Agriculture and creation of the rain-cooperating Cooperative Extension, the University of Georgia College of Agricultural and Environmental Sciences, offer educational programs, resources and materials to all people without regard to race, color, national origin, age, gender or disability. An Equal Opportunity Employer/Affirmative Action Organization Committed to a Diverse Work Force. Based in part on research of Cooperative Extension work, Act of July 8 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating. State Statute, State and Director. Circular # 1 Date: July, 2020

STEP 3: Sequential topically applied herbicide treatments are needed in most fields.

Selecting the ideal postemergence herbicide system to control weeds while minimizing cotton injury is challenging. The table below provides several suggested systems, but of course growers need to adjust programs to fit the weeds and environmental conditions present at application time.

POST 1 ~15-17 d after PRE (assuming PRE is activated)	POST 2 ~ 15-17 d after POST 1 ¹ (before 9-leaf cotton)
LIBERTY OR LIBERTY + ROUNDUP SYSTEMS	
Liberty + Roundup + Dual Mag., Outlook, or Warrant	Liberty + Dual Mag., Outlook, or Warrant
or	
Liberty + Dual Mag., Outlook, Warrant, or Staple	(No 3-way mixture suggested late-season)
In research, rates of residual herbicides have included Dual Mag. at 1 pt/A; Outlook at 12.8 oz/A; Warrant at 2 pt/A, and Staple at 2 oz/A. Mixtures of Liberty + Roundup + residual are often the most effective option for weed control but 25+% injury and leaf-shed has been noted. Mixing Liberty with Roundup may reduce grass control, maximize Roundup rate.	
ENGENIA OR XTENDIMAX SYSTEMS – XTENDIFLEX COTTON	
Engenia 12.8 oz/A or XtendiMax 22 oz/A + glyphosate	Engenia 12.8 oz/A or XtendiMax 22 oz/A + glyphosate
or	
Tavium 56 oz/A + glyphosate (cannot apply overtop after 6-leaf cotton)	Liberty + Dual Mag., Outlook, or Warrant
Warrant (2 pt/A), Dual Mag. (1 pt/A), or Outlook (12.8 oz/A) may be added with glyphosate + Engenia or XtendiMax mixtures to improve residual weed control; however, more injury will occur. Injury with mixtures of three herbicides often can reach 25+% with leaf shed in some conditions. Visit web sites for latest information on approved tank mixtures, adjuvants and drift reduction agents for Engenia (www.engeniatankmix.com), XtendiMax (www.xtendimaxapplicationrequirements.com), and Tavium (www.TaviumTankMix.com).	
ENLIST ONE SYSTEMS – ENLIST COTTON	
Enlist One 2 pt/A + Liberty or glyphosate	Enlist One 2 pt/A + Liberty or glyphosate
Warrant (2 pt/A) or Dual Mag. (1 pt/A) may be added with Enlist One + Liberty or glyphosate for improved residual control; however, injury with mixtures of three herbicides often reach 25+% with leaf shed in some conditions. If making only one Liberty + Enlist One application in the system, apply it first if all pigweed can be controlled; otherwise, apply it second. Visit web site for latest information on approved tank mixtures, adjuvants and drift reduction agents for Enlist One (www.enlisttankmix.com).	

STEP 4: Layby directed or hooded applications



IMPORTANT: Complaints about morningglory, spiderwort, and grass escapes in cotton have risen drastically. This result is primarily a response to making the last herbicide application overtop of the cotton where the spray covers the crop but does not effectively contact emerged weeds or the soil for residual control. Layby applications will improve spray coverage of emerged weeds and the soil resulting in better control (Fig 2). diuron + MSMA (best for pigweed) or Roundup + diuron (best for grasses, 2nd best on pigweeds) are effective options. Add Envoye to improve morningglory control. For spiderwort, add Dual Mag, Outlook, or Warrant. Valor, Caparol, and Cotoran are also useful tools to be considered in a directed system.

Fig 2. Large Acreage Study – Results At Year 3!

