ESTIMATING THE NET RETURNS OF MANAGING PIGWEED IN COTTON

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Abstract

The use of a winter cover crop in cotton production is an important part of a conservation tillage system, along with a cost effective weed management program. A study was established in the fall of 2007 to determine the effect of management practices and herbicide treatments on the net returns in the two different locations in Alabama. The experiment included horizontal strips consisting of four conservation-tillage treatments with differing cover crop planting dates, a conservation tillage/winter fallow treatment, and a conventional tillage treatment with no cover crop. There were four herbicide regimes: 1) a broadcast preemergence (PRE) herbicide followed by a postemergence (POST) followed by a LAYBY application, 2) a banded PRE application followed by a POST application followed by a LAYBY application, 3) a POST herbicide followed by a LAYBY application, and 4) a LAYBY application. Net returns were lower for the LAYBY only herbicide treatment and were generally highest for the POST and LAYBY herbicide treatment. The use of conservation tillage with a early planted winter cover crop had higher net returns than the conventional tillage system in two of the three years. The addition of PRE and POST applications of herbicides significantly increased the net returns ($P \leq 0.05$) as compared to a LAYBY treatment alone.

Introduction

In 2007, approximately 3.8 million acres were planted to herbicide resistant cotton and 0.75 million acres were planted to insect and herbicide resistant cotton (ERS, 2010). With the use of weed management practices, there is the potential for weed shifts that can be of economic concern (Culpepper, 2006). Glyphosate resistant Palmer amaranth (*Amaranthus palmerii*) is one such example that has been identified in Alabama, Arkansas, Georgia, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, and Tennessee. We hypothesize that the use of cover crops, as part of a conservation tillage system, and soil applied herbicides will provide higher net returns in fields with Palmer amaranth. Therefore, the objective of this work was to determine the effect of management practices and herbicide treatments to control pigweed on net returns in a continuous cotton rotation.

Materials and Methods

Field experiments were established at the E.V. Smith Research and Extension Center (EVS) located near Shorter, AL and at the Tennessee Valley Research and Extension Center (TV) near Bella Mina, AL in the 2007, 2008, and 2009. The experiment involved five tillage and conservation cover regimes. Parallel strips consisted of conservation tillage with a cereal rye cover crop planted 4 weeks prior to the date of the historical average first frost (PD1); conservation tillage with a cereal rye cover crop planted 2 weeks prior to the date of the historical average first frost (PD2), and conservation tillage with a cereal rye cover crop planted on the date of the historical average first frost (PD3). The fourth conservation tillage treatment was conservation tillage with no cover crop (WF). The final tillage treatment was conventional tillage with no cover crop (CT). There were four herbicide regimes: 1) a broadcast PRE herbicide followed by a POST followed by a LAYBY application (H1), 2) a banded PRE herbicide followed by a POST followed by a LAYBY application (H2), 3) a POST followed by a LAYBY application (H3), and 4) a LAYBY application (H4). In the spring, the rye cover crop, as well as weeds in the winter fallow treatment, was terminated using glyphosate and flattened prior to cotton seeding with a mechanical roller-crimper to form a dense residue mat on the soil surface.

A partial budgeting approach was used to calculate the net returns of each treatment. Table 1 outlines the production costs for the tillage/cover crop treatment and herbicide treatments and other production costs. Net returns were equal to the revenue from cotton production, both from lint and seed, minus the costs associated with tillage, cover crop establishment/termination, planting, herbicide application, and processing costs. Production costs not associated with tillage, the cover crop, the herbicide treatments, or production costs that vary with yield were not included in the analysis. To calculate revenue, the price of cotton lint ($1.41 kg^{-1}; NASS, 2009) was multiplied by the percentage list turnout (0.40) times the cotton yield plus the price of cottonseed ($0.14 kg^{-1}; NASS, 2009) times the pounds of cottonseed per pound of cotton lint (1.60). All prices and production costs used in the analysis were from 2009 to control for variability caused by changing market conditions (MSU, 2010; UGA, 2010). Data were analyzed separately due to significant year by location effects. Due to space limitations, the results from Tennessee Valley have been omitted.

Table 1. Production costs for tillage/cover crop treatments and herbicide treatments, and other production costs at EVS (MSU, 2010; UGA, 2010).

Tillage/Cover Crop Treatments			
	Production Costs ($/ha)		Operations
	EVS	TV	
CT	$37.73	$37.73	Heavy disk (x2), Field cultivator, Planter
P1, P2, P3	$182.59	$170.80	Rye cover crop establishment and termination, Subsoiler (EVS only), No-till planter
WF	$57.01	$45.22	Subsoiler (EVS only), nt planter
Herbicide Treatments			
	Production Costs ($/ha)		Operations
1	$131.68		PRE (broadcast), POST, LAYBY
2	$131.68		PRE (banded), POST, LAYBY
3	$95.06		POST, LAYBY
4	$46.04		LAYBY
Other Production Costs			
Ginning	$0.17 per kg of cotton lint		
Storage	$10.50 per cotton bale		
Promotion	$5.77 per cotton bale		

Results and Discussion

The tillage/cover crop management systems had a significant impact on net returns in 2007 and 2008. As shown in Figure 1, net returns decreased with the middle and low cover crop planting dates (P2 and P3), winter fallow treatment (WF) and conventional tillage (CT) in 2007. The net returns to P1 were 44.25% and 18% greater than the net returns to CT in 2007 and 2008 respectively. There was no statistical difference between net returns in 2009; however, net returns were the highest for CT. This may have been due to differing weather conditions in 2009, as compared to 2007 and 2008.

In 2007 and 2008, even though CT had the lowest tillage/cover crop production costs, the yield increase from CT to P1 was large enough to more than cover the 144.86 $ ha^{-1} increase in production costs associated with the rye cover crop establishment and termination. In 2008, net returns for PD2 and PD3 were similar to net returns for CT, further demonstrating that the yield increase from the use of a winter cover crop covers the additional production costs. There was no significant interaction ($P \leq 0.05$) between the tillage/cover crop regimes and the herbicide treatments.

In 2007, 2008, and 2009, net returns were lowest for herbicide treatment 4 (Figure 2). Herbicide treatment 3 had the highest net returns; however, in 2007 and 2009, net returns for herbicide treatments 1, 2, and 3 were not significantly different from each other at $P \leq 0.05$. In 2008, the net returns for herbicide treatment 3 were significantly greater than herbicide treatments 1 and 2 at $P \leq 0.05$. Net returns were not significantly different between a broadcast PRE herbicide (1) and banded PRE herbicide application (2) in any year. This follows the results for seed cotton yields (not shown). The production costs were similar between the two treatments, and the difference between the average seed cotton yields was less than 150 kg ha^{-1} (not shown).

Figure 1. Net Returns in \$ ha^{-1} by tillage/cover crop regime by year at EVS. Different letters denote statistical significance between treatments in a given year ($P \leq 0.05$). PD1 is conservation tillage with a cereal rye cover crop planted 4 weeks prior to the date of the historical average first frost. PD2 is conservation tillage with a cereal rye cover crop planted 2 weeks prior to the date of the historical average first frost. PD3 is conservation tillage with a cereal rye cover crop planted on the date of the historical average first frost. WF is conservation tillage with no cover crop. CT is conventional tillage with no cover crop.

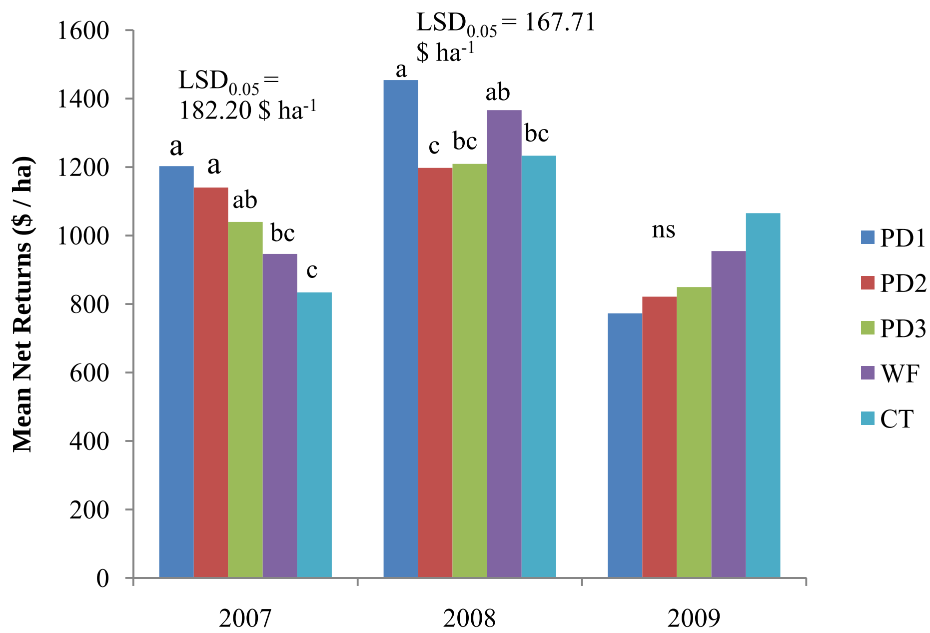
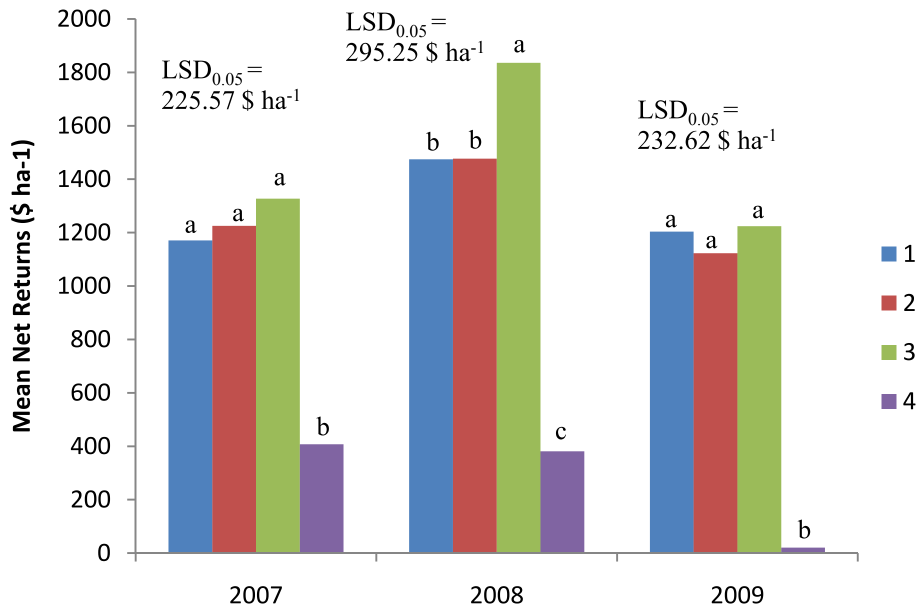


Figure 2. Net Returns in \$ ha^{-1} by herbicide treatment by year at EVS. Different letters denote statistical significance between treatments in a given year ($P \leq 0.05$). Herbicide treatment 1 is a broadcast PRE herbicide followed by a POST herbicide followed by a LAYBY application. Herbicide treatment 2 is a banded PRE herbicide followed by a POST herbicide followed by a LAYBY application. Herbicide treatment 3 is a POST herbicide followed by a LAYBY application. Herbicide treatment 4 is a LAYBY application.



Summary

A PRE and POST herbicide application along with a LAYBY application significantly increased net returns as compared to a single LAYBY application. A POST herbicide followed by a LAYBY application performed as well as or better than a PRE and POST herbicide followed by a LAYBY application in all three years. However, when considering a herbicide resistant weed management program, it may be likely that a highly intensive herbicide system would be beneficial. Lastly, the use of a cover crop along with a conservation tillage system provided the highest net returns in 2007 and 2008.

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