TITLE: Weed control as affected by pendimethalin timing and method of application in conservation tillage cotton (*Gossypium hirsutum* L.)

DISCIPLINE: Weed Science

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ABBREVIATIONS: WAP (weeks after planting) WBP (weeks before planting), AP (at planting)

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ABSTRACT

Field studies were conducted to evaluate weed control with pendimethalin preemergence applied in conservation tillage cotton. Pendimethalin was applied at eight weeks before planting (8 WBP) as an aqueous solution (sprayed), or as either an aqueous solution or impregnated on fertilizer at four weeks before planting (4 WBP) or at planting (AP). Texas panicum and Florida pusley control were similar when pendimethalin was impregnated on fertilizer as compared to pendimethalin spray applied at 4 WBP or AP. Florida pusley and Texas panicum control were variable when pendimethalin was applied 4 WBP and 8 WBP, regardless of method of application. Pendimethalin impregnated on fertilizer and applied either 4 WBP or AP did not negatively affect weed control. Maximum and similar Texas panicum and Florida pusley control four weeks after planting occurred with a split application of pendimethalin at 4 WBP followed by the same treatment AP, or when pendimethalin was impregnated on fertilizer and applied 4 WBP followed by pendimethalin spray applied AP.

INTRODUCTION

Cotton production in the southeastern United States may exceed 831,000 hectares each year with an estimated annual farm gate value of greater than $700 million (NASS 2006). While cotton production since 2000 has remained relatively constant in this region, the use of cotton that incorporates biotechnology into the production scheme has continued to increase. Since commercial introduction in 1997, glyphosate-tolerant cotton has readily been accepted by growers across the southeast with greater than 89% planted to these cultivars in 2005 (USDA-AMS 2006). The technology has allowed growers to reduce or eliminate soil-applied herbicides and to abandon cultivation and make the transition to conservation tillage, which promotes soil conservation and compliance with government regulation.

With the elimination of cultivation as a control tactic in conservation tillage systems, herbicides are now the primary and often only method used for weed control. When glyphosate-tolerant varieties were first introduced, glyphosate was applied two to four times on most fields and may have been the only herbicide used (Culpepper et al. 2004). In Georgia, 93% of the cotton hectares received at least one glyphosate application in 2005 (NASS 2006).

Pendimethalin is applied preemergence (PRE) or preplant incorporated to approximately 30% of Georgia cotton (NASS 2006) for control of grasses and small-seeded dicot weed species (Byrd and York 1987). This makes it more conducive for conservation tillage crop production, which continues to increase in the southeastern United States (Johnson et al. 2001).

An alternative method to applying pendimethalin and other herbicides is to impregnate the active ingredient on fertilizer prior to application. The effectiveness of pendimethalin impregnated onto fertilizer for weed control in conservation tillage cotton has not been investigated. Comparisons of pendimethalin EC to ME in strip-tillage cotton have not been evaluated. Therefore, studies were conducted in conservation tillage cotton to evaluate control

of Texas panicum and Florida pusley with pendimethalin applied as either a spray application or when impregnated onto fertilizer.

EXPERIMENTAL PROCEDURE

Field trials were conducted for three years from 2004 to 2006 at the University of Georgia Ponder Research Station near Ty Ty, Georgia. Soil was Tifton loamy sand (fine-loamy, kaolinitic, thermic Plinthic Kandiudults) with 83% sand, 12% silt, 5% clay, organic matter content of 1 to 1.8%, and pH of 5.6 to 6.1. Soft red winter wheat (68 kg/ha) cover was established by no-tillage drilling into peanut stubble the autumn prior to experiment establishment. The cover crop and winter annual weeds were destroyed using glyphosate at 0.84 kg ae/ha at 4 WBP to wheat at Feekes stage 5 to 6. On the day of planting, land preparation was performed using a strip-till implement. Delta and Pineland 555 BG/RR were planted in 2004 and 2005 and Delta and Pineland Flex 445 BG/RR in 2006 using a planter set to deliver 14 seed per meter of row.

Treatments included pendimethalin EC at 1.1 and 1.7 kg ai/ha impregnated on fertilizer (10-10-10) that was applied at rates of 280 or 560 kg/ha and applied at 4 WBP or AP. Preemergence herbicide treatments included pendimethalin EC at 1.1 and 1.7 kg/ha spray applied eight weeks before planting (8 WBP) to wheat at Feekes stages 3 to 4, four weeks before planting (4 WBP), and at planting (AP). In 2005 and 2006 additional treatments were split applications that consisted of pendimethalin EC at 0.84 kg/ha spray applied at 4 WBP followed by the same treatment AP, or pendimethalin at 0.84 kg/ha impregnated on 280 or 560 kg/ha fertilizer 4 WBP followed by pendimethalin at 0.84 kg/ha sprayed in 140 L/ha AP. A non-treated control was included for comparison.

All herbicide spray treatments were made with a backpack sprayer. Fertilizers were applied with a tractor mounted fertilizer drop spreader. All plots were four rows wide by 9 m long, with rows spaced 0.9 meters apart. Planting occurred during the first week of May each year. Supplemental overhead sprinkler irrigation was applied as needed. All four rows of each plot were harvested with a spindle picker and seed cotton yield quantified.

Weed control ratings were evaluated at one and four WAP each year using a scale of 0 (no control) to 100 % (complete control). The experimental design was a randomized complete block with four replications. Data were subjected to analysis of variance and tested for year by treatment interactions. Non-treated controls for weed control ratings were not included in the statistical analyses to improve homogeneity. Treatment means were separated by Fisher's Protected LSD Test at $P \leq 0.05$.

RESULTS AND DISCUSSION

Data for 2005 and 2006 were combined for analysis. As there were 17 treatments in 2004 and 20 treatments in 2005 and 2006, all data for 2004 were analyzed separately. Analysis indicated significant year-by-treatment interactions for Texas panicum control and therefore, data for this variable was analyzed and presented by individual experiments. For 2005 and 2006, analysis indicated no significant year-by-treatment interactions for Florida pusley control. Thus, data were combined for presentation for this variable across experiments.

Texas panicum control: Texas panicum control in 2004 was similar for all AP treatments (76 to 87%) regardless of the method of application. In contrast, control was less, although not always significantly different, for the 4 WBP treatments in 2004 (59 to 71%). The 8 WBP treatments (74 to 83%) were similar to the AP treatments in 2004. Texas panicum control for 2005 and 2006 for the 8 WBP spray applications was not very effective (49 to 65%), indicating

that this may not be the most effective treatment timing for Texas panicum control with pendimethalin in a conservation tillage cotton program. The 4 WBP treatments sprayed or impregnated on fertilizer were similar for Texas panicum control in 2005 and 2006 (65 to 82% and 39 to 66%, respectively). In general, Texas panicum control was greater for pendimethalin AP in 2005 and 2006, (57 to 88% and 54 to 76%, respectively) compared to 4 and 8 WBP treatments.

In 2005 and 2006, the most effective Texas panicum control (71 to 95%) was with split applications of pendimethalin at 0.84 kg/ha as a spray or when impregnated on 280 or 560 kg/ha fertilizer at 4 WBP followed by pendimethalin at 0.84 kg/h applied on the day of planting. Improved Texas panicum control was observed with the split application since the level of pendimethalin was extended in time, and this rate (0.84 kg/ha) is efficacious to this weed (Culpepper 2007). There was no difference for Texas panicum control between pendimethalin EC and ME formulations spray applied AP.

Florida pusley control: Florida pusley control was 54% and less in 2004 and 50 to 74% in 2005 and 2006 for the 8 and 4 WBP treatments. Control of Florida pusley was 57 to 87% in 2004 and 43 to 73% in 2005 and 2006 when pendimethalin was applied as a spray or when fertilizer impregnated AP. These data indicated that Florida pusley control was variable when pendimethalin was applied at 8 or 4 WBP and AP. As with Texas panicum, the most consistent Florida pusley control (80 to 83%) was with split applications in 2005 and 2006 of pendimethalin at 0.84 kg/ha as a spray or when impregnated on 280 or 560 kg/ha fertilizer at 4 WBP, followed by pendimethalin at 0.84 kg/h PRE spray applied at planting.

SUMMARY AND CONCLUSIONS

Variability in weed control was attributed to the interception of the spray and impregnated fertilizer treatments by the cover crop at 8 and 4 WBP applications. At the time of the 8 and 4 WBP applications the wheat cover crop and annual winter weeds were not yet chemically destroyed. All of these factors explain why there was variability observed with pendimethalin spray versus impregnated on fertilizer applications.

Fertilizer impregnation did not negatively affect pendimethalin performance compared to surface-applied treatments. The benefit of this type of application is that it provides another means of pendimethalin application, and could reduce the number of trips across the field. This research indicated that the time of pendimethalin application was critical for Florida pusley control with AP application providing greater control than 8 or 4 WBP treatments. There were no indications that rate of pendimethalin applied, method of application (spray or fertilizer impregnated).

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