

COTTON RESEARCH ANNUAL REPORT
Alabama Cotton Commission

PROJECT TITLE: "NITROGEN FERTILIZER SOURCE, RATES, AND TIMING FOR A COVER CROP AND SUBSEQUENT COTTON CROP"

AGREEMENT NUMBER: ALCTNCOM-NITROGEN FERTILIZER

PRINCIPAL INVESTIGATOR(S):

Kip Balkcom Research Agronomist USDA-ARS Phone: (334) 844-4666 FAX: (334) 887-8597 EMAIL: balkcks@auburn.edu	Francisco Arriaga Soil Scientist USDA-ARS Phone: (334) 844-0851 FAX: (334) 887-8597 EMAIL: arriafj@auburn.edu	Charles Mitchell Extension Soils Specialist Department of Agronomy and Soils Phone: (334) 844-5489 FAX: (334) 844-3945 EMAIL: mithc1@auburn.edu
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Dennis Delaney Extension Specialist Department of Agronomy and Soils Phone: (334) 844-4107 FAX: (334) 844-4586 EMAIL: delandp@auburn.edu	Jason Bergtold Agricultural Economist USDA-ARS NSDL Phone: (334) 844-0864 FAX: (334) 887-8597 EMAIL: jbergtold@ars.usda.gov
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PERFORMING INSTITUTION: USDA-ARS NSDL, Auburn, AL and Auburn University, Auburn, AL

PROJECT OBJECTIVE:

- 1 - Compare N fertilizer sources, rates, and time of application for a rye winter cover crop to determine optimal biomass production for conservation tillage production.
- 2 - Compare recommended and no additional N fertilizer rates across different biomass levels for cotton.
- 3 - Determine the effect of residual N applied to the cover crop across two N fertilizer rates for cotton.

PLAN OF WORK:

Nitrogen sources, rates, and time of application were implemented at the Wiregrass Research and Extension Center (WREC) in Headland, AL. Biomass cover treatments were arranged in a split-split-plot design with 4 replications. At cotton planting, the eight row plots were split with one side receiving 90 lb N ac⁻¹ at sidedress and the other side receiving no additional N.

Time of application

1. Fall
2. Spring

Nitrogen Source

1. Commercial fertilizer
2. Poultry litter

Nitrogen Rates

- | | |
|------------------------------|----------------------------|
| <u>Commercial fertilizer</u> | <u>Poultry litter</u> |
| 1. 0 lb ac ⁻¹ | 1. 0 ton ac ⁻¹ |
| 2. 30 lb ac ⁻¹ | 2. 1 ton ac ⁻¹ |
| 3. 60 lb ac ⁻¹ | 3. 2 tons ac ⁻¹ |
| 4. 90 lb ac ⁻¹ | 4. 3 tons ac ⁻¹ |

REPORT:

A rye cover crop was drilled across the experimental area on Nov. 19, 2005 at the WREC. Rye was seeded at 90 lb ac⁻¹. Plot size was 24 ft. (8-36 inch rows) wide and 40 ft. long. Fall poultry litter treatments were applied on the same day the cover crop was planted. Commercial fertilizer was applied on Dec. 12, 2005 after stand establishment. The spring applications of commercial fertilizer and poultry litter were applied on Feb. 8, 2006. Poultry litter application rates were designed to approximate commercial fertilizer rates based on total and estimated available N supplied in the litter (Table 1). Biomass samples were collected on April 20, 2006 by collecting all aboveground plant biomass from two 2.7 ft² areas within each plot. Immediately prior to cotton planting, all plots, were in-row subsoiled with a KMC Ripper Stripper® equipped with rubber pneumatic tires to minimize surface disruption. DPL 555® BG/RR was planted on May 15, 2006. The eight row plots were split and corresponding cotton plots were sidedressed on June 22, 2006 with 90 lb N ac⁻¹, while other plots were not fertilized, in order to estimate any residual effects from the poultry litter.

Table 1. Total and available N applied in the fall and spring from poultry litter on a dry weight basis at the Wiregrass Research and Extension Center in Headland, AL during the 2005-2006 growing season.

Time of application	Rate (tons ac ⁻¹)				Rate (tons ac ⁻¹)			
	0	1	2	3	0	1	2	3
	Total N				Available N†			
	-----lb ac ⁻¹ -----							
Fall	0	77	154	231	0	39	77	116
Spring	0	73	146	219	0	37	73	110

† Available N based on an estimate of 50% total N available during the first year of application.

Rye biomass production

First year rye biomass results indicate that N fertilizer source or time of application had no effect on measured biomass levels. Rate was highly significant. There was no rate by source interaction, but Fig. 1 illustrates the corresponding biomass levels across N rates for the different sources. Figure 1 shows that corresponding N rates between N sources produced very similar biomass levels and that source was not a factor during the first year. Biomass production was maximized at 60 lb N ac⁻¹ for commercial fertilizer and 2 tons poultry litter ac⁻¹. Although N timing was not significant, fall applied N, regardless of source, produced 26% more biomass than spring applied N.

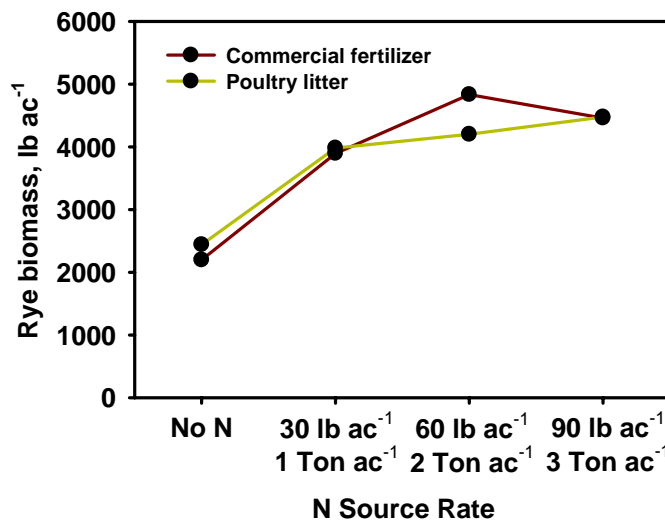


Figure 1. Rye biomass production attributed to source and rate of application during the 2005-2006 winter growing season at the Wiregrass Research and Extension Center in Headland, AL.

Plant heights and whole plant biomass were collected from each plot on July 19, 2006. Plant heights were the average of 10 randomly selected plants within each plot. Whole plant biomass consisted of clipping the aboveground portion of all the plants within a 1-meter section of a non-harvest row from each plot. The plant material collected was dried at 55 degrees Celsius for 72 hours and weighed to estimate the plant biomass of each plot. The experimental area was defoliated with 1.5 pt/ac of Finish® on Oct. 10, 2006. All plots were harvested with a spindle picker equipped with a bagging attachment on Oct. 19, 2006. A sub-sample of seed cotton from each plot was ginned in a 20-saw tabletop micro-gin to determine ginning percentage. Lint yields were determined by weighting lint and seed collected from each plot and multiplying corresponding seed cotton by the ginning percentage of each plot. No fiber properties will be reported at this time.

Plant heights and biomass

The residual effects of poultry litter or commercial fertilizer for the cotton were estimated by applying no additional N or 90 lb N ac⁻¹ across the plots. Time of application or source of fertilizer had no effect on biomass levels; therefore, these variables were not accounted for in the analysis related to residual fertility. Rate applied to the cover crop was significant and served as the main plot, while the two N rates applied to cotton were used as subplots for the analyses of residual N. Both plant heights and plant biomass were measured at mid-bloom. No interactions existed between cover crop N rates and cotton N rates for either of these variables. The continuous mineralization of N from the poultry litter is evident across plant heights when values are compared to no N applied (Table 2). The highest rate of poultry litter produced the greatest plant biomass compared to no additional N or any of the commercial fertilizer rates. In some cases, the lower poultry litter rates produced greater plant biomass compared to commercial fertilizer. Most of the cover crop N rates required additional N to maximize plant heights and biomass at mid-bloom based on the response to 90 lb N ac⁻¹ applied to the cotton at sidedress (Table 2).

Table 2. Plant heights and biomass at mid-bloom measured across cover crop N rates and cotton N rates in 2006 at the Wiregrass Research and Extension Center in Headland, AL.

Cover crop N rate	Plant height	Plant biomass
	-----inches-----	-----lb ac ⁻¹ -----
No N applied	28.2	1693
1 ton ac ⁻¹	29.8	1899
2 tons ac ⁻¹	30.4	1718
3 tons ac ⁻¹	31.3	2128
30 lb ac ⁻¹	28.6	1743
60 lb ac ⁻¹	28.2	1467
90 lb ac ⁻¹	28.9	1555
LSD _{0.05}	1.6	365
Cotton N rate		
0 lb ac ⁻¹	28.1	1569
90 lb ac ⁻¹	30.7	1917
LSD _{0.05}	0.7	167

Lint yields

Although not significant, there was a strong trend ($Pr > F = 0.1035$) for an interaction between cover crop N rates and cotton N rates across lint yields. The addition of 90 lb N ac⁻¹ benefited the cotton crop, which was evident by the substantial increase in lint yields observed, regardless of the cover crop N rate (Table 3). It should be noted that lint yields presented represent one year and the residual effects could become greater as the study continues. Interestingly, 3 tons of poultry litter ac⁻¹ applied to the cover crop resulted in similar yields to 90 lb N ac⁻¹ at sidedress with no N applied to the cover crop. Sidedress applications of N are usually preferred because N is applied at the time when cotton plants can readily take up the N, which minimizes potential losses. Poultry litter can be considered a slow release fertilizer that when applied in the fall benefits the cover crop and the cotton crop. Cover crop biomass is maximized and cotton N rates could at least be

partially reduced. However, the combination of poultry litter and commercial fertilizer to maximize biomass production and cotton yields has been difficult to quantify. The continuation of this experiment will provide information related to the interactive effects of cover crop and cash crop fertilization.

Table 3. Lint yields measured across cover crop N rates and cotton N rates during the 2006 growing season at the Wiregrass Research and Extension Center in Headland, AL during the 2005-2006 growing season.

Cotton N rate	Cover crop N rate						
	0	Poultry litter (tons ac ⁻¹)			Commercial N (lb ac ⁻¹)		
		1	2	3	30	60	90
0	1141	1364	1363	1534	1178	1305	1413
90	1564	1659	1670	1674	1603	1578	1589

LSD_{0.05} = 213