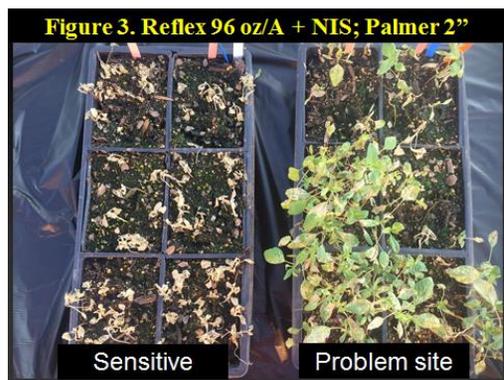
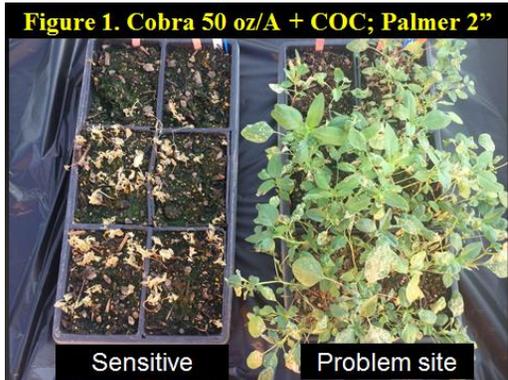


Palmer Amaranth Control in Georgia Cotton During 2019

A. S. Culpepper and J.C. Vance

Cotton weed control has become dynamic and complex with the greatest challenges being 1) mitigating off-target herbicide movement and 2) minimizing the development of more herbicide resistance. Our circular is designed to assist with improved, economically-sound management programs, minimize cotton injury, and make on-target pesticide applications. *The Georgia Cotton Commission, Cotton Incorporated, and Industry are primary funding sources!!*

Herbicide Resistance Threatens Our Future! Unlike never before, herbicide resistance threatens the sustainability of our family farms. The lack of new herbicide modes of action along with the overuse of some herbicides has led to serious issues. Ryegrass and Palmer amaranth pose the greatest threats because of their competitive and genetic potentials. Herbicide resistant Palmer amaranth has cost Georgia's cotton industry well over \$1.2 billion and the pest continues to evolve. Palmer resistance to the PPO herbicides (common PPO herbicides include Blazer, Cobra, Flexstar, Goal, Reflex, and many more) is wide spread in the mid-south. Although we have not officially confirmed PPO resistance, we are greatly concerned of the potential "loss" of these herbicides. Figures 1, 2, & 3 show the response of a sensitive population (sensitive meaning it is responding like it should) of Palmer to Cobra, Blazer, or Reflex applied POST at very high rates compared to the response of Palmer from a problem GA field.



STEPS TO IMPROVE ON-TARGET AUXIN HERBICIDE APPLICATIONS

1. Avoid applications near sensitive crops (Fig 4/5).
2. Apply in winds between 3-10 mph; drift can still be large.
3. Land terrain & wind direction relative to the sprayer have huge impacts on drift.
4. Max boom height above canopy or pest is 24". Drift distances can be cut in half with a 24" boom height compared to one at 50".
5. Sprayer ground speed influences drift; stay under 10 mph. Absolutely no aerial applications!

Fig 4. Visual Sensitivity Scale for Dicamba

Lower	Moderate	Severe	Extreme
Broccoli Cabbages Collards Cabbage Kale Mustard Pecan Turnip	Cantaloupe Canola* Cucumber Peach Peanut Squash	Cotton Pepper Tomato Watermelon	Grapes* Lima Bean Southern Pea Snap Bean Soybean Sweet potato* Tobacco*
>1/75X	1/75-1/300X	1/300-1/800X	<1/800X

Herbicide Rate of Visually Detectable Injury

For relative comparison, tomato, squash, and watermelon response to Roundup for visual damage would be in the "lower" category.
*Data from literature; all other data generated in over 70 UGA field experiments.

Fig 5. Visual Sensitivity Scale For 2,4-D

Lower	Moderate	Severe	Extreme
Broccoli Cabbage Collards Cabbage Kale Mustard Onions Peach Peanut Pecan Turnip	Cantaloupe Canola Cucumber Soybean Squash	Pepper Tomato Watermelon	Cotton Grapes* Lima Bean Southern Pea Snap Bean Sweet potato* Tobacco*
>1/75X	1/75-1/300X	1/300-1/800X	<1/800X

Herbicide Rate of Visually Detectable Injury

For relative comparison, tomato, squash, and watermelon response to Roundup for visual damage would be in the "lower" category.
*Data from literature; all other data generated in over 70 UGA field experiments.

6. No application made with wind toward any residential area or sensitive crop. When no sensitive crop is downwind then buffers for 1X labeled dicamba rate is 110 ft and 1X labeled 2,4-D rate is 30 ft.
7. ALL APPLICATORS OF Engenia, Fexapan or XtendiMax must have a pesticide license.
8. DO NOT ADD AMS to any dicamba mixture.
9. Only apply labeled formulations and tank mixtures to reduce volatility/drift potential.

Review Web Sites for Approved Spray Tips, Adjuvants, Tank Mixtures, etc.

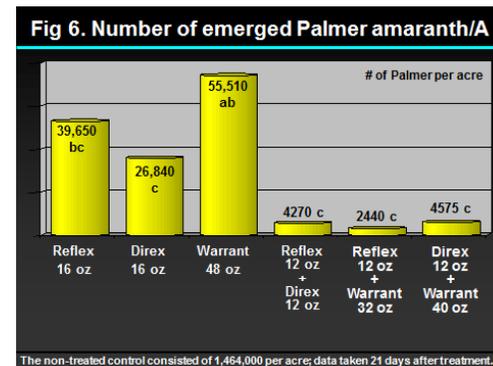
1. Enlist Duo or Enlist One: www.EnlistTankMix.com
2. Engenia: www.engeniatankmix.com
3. XtendiMax: www.xtendimaxapplicationrequirements.com

STEP 1: BURNDOWN: Palmer amaranth must not be emerged when planting, regardless of cotton cultivar planted.

Standard programs using Valor (before Palmer emergence), Direx, and Gramoxone + Direx are advised. Dicamba or 2,4-D would be beneficial for primrose, horseweed, and radish (2,4-D is much more effective on radish). All weeds and cover crops with the exception of cereal grains should be killed ≥ 10 d before planting. No plant back interval exists for XtendiMax or Engenia in XtendFlex cotton; other cultivars may be planted 30 d after 1” of rainfall. No plant back interval exists for Enlist Duo or Enlist One in Enlist cotton; other cultivars may be planted 30 d after application, and 0.5” of irrigation between application and planting is beneficial.

STEP 2: Preemergence (PRE) applications: Include 2 active ingredients for better control (Fig 6), less crop injury, and less herbicide resistance development.

PRE'S	HERBICIDE RATES ASSUME TIMELY SEQUENTIAL POST APPLICATIONS AND DIRECTED LAYBY
1) Brake + Reflex 2) Brake + Warrant 3) Direx + Warrant 4) Reflex + Direx 5) Reflex + Warrant	1) Brake contains fluridone; 1 pt/A is an effective rate in mix with other herbicides. Fluridone requires significant rain/irrigation to become fully active. 2) Warrant: For most soils, 32-40 oz/A is in order. Effective on most grasses, pigweeds and is <u>essential for spiderwort</u> . 3) Direx: For most soils the ideal rate is 10-20 oz/A; lower rates on sands or under intense irrigation. Avoid diuron PRE if it was applied within 14 d of planting as a burndown. 4) Reflex: For most soils, ideal rate is 10-12 oz/A when in these tank mixtures. Reflex mixtures are the most effective option for Palmer. <i>NOTE: Add paraquat if pigweed is emerged; a jar test is strongly advised if mixing with Brake.</i>



STEP 3: Sequential POST's are needed for many fields.

POST 1 ~15 d after PRE ¹	POST 2 ~ 15 d after POST 1 ¹	Comments/Critical Thinking Points
LIBERTY OR LIBERTY + ROUNDUP SYSTEMS²		
Liberty + Roundup + Dual Mag. or Warrant ^{3,4} or Liberty + Dual Mag or Warrant or Staple	Liberty + Dual Mag. or Warrant (No 3-way mix suggested late season)	¹ Day interval assumes PRE residual herbicides were ideally activated and applications are made on pigweed 3” or smaller; <u>if pigweed is larger this interval must be shortened.</u> ² Glytol LibertyLink, XtendFlex, or Enlist Cotton Cultivars. UGA data suggests tolerance to Liberty is as follows: Glytol LibertyLink > Enlist > XtendFlex>>>Widestrike. ³ Mixes of Liberty + Roundup + residual are the most effective option for weed control; however, more injury occurs with 3-way mixes. Leaf shed and 25% injury has been noted. ⁴ Mix may provide less grass control than Roundup but more control than Liberty alone, especially for goosegrass. Use full rate of Roundup. Base Liberty rate on pigweed size. ⁵ Warrant may be added and will improve weed control; however, more injury occurs with 3-way mixes. Leaf shed and 25% injury has been noted. Visit web sites (on front) for latest information on glyphosate to use, tank mixes, adjuvants, and drift reduction agents. ⁶ Warrant or Dual Mag may be added and will improve weed control; however, more injury occurs with 3-way mixes. Visit web sites (on front) for latest information on tank mixtures, adjuvants and drift reduction agents.
ENGENIA OR XTENDIMAX SYSTEMS – XTENDFLEX COTTON		
Engenia 12.8 oz/A or XtendiMax 22 oz/A + glyphosate ⁵	Engenia 12.8 oz/A or XtendiMax 22 oz/A + glyphosate	
ENLIST DUO OR ENLIST ONE SYSTEMS – ENLIST COTTON		
Enlist Duo 4.75 pt/A or Enlist One 2 pt/A + glyphosate ⁶ or Enlist One 2 pt/A + Liberty ⁶	Enlist Duo 4.75 pt/A or Enlist One 2 pt/A + glyphosate or Enlist One 2 pt/A + Liberty	

STEP 4: LAYBY OR HOODED SPRAYER IS ESSENTIAL FOR LONG-TERM SUSTAINABILITY

Direx + MSMA (best for pigweed) or Roundup + Direx (best for grasses and pigweeds) are great directed options; add Envoke to improve morningglory control!!!!!!!!!!!!