Investigation Into Post-Harvest Control of 2,4-D Tolerant Cotton

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INTRODUCTION

Stalk destruction following cotton harvest the Gulf Coast and Brazos Bottom regions of Texas is critical for the successful completion of the Boll Weevil Eradication Program. Chemical stalk destruction with herbicides such as 2,4-D is an efficient method of managing regrowth and preventing the production of hostable fruiting structures in which the boll weevil reproduces. The Enlist™ Weed Control System which will include cotton tolernt to a new form of 2,4-D is currently under development by Dow AgroSciences. The purpose of this research was to find chemical alternatives to 2,4-D for post-harvest cotton stalk destruction.

METHODS AND MATERIALS

Studies were conducted at two locations: Halfway, TX, and Galloway, AR. Cotton was seeded at 3-4 seed per foot, planted at normal planting time for the two locations and managed using typical cultural practices during the period between planting and until the stalk destruction study was initiated. Plot size was 2 rows by 20-30 feet long.

Both locations were planted to cotton transformed to express the *aad-12* transgene which enables 2,4-D tolerance and is currently under development by Dow AgroSciences as Enlist™ cotton.

To maximize regrowth potential, both sites were shredded to a height of 4-6 inches using a stalk shredder or rotary mower 30-45 days prior to normal harvest time . Herbicide applications were made approximately 2 hours after stalk shredding. Applications were made using a backpack CO_2 pressurized sprayer, calibrated to deliver 10-15 GPA using flat fan nozzles. Assessment of percent plant regrowth was made approximately 3, 4, 6, and 7 weeks after application at both locations. At the latest observation, plots were assessed for percent incidence of square development (fruiting structures). Due to an unexpected frost/freeze which subsequently killed the cotton, the incidence of fruiting structures was not obtained at the Halfway location.

Herbicides evaluated and treatment list are presented in Tables 1 & 2. All treatments included methylated seed oil (MSO) at 1 qt/A as an adjuvant except in the three treatments where basal oil was substituted at a rate of 40 fl oz/A. Due to application issues with the 2,4-D applications at the Halfway location, those data are not included. Due to site to site variability, data was summarized by location. Data are presented in box plot diagrams, which is explained in Figure 1.

Table 1. Information on the chemicals used in the studies.

Trade Name	Active Ingredient	Formulation Concentration	Manufacturer
DMA 4 IVM	2,4-D amine	3.8 lb ae/gal	Dow AgroSciences, LLC
MCPP-p 4 Amine	mecoprop-p amine	1.9 lb ae/gal	Nufarm Americas Inc.
--	2,4-DP-p (dichlorprop-p amine)	4.28 lb ae/gal	Nufarm Americas Inc.
Clarity	dicamba diglycolamine salt	4 lb ae/gal	BASF Corporation
Distinct	dicamba + diflufenzopyr	50% + 20% w /w	BASF Corporation
Super Brush Killer	2,4-D ester + 2,4-DP-p ester + dicamba	1.89 + 0.94 + 0.47 lb ae/gal	PBI / Gordon Corporation
Weedmaster	dicamba + 2,4-D amine	2.87 + 1.0 lb ae/gal	Nufarm Americas Inc.
Aqumix T&G Basal Oil*	aliphatic hydrocarbon oils	--	Aqumix, Inc
MSO	methylated seed oil	--	several

*AQUMIX T&G Basal Oil is a low viscosity non-aromatic/noncarcinogenic diluent with selected emulsifiers. AQUMIX T&G Basl Oil is designed for basal-bark and cut-surface brush control applications utilizing 15-20%Garlon 4 in combination with 5%Tordon Kherbicide.

Table 2. Treatments evaluated in stalk destruct studies.

Treatment	Rate (lbs ae/A)	Rate (amt pr/A)
Untreated	--	--
2,4-D Amine + MSO*	0.5	16.8 fl oz
2,4-D Amine + MSO	1	33.7 fl oz
MCPP + MSO	0.5	33.7 fl oz
MCPP + basal oil (BO)*	0.5	33.7 fl oz
MCPP + MSO	1	67.4 fl oz
2,4-DP + MSO	0.5	15 fl oz
2,4-DP + basal oil (BO)	0.5	15 fl oz
2,4-DP + MSO	1	30 fl oz
Clarity + MSO	0.25	8 fl oz
Clarity + basal oil (BO)	0.25	8 fl oz
Clarity + MSO	0.375	12 fl oz
Clarity + MSO	0.5	16 fl oz
Distinct + MSO	0.175	0.25 lbs
Distinct + MSO	0.35	0.5 lbs
Superbrush Killer + MSO	0.825	32 fl oz
Superbrush Killer + MSO	1.65	64 fl oz
Superbrush Killer + MSO	2.48	96 fl oz
Weedmaster + MSO	0.974	32 fl oz
Weedmaster + MSO	1.95	64 fl oz

** MSO (methylated seed oil) rate was 1 qt/A; basal oil (BO) rate was 40 fl oz/A.*

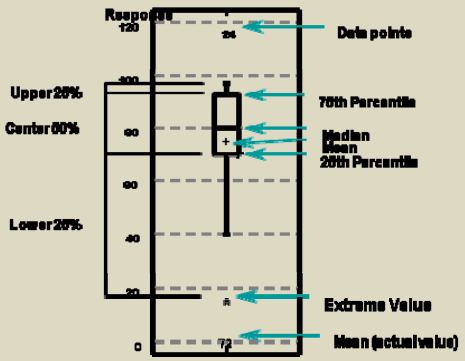
RESULTS

Halfway, TX Location (Figure 3)
Results at the Halfway location were highly variable, due to windy conditions at application causing poor coverage. However, trends were similar to the results from the Galloway location. Treatments which limited cotton regrowth to less than 10% of the untreated through 49 DAA were 2,4-DP (1.0 lbs ae/A), Distinct (0.35 lbs ae/A), Superbrush Killer (2.48 lbs ae/A), and Weedmaster (1.95 lbs ae/A). Use of a basal oil with MCPP, 2,4-DP, and Clarity did improve efficacy by 10-20% compared to the use of MSO.

Galloway, AR Location (Figures 4 & 5)
As expected, cotton regrowth and square development were similar for both rates of 2,4-D and the untreated because 2,4-D tolerant cotton was utilized. Treatments which limited cotton regrowth to less than 10% of the untreated through 50 DAA at both locations were 2,4-DP (1.0 lbs ae/A), Clarity (0.375-0.5 lbs ae/A), Distinct (0.175-0.35 lbs ae/A), Superbrush Killer (0.825-2.48 lbs ae/A), and Weedmaster (0.974-1.95 lbs ae/A). Clarity (0.5 lbs ae/A), Superbrush Killer (1.65 & 2.48 lbs ae/A), and Weedmaster (0.974 & 1.95 lbs ae/A) provided complete kill (no regrowth) of the cotton. Use of basal oil improved the efficacy of MCPP, but no significant efficacy improvement was seen with 2,4-DP or Clarity.

Development of fruiting structures (squares) was greatly reduced by all treatments except 2,4-D. In the untreated plots, 100% of the plants produced squares by 50 DAA. Treatments which completely eliminated the development of fruiting squares were 2,4-DP (1.0 lb ae/A), Clarity (0.25 & 0.5 lbs ae/A), Distinct (0.35 lbs ae/A), Superbrush Killer (1.65 & 2.48 lbs ae/A), and Weedmaster (0974 & 1.95 lbs ae/A).

Figure 1. Explanation of box plot analysis



CONCLUSIONS

Promising alternatives to 2,4-D for destruction of post-harvest 2,4-D tolerant cotton stalks are treatments including:

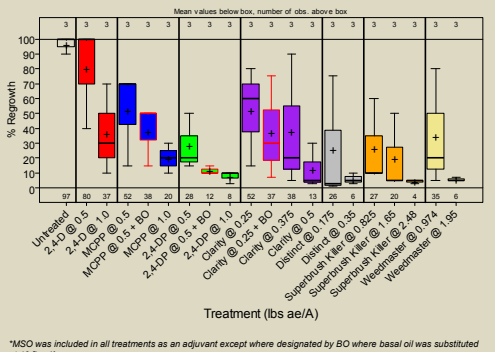
- Dicamba (≥0.5 lbs ae/A)
- 2,4-DP (≥1.0 lb ae/A)
- Distinct (≥0.35 lb ae/A)
- Dicamba + 2,4-DP at approximately 1:2 ratio (Superbrush Killer)

FUTURE RESEARCH

Additional research should include:

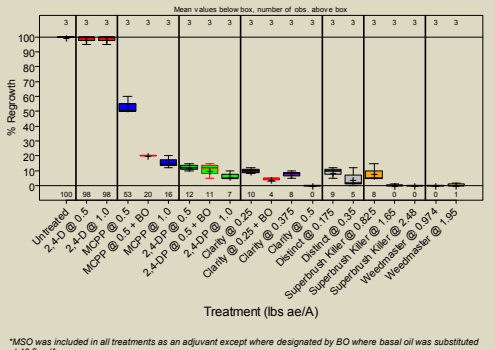
- Sequential applications (2,4-DP, dicamba, MCPP) to control secondary regrowth and any emergence of volunteer plants;
- Evaluating higher rates (>1.0 lb ae/A) of 2,4-DP, MCPP;
- Exploring tank mixtures or premixtures of dicamba + 2,4-DP (i.e., Superbrush Killer) or dicamba + MCPP;
- Investigating alternative adjuvant systems to improve uptake through woody cotton stems.

Figure 2. Post-Harvest Cotton Stalk Destruction - Enlist(TM) Cotton
Regrowth (49 DAA) - Halfway, TX



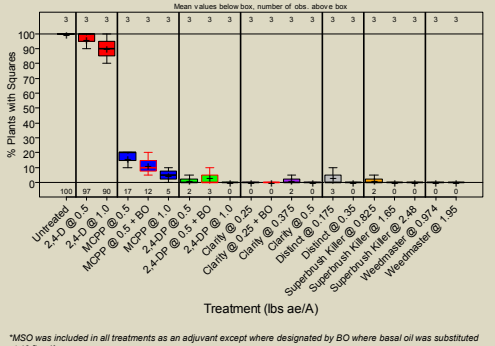
*MSO was included in all treatments as an adjuvant except where designated by BO where basal oil was substituted at 40 fl oz/A.

Figure 3. Post-Harvest Cotton Stalk Destruction - Enlist(TM) Cotton
Regrowth (50 DAA) - Galloway, AR



*MSO was included in all treatments as an adjuvant except where designated by BO where basal oil was substituted at 40 fl oz/A.

Figure 4. Post-Harvest Cotton Stalk Destruction - Enlist(TM) Cotton
Regrowth (50 DAA) - Galloway, AR



*MSO was included in all treatments as an adjuvant except where designated by BO where basal oil was substituted at 40 fl oz/A.

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