Abstract

Field trials were conducted in 2007 and 2008 in Tifton, GA to measure the decomposition of cover crop residues and cycling of nutrients from residues to soil and a subsequent cotton (*Gossypium hirsutum* L.) crop. Cotton was grown in strip-tillage with a crimson clover (*Trifolium incarnatum* L.), wheat (*Triticum aestivum* L.), or rye (*Secale cereale* L.) cover. Total percent biomass degradation did not differ among crimson clover, rye, or wheat residues (67%, 63%, and 65%, respectively) both years ($p < 0.05$). Similarly, reduction in total content of N, P, and K did not differ among cover crops ($p < 0.05$). Total content of N and K in vegetative cotton tissue was greatest ($p < 0.05$) with crimson clover (295 kg ha^{-1} and 254 kg ha^{-1}, respectively) in 2007. However, differences among cover crop treatments in N, P, and K content in cotton vegetation were not significant in 2008. Seed cotton yields among treatments ranged from 3532 kg ha^{-1} to 3567 kg ha^{-1}, with no significant differences ($p < 0.05$). Based on these results, under standard management of cotton in strip-tillage, there are few differences among these three cover crops in nutrient uptake and final seed cotton yield.

Introduction

- Conservation tillage and cover cropping techniques have significantly reduced erosion losses on southeastern U.S. cotton farms.
- Strip-tillage is a common form of conservation tillage utilized by cotton growers in Coastal Plain regions—involves tilling a 15-cm-wide zone for crop rows, leaving cover crop residues undisturbed in inter-row space.
- Cover crop residues also aid in cycling organic matter and nutrients back to soil as they decompose—similar to a slow-release fertilizer.
- Leguminous and non-leguminous cover crop species could have potentially differing effects on the nutrient cycling capacity and overall productivity of strip-tillage cotton systems.

Objectives

These experiments were designed to evaluate the effect of a crimson clover, rye, or wheat cover crop on the movement of plant nutrients from decomposing cover crop residues to vegetative cotton tissues and on cotton growth and seed cotton yield.

Materials and Methods

- **Location:** UGA Lang Farm - Tifton, GA
- **Experimental Design:** Randomized Complete Block Design with 4 replications
- **Treatments:** Cover crop species (planted 23 Oct. 2006 and 28 Nov. 2007; terminated 9 Apr. 2007 and 9 Apr. 2008)
  - **Crimson clover**
  - **Rye**
  - **Wheat**
- **Cotton Variety:** DP 515 BG/RR (planted 28 May 2007; harvested 8 Nov. 2007) and DP 164 B2RF (planted 5 May 2008; harvested 26 Sept. 2008)
- **Data Collection:**
  - Cover crop surface residue collection using 0.5-m^2 quadrat
  - Soil samples collected from 5 cm and 20 cm depths
  - Cotton vegetative biomass collection using 0.5-m^2 quadrat
  - Soil and biomass sampling every 3-4 wk until harvest
  - Nutrient analysis of all soil and tissue samples
  - Yield determination by treatment
  - Data analysis conducted using PROC GLIMMIX function of SAS (SAS, Cary, NC)

Results

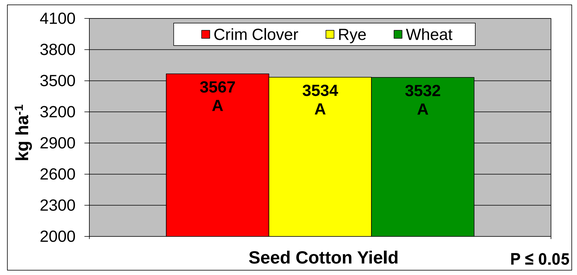

Fig. 1. Seed cotton yields as influenced by three cover crop treatments in strip-tillage, pooled over year – Tifton, GA, 2007-2008

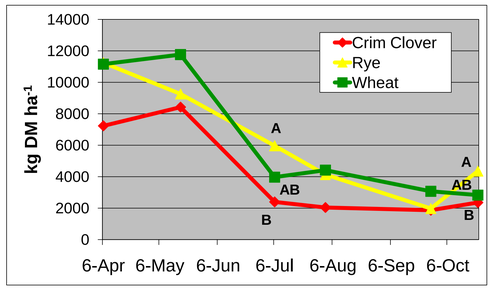

Fig. 2. Biomass breakdown of three cover crop species in strip-tillage cotton – Tifton, GA, 2007

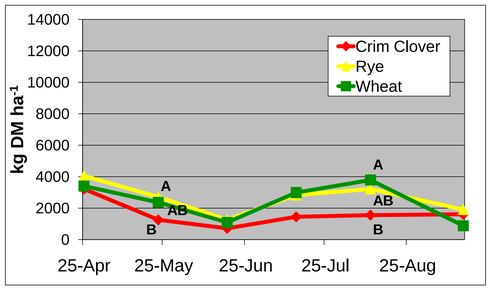

Fig. 3. Biomass breakdown of three cover crop species in strip-tillage cotton – Tifton, GA, 2008

Table 1. Total percent biomass loss and overall reduction in total plant macronutrient content of three cover crop residues in strip-tillage cotton – Tifton, GA, 2007-2008

Cover Crop	Biomass Lost	Nitrogen	Phosphorus	Potassium	Sulfur	Calcium	Magnesium
	%	kg ha^{-1}					
Crimson Clover	67 a	100 a	14 a	139 a	14 ab	24 a	10 a
Rye	65 a	121 a	17 a	170 a	18 a	20 a	10 a
Wheat	63 a	78 a	11 a	123 a	11 b	8 a	5 b

Data pooled over year. Means within a column followed by the same lowercase letter are not significantly different at P = 0.05

Table 2. Vegetative cotton production and total accumulation of plant macronutrients in cotton tissues as influenced by three cover crops in strip-tillage cotton – Tifton, GA, 2007-2008

Cover Crop	Vegetative Biomass	Nitrogen	Phosphorus	Potassium	Sulfur	Calcium	Magnesium
	kg DM ha^{-1}	kg ha^{-1}					
Crimson Clover	12,690 a	212 a	31 a	212 a	42 a	112 a	27 a
Rye	10,455 a	144 b	24 a	159 a	33 a	94 a	21 ab
Wheat	9649 a	121 b	23 a	154 a	30 a	87 a	17 b

Data pooled over year. Means within a column followed by the same lowercase letter are not significantly different at P = 0.05

Discussion and Conclusions

- All data are not shown due to sheer volume of information.
- Cover crop residues decomposed most rapidly during first 4-8 wk following burndown. Crimson clover displayed the most rapid initial decomposition, but total percent biomass lost did not differ among cover crops by the end of the season. The lower C:N ratio of the leguminous crimson clover likely resulted in rapid initial decomposition, while rye and wheat residues decomposed at slower, more constant rate throughout the growing season.
- Reduction of N, P, K, and Ca content did not differ among cover crop residues. Crimson clover and rye, however, displayed greater reductions of total Mg than wheat; rye also had greater reduction of S than wheat.
- Crimson clover residues resulted in the greatest accumulation of all macronutrients in cotton tissues, though differences were only significant for N and Mg. Its rapid initial breakdown may have provided a flush of nutrients to the soil early-season, during the cotton's most rapid growth period, resulting in rapid nutrient assimilation. None of the differences in nutrient accumulation translated to significant differences in cotton growth or yield.
- All three cover crops displayed varying potential for cycling nutrients to a subsequent cotton crop, but the effects were not potent enough to significantly impact vegetative cotton growth or yield among treatments. However, the many other benefits of cover crops ensure their long-term necessity for strip-tillage crop production.