TILLAGE, ROTATION AND HERBICIDE INPUT IMPACT WEED CONTROL IN XTENDFLEX COTTON

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Abstract

Field research was conducted during 2019 and 2020 in irrigated (College Station) and dryland locations (Thrall and Corpus Christi) in Texas to determine the influence of tillage, crop rotation and dicamba-based herbicide programs on weed control in XtendFlex cotton. Herbicide programs include a non-treated check, weed free check, Low input program with EPOST and LPOST applications, and a High input program with PRE, and MPOST applications. Experiments were arranged as a split-split plot design with the cover crop, strip till and conventional till as main plots, and cotton-cotton and cotton-sorghum rotations as sub plots in each tillage. Four levels of the herbicide program represented sub-sub plots. Based on data in hand from College Station and Thrall, a significant four-way interaction was observed at 14 DA PRE timing for Palmer amaranth control between location, year, tillage and crop rotation. In 2019, at both locations, more than 90% control was observed in both cotton-cotton and cotton-sorghum rotation plots across all tillage practices. At College Station, conventional till provided the highest control of Palmer at more than 97% during both. In 2020 at College Station, strip till provided 26% and 52% control in cotton-cotton and cotton-sorghum rotation treatments respectively. At Thrall, cover cropping gave more than 98% control of Palmer both years, while in 2020, strip till provided 89% and 85% control in continuous and rotation plots respectively. Tillage and herbicide program influenced the emergence of Palmer during 2020. Application of residual herbicide PRE reduced the emergence of Palmer by more than 50% compared to the low input program in all the tillage practices at both the locations. Palmer emergence was 0 until two months after planting in both low and high input treatments of conventional tillage at Thrall whereas high input treatments in cover cropping showed the greatest effect on emergence of Palmer at College Station.

Introduction

Herbicide resistant Palmer amaranth (AMAPA) is causing severe economic damage to US cotton production systems. Dicamba has shown promise to effective management of glyphosate resistant (GR) Palmer amaranth in XtendFlex (dicamba resistant) cotton. Previous research shows In-season residual herbicides provide season long control of GR Palmer amaranth (Wiggins et al., 2016). Non-chemical weed management tactics like tillage type can influence the germination of small seeded broad leaf weeds (Ruisi, Frangipane et al., 2015) and Crop rotation facilitates the use of different modes of action, thereby reducing the selection pressure (Hume et al., 1991). However, there are no long-term studies conducted over multiple locations integrating residual herbicides, cover crops, tillage types and crop rotation and testing their efficacy on AMAPA control. Therefore, field trials were conducted during 2019 and 2020 to determine the efficacy of High Input herbicide program (HI) with residual herbicides against Low Input herbicide program (LI) without residual herbicides in no till-cover crop, Strip till and Conventional till practices under cotton-cotton and cotton-sorghum rotation schedules on AMAPA control. Objectives of this study include 1. To test the efficacy of herbicide programs for AMAPA control in no till-cover cropping, strip till and conventional till practices, under cotton-cotton vs cotton-sorghum cropping schedules. 2. To test the influence of the above treatments on AMAPA densities during the cropping season.

Methods

Research locations where the study was conducted were Extension linear Farm, College Station, TX (Irrigated, Belk Clay, 8.1 pH), Stiles Farm and Thrall, TX. (Dryland, Branyon Clay, 6.1 pH). Cotton variety DP1646B2XF was planted at 112,500 plants/ha and Grain Sorghum variety DK57-07 was planted at 175,000 plants/ha rates on flat ground. Experimental Design used was An RCBD Split-split plot design with 4 replications where No till-cover crop, one pass of Strip till and conventional till were the main plots, Cotton-cotton & cotton-sorghum rotation schedules were the sub-plots and 4 herbicide programs (table 1) including a weedy check within each rotation schedule were sub-sub-plots. Treatments applied with a backpack CO2 8 nozzle sprayer delivering 140 L/ha at 234 kPa walking at 4.8 KPH. Winter wheat varieties 'Expresso' and 'Trigger' were used in cover cropping during 2019 and 2020 respectively at both the locations and were planted at 100 kg/ha under irrigated conditions, 65 kg/ha under dryland conditions. Percent weed control data for 2019 and 2020, Cover crop biomass and germination/density during 2020 were collected and analyzed using Proc GLIMMIX in SAS (Version 9.4, SAS Institute, Cary, NC). Means were separated using Tukey's HSD at alpha = 0.05. Graphs with different letters indicate means are significantly different at alpha = 0.05

Table 1: Application timings and herbicide programs in Cotton-cotton vs Cotton-Sorghum cropping schedules. LPOST and Layby applications were added to the list during 2020 in HI and LI.

Application timing	**Low input program (LI)**		**High input program (HI)**		**Weed Free Check**	
Pre emergence (PRE)	-	-	Cotoran	Outlook	Dual II Magnum	Huskie
Early Post emergence (EPOST)	Xtendimax + Roundup Powermax	Atrazine	-	-	-	-
Mid Post emergence (MPOST)	-	-	Xtendimax + Roundup Powermax + Warrant	Atrazine + Huskie	Roundup Powermax + Dual II Magnum	Atrazine+ Huskie
Late Post emergence (LPOST)	Xtendimax + Roundup Powermax	-	-	-	-	-
Early Layby	-	-	Direx	-	Roundup Powermax + Dual II Magnum	Atrazine+ Huskie

Table 2: Herbicides, active ingredients and the rates at which they are applied in each herbicide program in the study

Herbicide	Active Ingredient	Rate applied (gm ae / a.i/ha)
XTENDIMAX W/ VAPORGRIP	Dicamba	560
ROUNDUP POWERMAX	Glyphosate	1260
COTORAN	Fluometuron	1120
WARRANT	Acetochlor	1260
DIREX	Diuron	1120
HUSKIE	Bromoxynil	245
AATREX	Atrazine	1120
OUTLOOK	Dimethanide-P	840
DUAL II MAGNUM	S-metalochlor	1425

Results

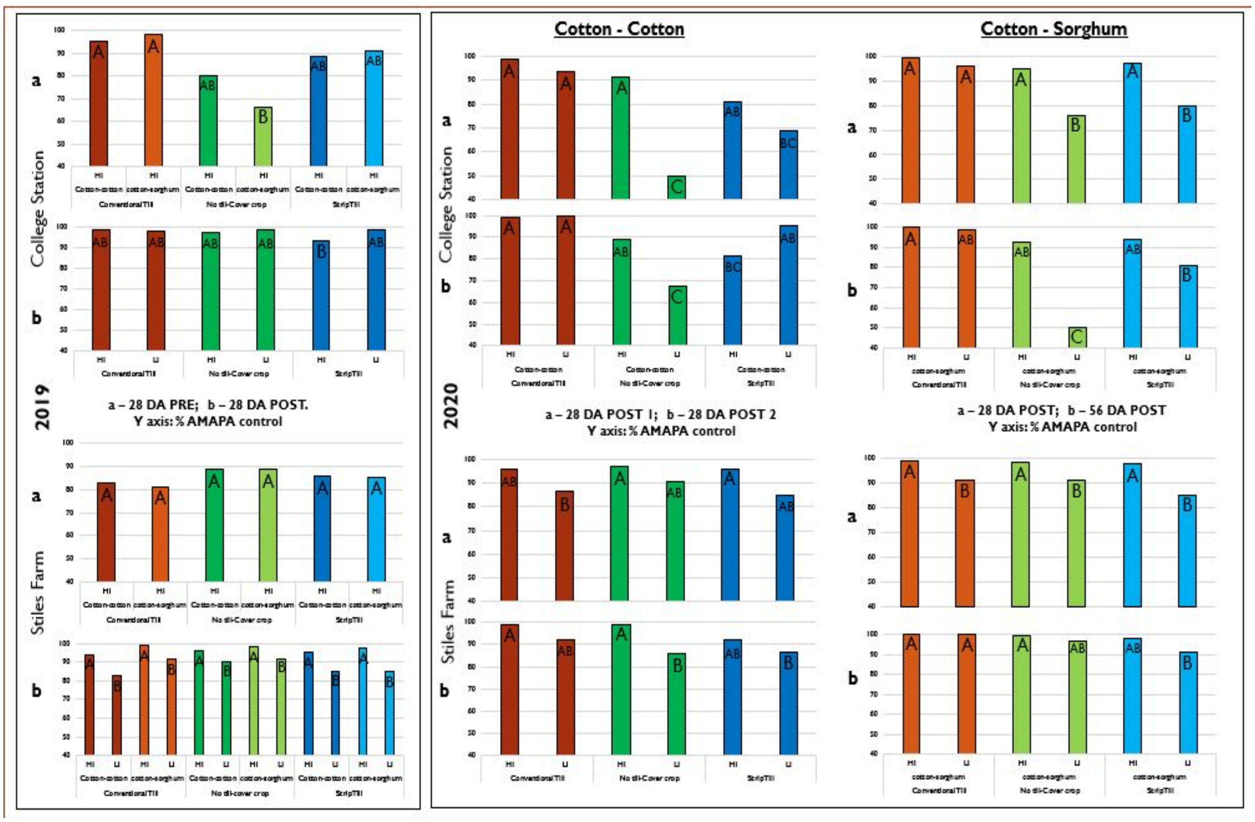
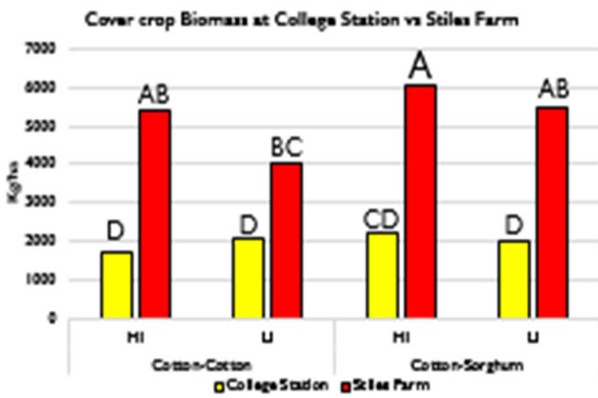


Figure 1: Efficacy of HI and LI under continuous cotton and crop rotation schedules in cover cropping, strip till and conventional tillage on Percent AMAPA control.



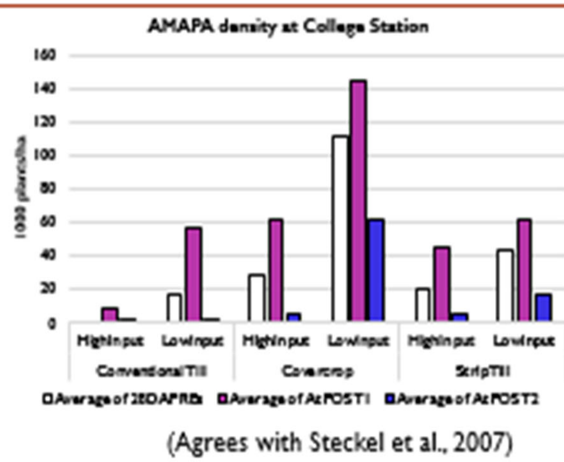


Figure 2: Cover crop biomass in HI and LI at College Station and Stiles Farm during 2020
Figure 3: Impact of herbicide programs and tillage on AMAPA density at different timings during the growing season in 2020 at College Station.

Conclusions

High input herbicide program in both no till-cover crop, conventional tillage provided the best season long AMAPA control during 2019. Reduction in the performance of no till-cover crop at College Station during 2020 can be attributed to decrease in the cover crop biomass content compared to Stiles Farm. High input program with residual herbicides at all tillage levels provided the best season long weed control during 2019 and 2020 at both the locations. AMAPA densities over time were influenced by tillage levels with high input herbicide program with residual herbicides reducing the germination/density at different timings by more than 50%.

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