ECONOMICS OF XTENDFLEX COTTON BY TILLAGE, ROTATION, AND HERBICIDE INPUT

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Abstract

Field trials were conducted during 2019 and 2020 in irrigated (College Station) and dryland (Thrall and Corpus Christi) locations in Texas to determine the influence of tillage, crop rotation and herbicide programs on weed management economics. Experiments were arranged as split-split plot design with the cover crop, strip till and conventional till as main plots, with cotton-cotton and cotton-sorghum rotations as sub plots in each tillage. Four levels of herbicide programs represented sub-sub plots. Seed cotton and grain sorghum yields, cotton fiber quality characteristics, and net revenue over two years were combined with relevant cost differences to compare net returns in partial budget context. Based on the data in hand, there was a significant three way interaction between tillage, location and year for yield. In 2019, cover crop produced statistically significant seed cotton yield increases at College Station (CS) (cotton-cotton: 1093-4335 kg/ha; cotton-sorghum: 986-5673 kg/ha) and Thrall (cotton-cotton: 959-1736 kg/ha; cotton-sorghum: 991-1816 kg/ha). In 2020, conventional tillage produced statistically significant yield increases in both continuous cotton (11-2480 kg/ha at CS; up to 1068 kg/ha at Thrall) and cotton-sorghum rotation (732-964 kg/ha at CS; 1815-1950 kg/ha at Thrall). In 2020, tillage also influenced the maturity of cotton at CS with conventional tillage maturing earliest at 140 DAP, strip and cover crop maturing latest at 158 DAP. Net returns incorporating fiber characteristics and cost differences will be included to compare treatments from a partial budgeting and risk efficiency standpoint.

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 comparison of yield, gross returns, and weed control costs were developed into risk simulations to compare cumulative distribution functions (CDFs) of partial net returns. Graphical comparisons of these CDFs provide guidance on the adoption potential of these weed control options by risk averse growers.

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-subplots. 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. Treatment costs include herbicide chemical costs, spray application costs, tillage costs, cotton and sorghum seed costs, and trait-technology costs. Location specific-individual field operations costs were estimated using the 2019 and 2020 Custom Rates Survey. Cotton gross returns were calculated as treatment yield times seasonal based price, adjusted for fiber quality premiums/discounts. Partial net return ($ per acre) = gross return per acre less all the chemical cost and treatment-specific field operations costs. CDFs of partial net returns were developed after simulating treatment yields.

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 and Conclusions

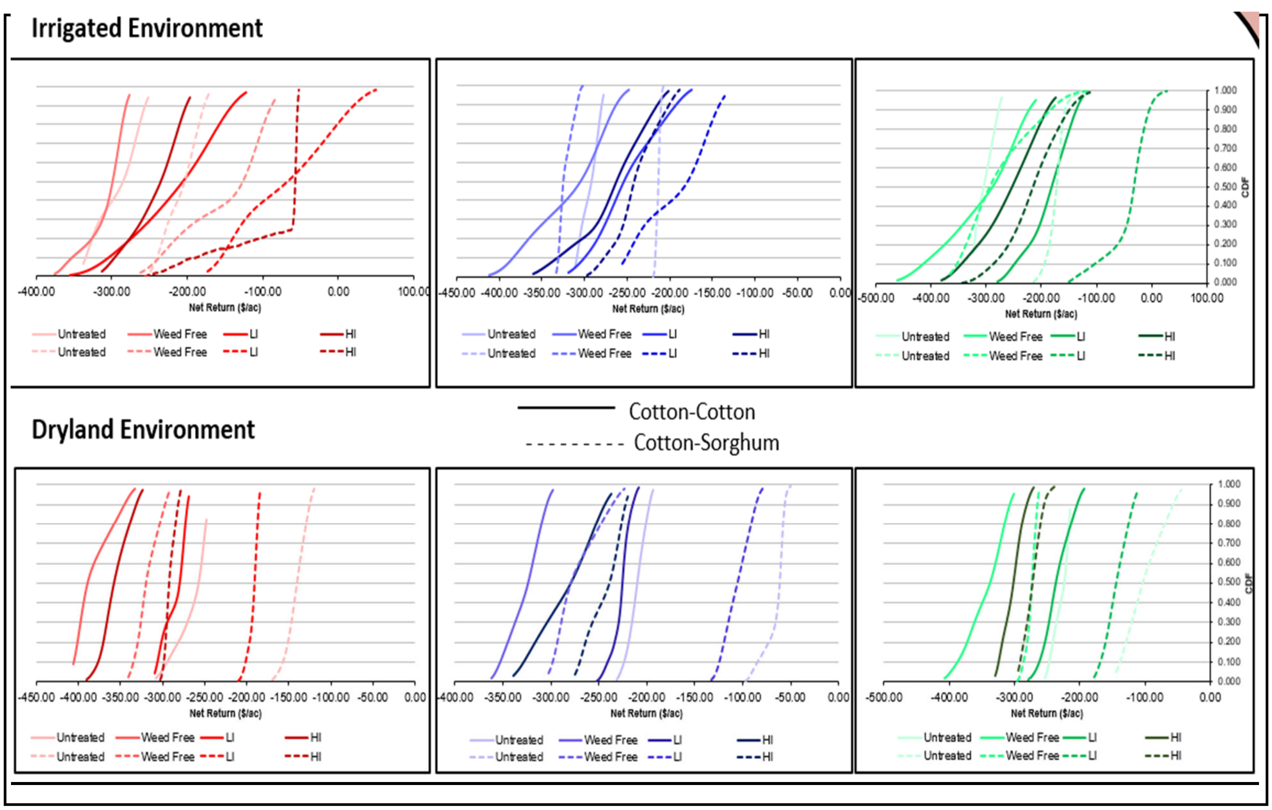

Figure 1: Graphs show cumulative density functions (CDFs) of partial net returns in Cover crop, Strip till and Conventional till. The CDFs reflect the probability (vertical axis) that partial net returns are below a given level (horizontal axis).

Economic performance of weed control options differed between environments. In the Irrigated environment, Cover crop tended to dominate Strip and Conventional till due to availability of soil moisture. Dominance of herbicide systems was LI > HI > Weed Free > Untreated. In the Dryland environment, Cover crop was dominated by Strip and Conventional till; rotation dominated continuous cotton; Dominance of herbicide systems was Untreated > LI > HI > Weed Free. Cover crop probably competed with main crop for soil moisture; thus, inadequate precipitation during the growing season hindered the performance of cover cropping over strip till and conventional till in dryland areas. Similarly, the poor relative performance of HI & Weed free herbicide programs in dryland areas can be attributed to inconsistent precipitation. Crop rotation plots did well irrespective of environment.

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