Cover Crops and Tillage Combinations for Wide and Ultra Narrow Row Cotton

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ABSTRACT

Ultra Narrow Row (UNR) cotton (*Gossypium hirsutum* L.) has potential to lower machinery costs and increase yields on poorer quality soils, but research with this system is lacking. Alternative crops and management methods are needed for drought prone soils in southeast Alabama. Lint yields from cotton planted in traditional wide (36 inch) rows with conventional tillage are often severely depressed by drought. High plant populations and close row spacing used in UNR systems may assist in drought avoidance, particularly when combined with conservation tillage techniques. Legume cover crops including white lupin (*Lupinus alba* L.) have been shown to increase lint yields of UNR cotton in Alabama, compared to traditional grain cover crops such as rye (*Secale cereale* L.). An experiment was conducted on a Lucy loamy sand (loamy, kaolinitic thermic Arenic Kandiudults) in southeast Alabama to determine the optimum combination of winter cover crops (rye or legumes), tillage (conventional or no-till), and row spacing (36-inch or 8-inch) on a drought prone soil from 1998 through 2001. In this experiment, UNR lint yields in 1998 were 50% greater than with 36-inch rows and 15% greater in 2001 with no difference in 1999. Conventionally tilled rye cover treatments yielded 35% more lint than no-tilled rye cover treatments in 1999. In 2000, conventional tillage yielded 19% more than no-till treatments. Leaf Area Index taken at early bloom and plant population counts usually followed the same trends as lint yields. These results indicate that UNR cotton may be a more productive system for cotton on marginal soils than traditional wide rows.

KEYWORDS

Ultra Narrow Row, cotton, lupin, rye, no-till

INTRODUCTION

Ultra Narrow Row (UNR) cotton, or cotton grown in row spacings of 10 inches or less, acreage has rapidly increased in in the last several years in the southeast US. The close rows and high plant populations used in this system have the capability to more rapidly shade the soil surface, conserving moisture and shading weeds, and to capture more sunlight at earlier growth stages. With these high populations, cotton plants may set only 3 to 4 bolls per plant, with most of these at the first or second position from the stalk. The small number of fruit per plant may allow cotton to rapidly set fruit and avoid drought effects with limited water.

Alternative crops and production methods are needed for marginal soils in southeast Alabama, where sandy soils with low moisture holding capacity often produce sub-economic cotton lint yields. Previous research has shown increased yields with the use of conservation tillage and lupin/ legumes as winter cover crops for cotton. Producers have become interested in UNR cotton as a way to use lower cost harvest machinery and to possibly increase yields on marginal cropland.

MATERIALS AND METHODS

A study was conducted from the fall of 1997 through the fall of 2001 at the Wiregrass Regional Research and Extension Center, Headland, Alabama to investigate the optimum combinations of row spacing, cover crops, and tillage for cotton on a marginal soil. Soil type was a Lucy loamy sand (loamy, kaolinitic thermic Arenic Kandiudults). Wide row (36-inch) cotton lint yields in this area have typically ranged from 500 to 600 lbs acre^{-1} or less, due to drought stress (B. Gamble, pers. comm.).

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The Experiment Design was a strip-split plot design with four replications. Cover crops (rye *vs*. legumes) were horizontal strips, tillage treatments (no-till *vs*. conventional) were in vertical strips, and row spacings (Wide *vs*. UNR) were split-plots.

Cover crops were planted in October or November in the test area, as soil moisture allowed. Rye (*Secale cereale* L.) and white lupin (*Lupinus albus* L.) were drilled in their respective plots and cultipacked. The lupin cultivar "Lunoble" was planted in 1997-98 in legume cover plots. Due to winterkill of the "Lunoble" in 1997-98, "AU Homer" white lupin was used in following years, and crimson clover (*Trifolium incarnatum* L. cv. AU Robin) was also broadcast in legume plots immediately before cultipacking.

All cover crops were killed with herbicides in the spring at the early bloom stage at least one month before planting cotton. No-till plots were then rolled flat with a crimping roller. Conventional tillage treatments were also begun at this time, including disk harrowing, chisel plowing, and leveling with a harrow before planting. All plots were subsoiled with a paraplow annually.

Paymaster PM 1220 BG/RR (1998, 1999) or PM 1218 BG/RR (2000, 2001) cotton was planted in May of each year. Plots were re-planted in June of 1998 and abandoned in 2000 due to poor stands from extremely dry weather. Seeding rates were 84,000 seed per acre for Wide (36-inch) Rows planted with unit planters, and 180,000 to 200,000 seed per care for UNR (8-inch) planted with a no-till drill. Best known management practices, including optimum fertility and growth regulators, were used. Wide rows were harvested with a spindle picker, while UNR plots were harvested with a stripper equipped with a finger harvester head.

Yearly rainfall patterns varied considerably with 1998 having a relatively dry spring and wet late summer. 1999 was wet early in the summer and dry later, and 2000 was extremely dry from early spring to mid-summer, while 2001 was dry in early spring and wet in mid-summer. No irrigation was applied.

All data was analyzed using SAS 8.2 (SAS Institute, Cary, NC) at P = 0.10, *a priori,* and LSD's calculated, where significant differences were obtained.

RESULTS AND DISCUSSION

Plant population counts showed that UNR had a higher population in 1998 than Wide Row (148,000 *vs*. 38,000 plants acre^{-1}, LSD = 22,000). In 1999, there was an interaction between Tillage and Row Width, with Wide Row treatments having a population of 37,000 plants acre^{-1}, while conventional UNR had a higher population of139,000 plants acre^{-1} and was higher than no-till UNR (98,000 plants acre^{-1}) with the LSD = 21,000 plants acre^{-1}. All cotton plots were abandoned due to drought in 2000. In 2001, there was a significant interaction of Legume and Tillage effects, as well as a significant Row Spacing effect. UNR plots had higher plant populations in each combination, except for those planted with No-till into rye (see Table 1).

Lint yields of UNR were over 50% higher (911 lbs acre^{-1}) than Wide Rows (596 lbs acre^{-1}) in 1998 (LSD = 50 lbs acre^{-1}). There was an interaction of Cover Crops and Row Width for yield in 1999, with Conventional tillage yielding higher with Legume and with Rye covers (see Table 2), while there was no difference in yield between UNR and Wide Rows. No lint yields were available in 2000, due to drought.

In 2001, there were main effects only for lint yield, with UNR (1387 lbs acre^{-1}) greater than Wide Rows (1203lb acre^{-1}; LSD = 68 lbs acre^{-1}), and Conventional Tillage plots yielding (1417 lbs acre^{-1}) greater than with No-till (1173 lbs acre^{-1}, LSD = 149 lbs acre^{-1}).

Table 1. Cotton plant populations for 2001.

Cover / Tillage	36 inch	UNR	LSD $_{0.10}$
	----- 1000 plants acre^{-1} -----		
Legume / Conventional	31	132	47
Rye / Conventional	33	184	47
Legume / No-till	28	112	47
Rye / No-till	55	85	47

Table 2. Cotton lint yield for 1999.

Cover	Conventional	No-till	LSD $_{0.10}$
	------------- lbs lint acre^{-1} ---------------		
Legume	949	865	49
Rye	923	669	49

CONCLUSIONS

These results show that Ultra Narrow Row cotton was a more productive system than traditional wide rows on this marginal soil for cotton lint yield in two of the three crop years studied. In a year with limited early season rainfall (1998), it yielded over 50% more than the Wide Row system. In a year with more evenly distributed rainfall (1999), there was no difference between UNR and Wide Row lint yields, while in the third crop year (2001), again with limited early season rainfall, UNR yielded 15% more lint than Wide Rows.