EVALUATING STOCKER CATTLE IN A SOUTHERN PIEDMONT CONSERVATION TILLAGE COTTON-COVER CROP SYSTEM TO INCREASE PRODUCTIVITY

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INTRODUCTION

Winter cover crops are often perceived as costly because there are no direct returns from selling the cover crop (Snapp et al., 2005). Additional negative concerns are expressed due to the potential for cover crop induced water stress early in the growth of the main cash crop. Cover crop conservation benefits have been documented for all major crops and growing regions of the US (Dabney, et al., 2001). Beyond the soil conservation benefits, cover crops have been shown to improve water availability by contributing to improvements in soil physical properties that increased water infiltration rate and reduce runoff (Touchton, et al., 1984; Bruce et al., 1995). Payments from government incentive programs, like the Conservation Security Program, can help offset the cost of cover crops (up to $8 acre^{-1}) (Causarano et al., 2005). Another option for offsetting cover crop costs and increasing farm revenue is grazing of winter cover crops by cattle (*Bos taurus* L.). Grazing stocker cattle in a cotton-peanut rotation in south Alabama produced $157 gross return and $75 net return per acre from cattle (Siri-Prieto et al., 2003).

Grazing cover crops may reduce soil productivity due to hoof-induced soil compaction during the grazing period (Miller et al., 1997). Cotton yields were reduced an average of 14% in two out of three years on silt loam soil in North Alabama where cover crops were grazed (Mullins and Burmester, 1997). Soil compaction from grazing is influenced by a number of factors (soil texture, soil water content, grazing intensity, vegetation type and climate regime; Taboada and Lavado, 1988). Siri-Prieto et al. (2003) found that paratill or in-row subsoiling was required to alleviate grazing-induced compaction and maximize cotton and peanut yields in south Alabama.

In the Southern Piedmont, depth to the Bt layer influences rooting volume and water availability (Endale et al., 2006) and in turn can influence the degree of compaction from grazing. Depth to the Bt is spatially distributed with erosion class being a surrogate indicator but at a very rough scale. Other factors influencing soil response to cattle may also be spatially variable but need to be quantified before management strategies can be developed to reduce negative effects. By identifying spatially variable factors with GPS technology management zones can be delineated for prescription deep tillage. Performing deep tillage only on areas with a high probability of compaction would therefore reduce producer costs.

Our objectives were to evaluate the impact of cattle grazing winter annual small grains on (1) cotton production (2) forage available for grazing, and (3) soil compaction. We measured a number of spatially distributed soil and plant properties to identify those that might easily be used to identify management zones for ameliorating any negative effects from cattle.

MATERIALS AND METHODS

This study started in the fall of 2005 and will continue through 2009. Four fields at the USDA-ARS J. Phil Campbell, Sr., Natural Resource Conservation Center in Watkinsville, GA

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(33° 59' N, 83° 27' W) historically in no-tillage and instrumented to determine management effects on sediment and nutrient losses from typical fields in the Southern Piedmont are used in the study. Three of the fields are 3.3 acres while the fourth is 6.9 acres.

Winter rye (*Secale cereale* L.) is planted with a no-till grain drill in early October as a cover crop on all fields. Poultry litter is applied in the fall to provide sufficient P for both rye and cotton (*Gossypium hirsutum* L.) and supplemental N is added as needed for cotton and rye. On two fields, rye is grazed with heifer cattle for 7 to 10 days starting in late-March. The other two fields are not grazed and the rye is killed with glyphosate the second week of April. Numbers of cattle are adjusted based on forage availability and estimated intake so that pastures are defoliated in less than 10 days. Cover crop biomass is determined prior to and after grazing and just prior to cotton planting. Cover crop residues are analyzed for carbon and N, P, K, Ca, Mg.

Soil type, EC data, depth to Bt, and soil penetrometer data collected in fall of 2006 were combined in a Geographic Information System (GIS) to develop plant sampling zones for the cotton growing season. The cumulative grazing effects on soil compaction will be determined by measuring soil penetration resistance at the same locations in the spring 2006 and 2009 following cotton planting. Geostatistical methods are being used to analyze soil, water, and plant data to determine landscape and grazing effects on cotton productivity.

Cotton is planted the first week of May with a no-till planter. Cotton plants are sampled at first bloom and mid-bloom for biomass, plant height, and nutrient status to determine grazing and landscape effects on growth and nutrient content. Winter grazing effects on plant water stress and soil water availability (0 to 30 cm) are determined from first bloom until cutout by measuring soil water content using TDR probes inserted vertically into the soil. Cotton is harvested in the fall after defoliation using a harvester equipped with a yield monitor and GPS to collect georeferenced yields. Cotton samples from five areas in each field are collected for determination of fiber length, strength, micronair, and uniformity using High Volume Instrument (HVI) classing.

RESULTS AND DISCUSSION

Grazing

In 2006, cereal rye (*Secale cereale* L.) herbage grew from approximately 1000 lbs/acre in late January to 8000 lbs/acre in mid April in the ungrazed plots. On the grazed plots, we began grazing with an herbage mass of approximately 4000 lbs/acre in mid to late March. The grazed plots were defoliated only once and the cattle consumed approximately 2600 lbs of dry matter per acre. In spring of 2007 herbage grew from approximately 1000 lbs/acre in February to 6000 lbs/acre in mid April in the ungrazed plots. On the grazed plots, we began grazing with a herbage mass of approximately 2200 lbs/acre in mid-March during a period of rapid growth. The mid-March grazing period was followed by a mid-April grazing and the animals consumed an estimated 2900 lbs of dry matter per acre during the grazing season. In spring of 2008, herbage grew from approximately 1000 lbs/acre in February to approximately 6000 lbs/acre in early April in the ungrazed plots. Grazing was initiated with only 1500 lbs/acre herbage mass. The watersheds were grazed twice and animals consumed approximately 2200 lbs of dry matter per acre of forage during the grazing season. Rye consumed in 2008 was about ½ this amount due to dry weather.

We estimate that 1.5 head/acre can be supported for a 75 day period between February 1st and April 15th if animal management and agronomic management are efficient and climate is adequate. Season to season variation will require careful and flexible management and alter rotational requirements. At $20 to $40 for an 800 lb round bale the 3000 lbs of forage would be worth $70 to $140/acre. The quality of grazed rye is higher than baled forage and should result in improved animal performance. In addition, grazed forage reduces labor, feeding losses and storage costs compared to hay. Adjusted to equivalents of feeding hay, yield/acre is closer to 4000 lbs/acre and the value of grazing the rye cover crop likely ranges from $100 to $200/acre.

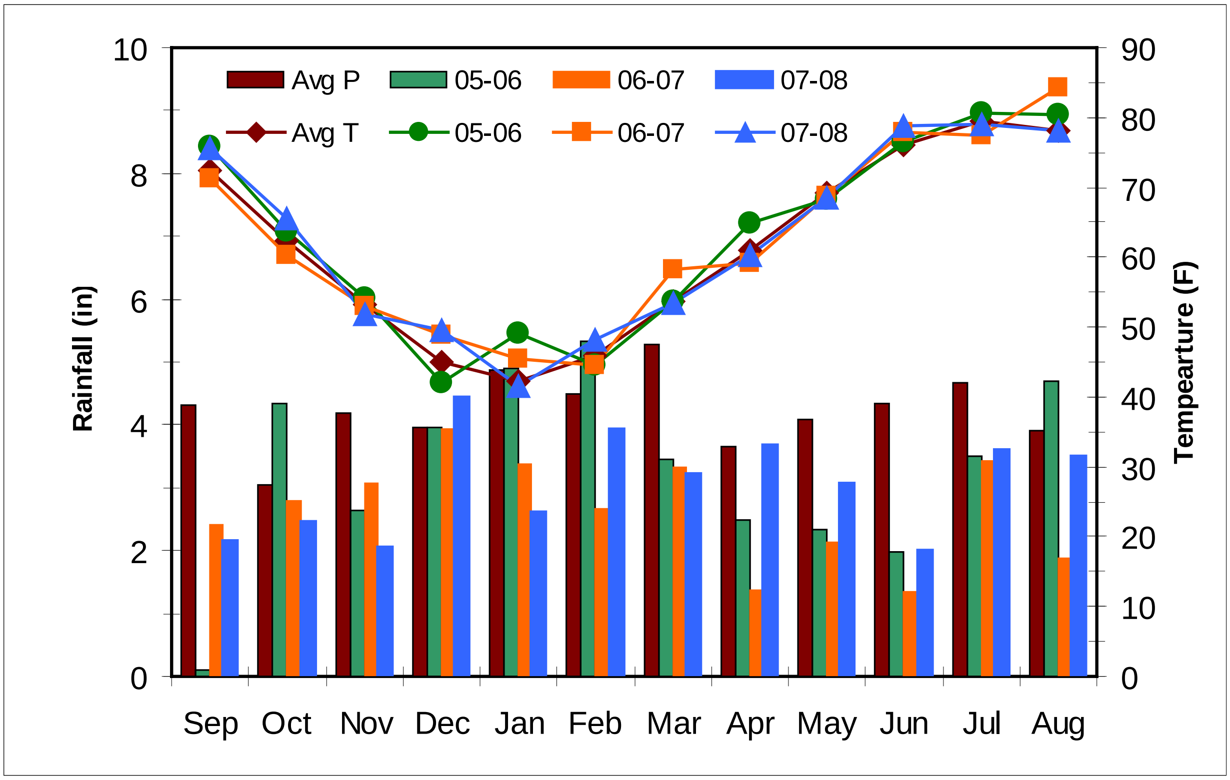
Cotton Yields

In 2006, cotton experienced 10 days of cool weather following planting on May 12th and 15th, which delayed germination and growth. Growing season rainfall was below historical averages but timely rains in late July and August were beneficial for cotton yields (Fig 1). Seed cotton yields ranged from 2140 lbs/ac to 2950 lbs/ac. No significant yield differences were detected between grazed and ungrazed fields (both treatments averaged approximately 2500 lbs/ac). After ginning, our yield per acre averaged 1008 lb lint/ac which was greater than the Georgia average of 765 lbs/ac or 1.6 bales/ac.

In 2007, rainfall was very low from planting to harvest. Rainfall in June (1.34 inches) and July (1.72 inches) was well below normal which reduced cotton growth and yield. Using our yield monitor equipped spindle picker, yields ranged from 200 to 300 lbs lint/acre and averaged 250 lbs/acre. About two weeks after using the spindle picker we picked the fields with a stripper unit and harvested another 140 lb lint/acre that was still in the field due to physiological hardlock. With the low yields there was no difference between grazed and ungrazed treatments.

In 2008, we had 12 inches of rain from planting to harvest. Rainfall in June was only 2 inches while July and August had 3.5 and 3.6 inches respectively. September rainfall was less than 1 inch. Our average yield was 794 lb lint / acre.

Fig 1. Temperature and Rainfall for the cover crop and cotton growing seasons Fall 2005 to Fall 2006 and the long-term averages at Watkinsville, GA.



CONCLUSIONS

Based on our grazing data, returns from grazing cover crops would be an economic benefit to cotton producers in the Southern Piedmont, especially in periods of poor crop production. In the first three years of the research, cereal rye provided sufficient forage to support approximately 1.5 animals/acre between February 1st and April 15th. Grazing did not influence yield in either year. Return on grazing was similar for both years while cotton returns were more variable. These results indicate grazing cover crops may be an important economic consideration for cotton producers in the Southern Piedmont because of the potential to increase revenues from grazing without reducing cotton yields and to minimize variations in total annual revenues. The research will continue in 2009.

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