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2008

NATIONAL PEANUT BOARD / SOUTHEAST PEANUT RESEARCH INITIATIVE

Executive Summary for work done under project agreement entitled:
"Nutrient Cycling and Cover Crop Decomposition in Conservation and Conventional Cropping Systems for Peanut".

NPB Project # 253
GPC Budget # 4-907-653-5
UGA Account #25-21-RF328-804

INSTITUTION:	University of Georgia
Principle Investigator:	Dr. R. Scott Tubbs
EXPIRATION DATE:	30 June 2009
SPRI CONTACT:	Emory Murphy
NPB CONTACT:	Marie Fenn

Executive Summary:

Cover crops are commonly used in peanut production and could potentially provide some nutrient benefit to a peanut crop as cover crop residues decompose. An experiment was designed to evaluate the effect of three different cover crops (rye, wheat, and crimson clover) on peanut production in conventional and strip-till management. A randomized complete block design with 4 replications and treatments randomized in a 3 x 2 factorial arrangement (cover crops x tillage). Cover crop residue and peanut ('Georgia-03L') biomass samples were made approximately every 3-4 weeks throughout the peanut growing season to determine rate of decomposition of the cover crops in strip-till management and accumulation of biomass and nutrients in the peanut vegetation.

There were no statistical differences in peanut yield (5432-5600 lb/ac) or grade (67.9-69.2%) regardless of cover crop planted. Likewise, there were no differences between tillage effects for yield (5328 lb/ac conventional; 5669 lb/ac strip-till) or grade (69.0 % conventional; 68.5% strip-till). Crimson clover did decompose more rapidly than either rye or wheat, which was expected since it has a lower C:N ratio than the grass crops. More rapid decomposition would supply more nutrients to the soil, and likewise to the growing peanut plants earlier in the season. However, this did not result in increased peanut biomass accumulation.

There were also few differences in economic analyses of these systems. The total variable costs associated with production resulted in higher costs for crimson clover because of a higher seed cost per acre to plant in this year. Since peanut is a legume and will fix its own N, the supplemental nutrient benefits that a leguminous cover crop like

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FINAL REPORT for work done under project agreement entitled:
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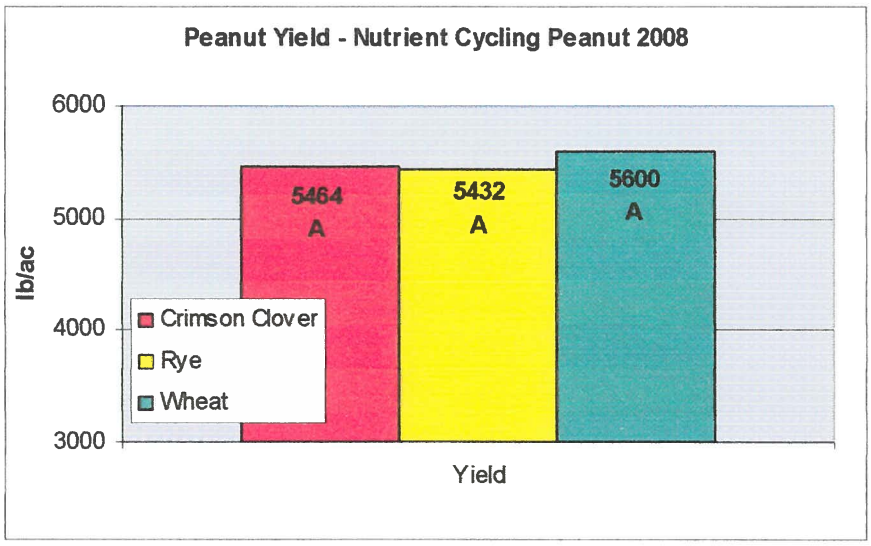
FINAL REPORT:

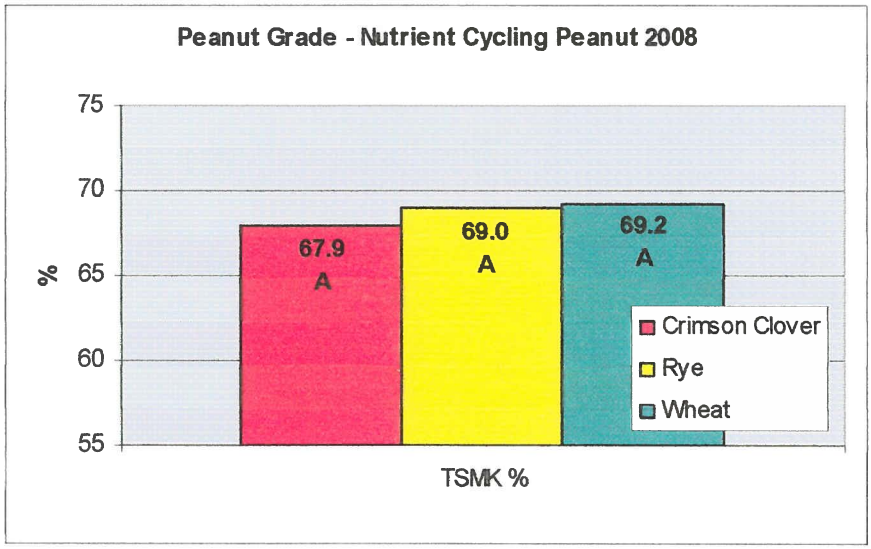
A field trial was set up on Lang Farm of UGA Tifton Campus using a randomized complete block design with 4 replications and treatments randomized in a 3 x 2 factorial arrangement. Three cover crops were established on Nov. 28, 2007 including rye, wheat, and crimson clover. These cover crops were terminated on April 9, 2008 using glyphosate. The other treatment variable was tillage effect, including strip-till and conventional tillage. A rip-and-bed operation was used for tillage to keep cover crop residues within the soil sampling zone for monitoring soil nutrients over the course of the season. Planting occurred on May 5, 2008 using variety 'Georgia-03L'. Emergence stand counts were made on May 19 for comparison of germination and harvest stand counts were made immediately prior to picking.

Cover crop biomass samplings occurred from a 0.5 m^2 area on April 29 for a pre-plant baseline, then again on May 23, June 18, July 9, Aug. 11, Sept. 12, and Sept. 24. At each sampling, soil samples were also removed from each plot at 0-2 inch and 2-8 inch depths. Also, peanut plant samples were taken on each sample date, and when plants were large enough, peanut root and pod samples were also taken. All plant tissue samples and soil samples were sent to Athens, GA to the Soil, Plant, & Water Analysis Lab for nutrient analyses (due to limited funds, peanut root and pod samples were not able to be analyzed). Biomass samples were dried and weighed.

Plots were evaluated for Tomato spotted wilt *Tospovirus* (TSW) on Sept. 25. Peanuts were dug on Sept. 26 and harvested on Sept. 29, 2008. Samples were weighed, subsampled, and taken to Federal-State Inspection Service for grade analyses.

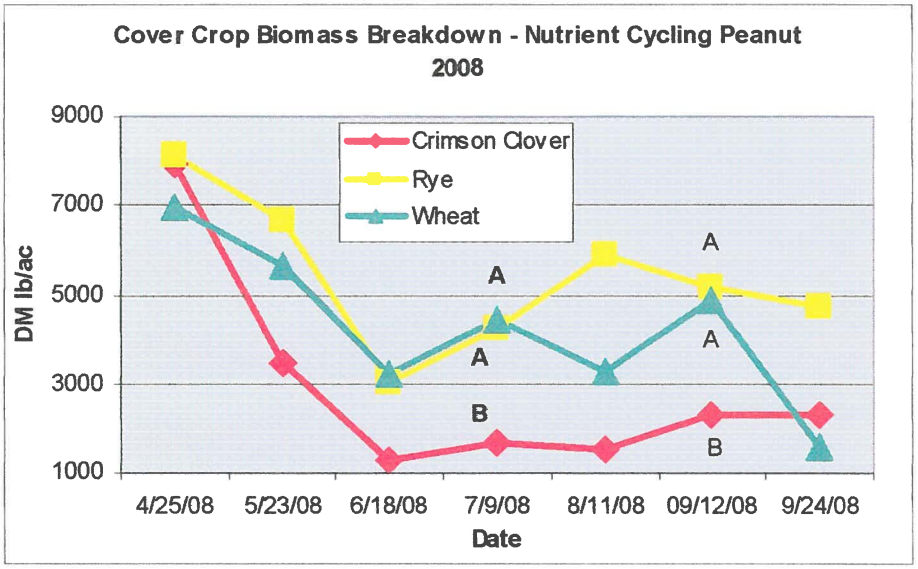
Peanut Yield, Grade, and Stand

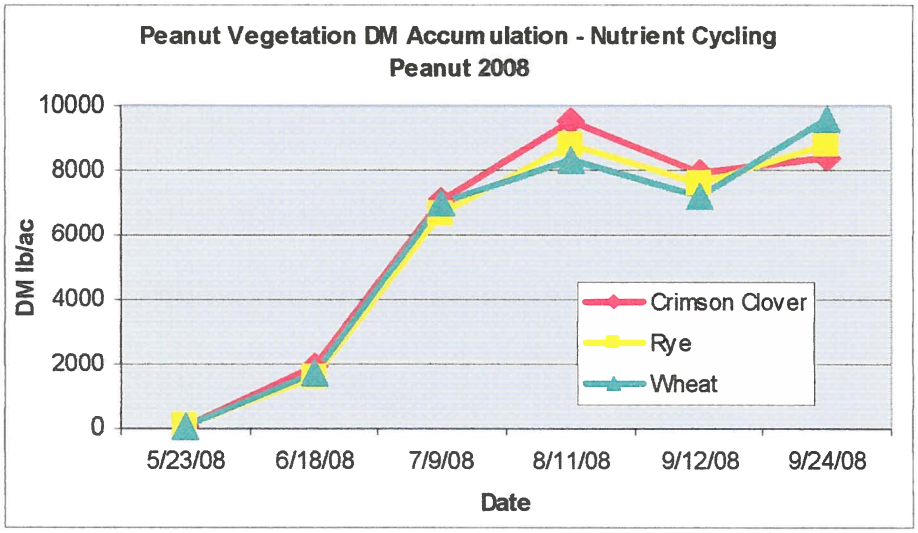




As seen in the above graphs, there were no differences in yield or grade. There was also no difference in emergent or harvest stand (data not shown) of peanuts for either the cover crop or tillage treatment effects. Thus, according to these data, peanuts can be produced equally as well in strip-till or conventional tillage, regardless of whether the preceding cover crop is crimson clover, rye, or wheat. It should be noted that continuous cropping of legumes can lead to pest outbreaks and nutrient management issues in the long run. However, these results show there is not an immediate decline in peanut production from following a legume with a legume, so use of crimson clover as a cover crop prior to peanut can be an occasional option.

Cover Crop and Peanut Vegetation – Decomposition and Dry Matter Accumulation



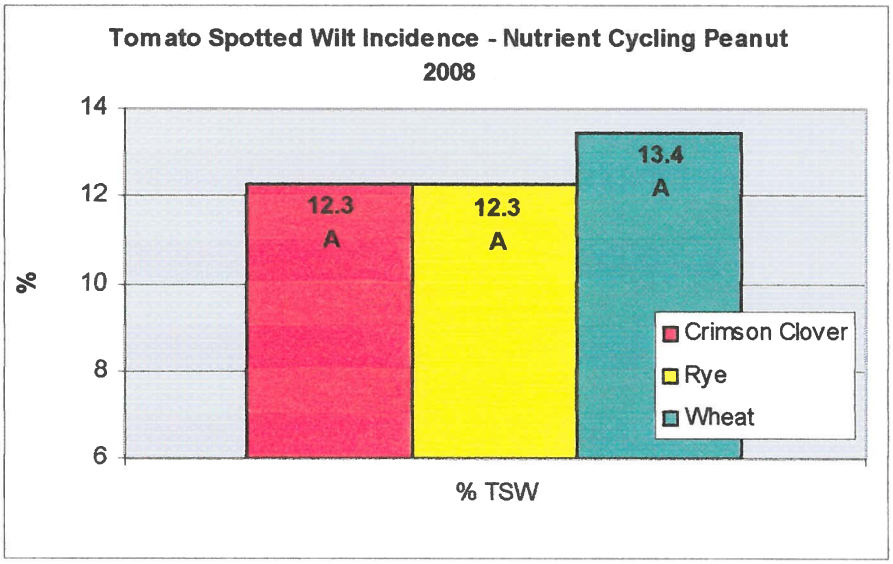


Breakdown of cover crop residues occur most rapidly early in the season when there is regular tractor activity in the field. This consistent field traffic from tillage, planting, and spraying operations causes cover crop residue in the tractor tire row middle to be pulverized and pushed into the soil, giving more surface area for soil microorganisms to decompose the material. Using two-row equipment maximizes the number of passes through the field and should increase the rate of decomposition compared to use of larger equipment. Crimson clover did have lower amounts of remaining biomass on July 9 and Sept 12. The other dates were not statistically significant, but the same trends were observed. A lower C:N ratio in leguminous (C-3 carbon pathway) plants will often result in more rapid decomposition compared to grass crops (C-4 carbon pathway). No differences were observed on any date for the vegetative biomass of above ground peanut during the course of the season.

Nutrient Analyses

Soil and plant tissue samples have been analyzed. Soil analyses include the 2- and 8-inch depths in each plot on each sample date and include Ca, K, Mg, Mn, P, and Zn. Plant tissue analyses include cover crop residue and peanut vegetative biomass in each plot on each sample data and were analyzed for Ca, K, Mg, N, P, B, Mn, and Zn. Because of the vast quantity of data which likely goes into more detail than the desired scope of this report, those data will not be included here. Instead, that data will be prepared and included in a manuscript to be submitted to a refereed scientific journal (such as Agronomy Journal or Peanut Science) upon collection of additional replicates of data. The data is accessible by contacting the Principle Investigator of this project.

Tomato spotted wilt



There was no statistical difference in TSW incidence on peanuts regardless of which cover crop was present. However, there was a difference in TSW for the tillage effect with conventional tillage peanuts (15.0%) having more TSW than strip-till peanuts (10.4%). This is consistent with most data comparing TSW in these two common tillage practices for peanuts since the surface residue disrupts the feeding patterns of thrips on early season peanut foliage.

Economics

Analyses were prepared to compare the cover crop and tillage factors for crop value per acre, total variable cost to produce the crop, and net return above variable costs per acre. Crop value per acre was calculated using the 2008 loan rate and adjusted for grade consistent with the USDA loan rate schedule. Variable costs were calculated using actual field practices and input prices published in University of Georgia 2007 wheat budgets and 2008 peanut budgets. Net returns above variable costs were used to analyze

profitability. A fixed cost analysis will be conducted with collection of additional replicates. There were no statistical differences between the two tillage systems. However, there was a statistical difference within the cover crop effect in terms of total variable cost to produce the crop (Table 1). This is primarily a function of the cost of crimson clover seed being more expensive than either rye or wheat. Since peanut is a legume and will fix its own N, the benefit of a leguminous cover crop in terms of providing a cost savings in fertilizer application is not existent like it would be in a non-leguminous crop where N would be part of the fertilization program. The variability observed in the net returns above variable cost does not result in a statistical difference for profit within the cover crop effect.

Table 1. Economic comparisons for peanuts following three different cover crops; Tifton, GA 2008.

Cover Crop	Crop Value $/Ac		TVC* $/Ac		NRAVC** $/Ac	
Crimson Clover	912.23	A	747.45	B	164.78	A
Rye	920.35	A	725.63	A	194.73	A
Wheat	951.10	A	734.93	A	216.17	A

Differences among cover crop treatments are indicated by alphabetical notation, where a different letter indicates a statistical difference at the $P<0.05$ level according to Fisher's Protected Least Significant Difference Test.

*TVC = Total Variable Cost

**NRAVC = Net Return Above Variable Cost

Summary

There were few differences observed among cover crops or between tillage treatments in this experiment. Crimson clover did have more rapid decomposition than the grass cover crops, which can have advantages and disadvantages. Having a high biomass cover crop can provide weed suppression, provide large quantities of nutrients to subsequent crops, and has been shown to increase soil organic matter in the long-term. However, incorporating a large mass of residue into conventional tillage systems can be difficult and may require additional time or multiple tillage passes before the ground is ready for planting. In this scenario, a cover crop that breaks down more rapidly would be desirable. Yet, in strip-till, a cover crop that decomposes rapidly will provide an initial boost of nutrients, but will not act as a season-long "slow-release fertilizer", and weed suppression and soil moisture conservation will not last as long.

Economically and in a long-term rotation, evidence suggests crimson clover would not be the best option as a cover crop preceding peanut. However, if a situation arises where a grower planted crimson clover in the anticipation of planting another crop in that field and that grower's plans changed and needed to plant peanut in that field after the crimson clover, this data shows that there is no deleterious effect on the peanut yields by planting immediately following a leguminous cover crop as a one-time occasion.