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RYE BIOMASS AMOUNT AFFECTS WEED SUPPRESSION LEVELS IN CONSERVATION-TILLAGE COTTON

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Historically, cover crop planting and termination has occurred at the discretion of growers' schedules and weather conditions. Previous research has shown that a winter cover's planting date and termination date influences both quality and quantity of residue production, and subsequent weed suppression. Therefore, a field study was conducted at two locations to determine optimum dates for planting and terminating winter cover crops to maximize biomass production, summer annual weed suppression, and cash crop yields. Rye (*Secale cereale* L.) was established with a no-till drill as winter cover preceding conservation-tillage cotton (*Gossypium hirsutum* L.) at 2 and 4 wk prior to, 2 and 4 wk after, and on the historical average first frost. In the spring, rye was terminated at 4, 3, 2, and 1 wk prior to cotton planting with glyphosate at 1 qt/ac. The rye was additionally flattened with a mechanical roller-crimper to form a dense residue mat on the soil surface. No herbicide was applied after cover termination until the 4-leaf growth stage in cotton. At E.V. Smith, rye planted 4 wk after first frost and terminated 4 wk before cotton planting produced the least biomass, 318 kg/ha, 27 times less than highest biomass treatment in which rye was planted 4 wk prior to first frost and terminated 1 wk prior to cotton planting. Correspondingly, weed biomass was 1,198 kg/ha in the treatment with the least rye biomass, 42 times greater compared to the treatment with the greatest rye biomass (Figure 1). A similar relationship was observed at the Tennessee Valley location. Cotton yield was not influenced by rye biomass (Figure 2). A similar relationship was again observed at the Tennessee Valley location.

Conservation-tillage systems are primarily used to address concerns about soil erosion, soil quality, and water availability (Blevins et al. 1971; Reeves 1997). The cotton area in conservation tillage systems is estimated to be 30% in the U.S. and approaches 60% in the southeastern U.S. (Anonymous 2003). Approximately 90% of the U.S. cotton grown in 2001 received herbicides (Anonymous 2002). Practical alternatives to the intensive use of herbicides for controlling weeds in cotton production offer economical as well as environmental benefits.
One advantage of using cover crops in conservation tillage is weed suppression through physical as well as chemical allelopathic effects (Nagabhushana et al. 2001). Cereal rye (*Secale cereale* L.) and soft red winter wheat (*Triticum aestivum* L.) are the two most common winter cover crops recommended for cotton production in the U.S. Both of these cover crops also contain allelopathic compounds that inhibit weed growth (Akemo et al. 2000; Chase et al. 1991; Perez and Ormeno-Nunez 1991; Yenish et al. 1996). Yenish et al. (1996) reported increased short-term weed control utilizing a rye cover crop in no-till corn (*Zea mays* L.), but not season-long control.
The Brazilian conservation-tillage system is based on terminating cover crops during early reproductive growth, by treating with glyphosate and mechanically rolling the covers, to form a dense mat of residue (>4,480 kg/ha) on the soil surface into which crop seeds are planted (Derpsch et al. 1991; Reeves 2003). Few growers are currently utilizing roller-crimpers to manage cover crops; however, grower interest in this management technique exists due to its potential for reducing erosion and increasing infiltration and soil water storage (Truman et al. 2002).
While some research evaluated weed-suppressive qualities of winter cover crops, few experiments have evaluated the effect of different biomass amounts of the same cover on weed suppression and crop response. Therefore, our objective was to evaluate weed control provided by different amounts of rye biomass in conservation-tillage cotton using the Brazilian system of managing cover crops. Cotton stand establishment, height, and yield was also evaluated.

Rye (*Secale cereale* L.) was established with a no-till drill as winter cover preceding conservation-tillage cotton (*Gossypium hirsutum* L.) at 2 and 4 wk prior to, 2 and 4 wk after, and on the historical average first frost. In the spring, rye was terminated at 4, 3, 2, and 1 wk prior to cotton planting with glyphosate at 1 qt/ac. The rye was additionally flattened with a mechanical roller-crimper to form a dense residue mat on the soil surface. No herbicide was applied after cover termination until the 4-leaf growth stage in cotton.

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Cotton yield was not influenced by rye biomass (Figure 2). A similar relationship was again observed at the Tennessee Valley location.

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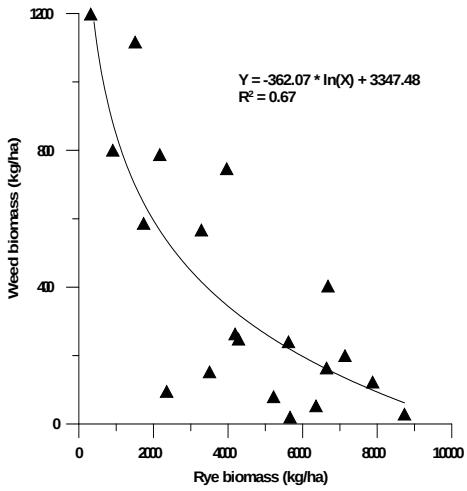

Figure 1. Weed biomass present at 4-leaf cotton growth stage, 41 to 61 d after rye termination, at E.V. Smith Research Center, Shorter, AL.

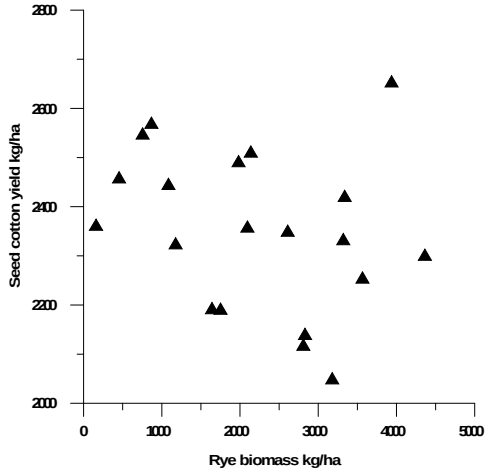

Figure 2. Cotton yield as influenced by rye biomass at E.V. Smith Research and Extension Center, Shorter, AL.