FORAGE AND TILLAGE SYSTEMS FOR INTEGRATING WINTER-GRAZED STOCKER CATTLE IN COTTON PRODUCTION

G. Siri-Prieto[1], D.W. Reeves*[2], R.L. Raper[3], and B.E. Gamble[4]

[1]Facultad de Agronomía, Universidad de la Republic del Uruguay, CP 60000, Paysandu, Uruguay
[2]USDA-ARS J. Phil Campbell Sr. Natural Resource Conservation Center, Watkinsville, GA 30677
[3]USDA-ARS Soil Dynamics Research Unit, Auburn, AL 38832
[4]Alabama Agricultural Experiment Station, Wiregrass Research & Extension Center, Auburn University, 36849

*Corresponding author: < **dwreeves@uga.edu** >

ABSTRACT

Integrating livestock with cotton (*Gossypium hirsutum* L.) offers profitable alternatives for producers in the southeastern USA, but could result in soil water depletion and soil compaction. We conducted a 3-yr field study on a Dothan loamy sand (fine-loamy, kaolinitic, thermic Plinthic Kandiudults) in south Alabama to develop a conservation tillage system for integrating cotton with winter-annual grazing of stocker cattle under dryland conditions. Winter annual forages and tillage systems were evaluated in a strip-plot design where winter forages were oat (*Avena sativa* L.) and annual ryegrass (*Lolium mutiflorum* L.). Tillage systems included: moldboard and chisel plowing; and combinations of non-inversion deep tillage (none, in-row subsoil or paratill) with/without disking. We evaluated forage dry matter, N concentration, average daily gain, net returns from grazing, soil water content, and cotton leaf stomatal conductance, plant populations and yield. Net returns from winter-annual grazing averaged over 3-yr were between $75 to $81/acre/year. Soil water content was reduced 15% with conventional tillage or deep tillage compared to strict no-tillage, suggesting that cotton rooting was increased by these systems. Oat increased cotton stands an average of 25% and seed-cotton yield by 7% compared to ryegrass. Strict no-tillage resulted in the lowest yields; 30% less than the overall mean (3295 lb seed-cotton/acre). Non-inversion deep tillage in no-till (especially paratill) following oat was the best tillage system combination (3535 lb seed-cotton/acre) but deep tillage did not increase cotton yields in conventional tillage systems. Integrating winter-annual grazing can be achieved in the Coastal Plain using non-inversion deep tillage following oat in a conservation tillage system, providing producers extra income while protecting the soil resource.

SUMMARY

In the Southeastern states, 48 to 63% of cotton is grown in rotation. However, even in a rotation, only a limited number of crops, usually corn (*Zea mays* L.) or peanut (*Arachis hypogaea* L.) are utilized. Integrating animal production with row cropping systems, e.g., with cotton, may offer economic and conservation benefits, but it presents an even greater challenge to diversification than rotation with other row crops. Winter-annual grazing of stocker cattle could diversify market opportunities and offer potential for extra revenue for producers double-cropping cotton. However, winter-annual grazing can result in excessive soil compaction, which can severely limit yields of double-cropped cash crops like cotton.

The objectives of this study were to determine the feasibility of double-cropping cotton following winter-annual grazing of stocker cattle in the Southeastern Coastal Plain and to identify an optimal choice of forage and tillage system combination for animal performance, cotton productivity, soil conservation, and profitability. The results presented here focus on cotton productivity and system profitability.

The field study was conducted for 3-yr on a Dothan loamy in south Alabama. Winter-annual forages and tillage systems were evaluated in a strip-plot design of 4 replications. Forages were oat and annual ryegrass. Both forages were terminated prior to summer tillage with an application of glyphosate approximately 4-6 wk before cotton planting. Yearling steers of mixed breeding Angus × Simmental (initial weight 570 lb averaged over years) were stocked at 2-head/acre.

During the summer, the experimental area was divided into cotton and peanut areas, which were rotated each year. Tillage plots within these areas were 50-ft long and 24-ft wide with eight, 36-in rows. 'Suregrow 125B/R' cotton was grown in 2001 and 'Suregrow 501 B/R' was grown in 2002 and 2003. The eight summer tillage practices were: 1) moldboard plowing to a depth of 12-in + disk/level (4- to 6-in depth); 2) disk/level only; 3) chisel plowing to a depth of 8-in + disk/level; 4) in-row subsoil with a narrow-shanked subsoiler (KMC®, Kelley Manufacturing Co., Tifton, GA) to a depth of 14- to 16-in + disk/level; 5) in-row subsoil + no-tillage; 6) under-the-row paratill with a bent-leg subsoiler (Paratill®, Bigham Brothers, Inc., Lubbock, TX) to a depth of 17- to 19-in + disk/level; 7) paratill + no-tillage; and 8) no-tillage. All tillage operations were performed after the removal of cattle from the winter annual forages. Tillage and planting equipment were guided with a tractor equipped with a Trimble AgGPS® Autopilot automatic steering system (Trimble, Sunnyvale, CA), with 1-in level precision, which reduced equipment-induced compaction near the cotton row. Alabama Cooperative Extension System recommendations were used to apply all herbicides and insecticides. We evaluated soil water content, cotton leaf stomatal conductance, plant density, cotton yield, cotton net return, and total system annual net return.

Integrating winter-annual grazing with cotton provided additional income for producers ($75-81/acre/year) with only 80-d grazing. Soil water content during cotton bloom period was reduced an average of 15% with conventional tillage or non-inversion deep tillage, suggesting that cotton rooting was increased by these systems. Cotton stands following oat grazing were increased 25% compared to following ryegrass and yields following grazed oat were 7% greater than following grazed ryegrass. Strict no-tillage resulted in the lowest yields; 30% less than the overall tillage mean (3295 lb seed cotton per acre). However, non-inversion deep tillage in no-tillage systems (especially with the paratill) following grazed oat was the best system combination, averaging 3545 lb seed-cotton/acre over the three years. Deep tillage did not increase cotton yields in conventional tillage.

Our results demonstrate that doublecropping cotton following winter-annual grazing is possible in the Southeastern Coastal Plain, allowing for extra income without sacrificing cotton yields. Integrating winter-annual grazing can be achieved using non-inversion deep tillage, especially paratilling, following oat in a conservation tillage system. This conservation practice can reduce erosion potential, provide a much needed source of additional revenue, and still sustain competitive cotton yields on these soils.