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BROILER LITTER AS A SUBSTITUTE N SOURCE FOR COTTON IN MISSISSIPPI UPLANDS

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Abstract

Mississippi broiler industry produces about one million tons of broiler litter annually. Producers are responsible for disposing of the litter in an environmentally safe manner. Most of the litter is disposed of through land application that must comply with federal, state, and local laws. The upland soils of Mississippi need annual applications of N, P, and K for cotton production. A study comparing litter with inorganic nitrogen was started in 2001 at the North Mississippi Branch Station. The soils were silty loam having less than one-percent organic matter. Nitrogen rates of 0, 30, 60, 90, and 120 lbs N/A and broiler litter rates of 2, 4, and 6 tons/A were compared in a randomized complete block design with four replications. Litter rates of 2, 4, and 6 ton/A represents approximately 40, 80, and 120 lb N/A. Results suggest broiler litter of four tons/A provided the needed nitrogen requirement for cotton production in the upland soils.

Introduction

Mississippi's broiler industry has continued to expand in the past two decades until Mississippi ranks fourth in the nation in broiler production. Today Mississippi sells approximately one billion birds annually with a farm gate value of one and half billion dollars. The large numbers of birds have resulted in one million tons of broiler litter for annual disposal. Producers must manage and dispose of the litter in a manner that is environmentally safe. Disposal of litter most often takes place on the farm where it is generated with the bulk of the litter spread on grasses and forages. In some cases, the broiler industry has slowed or stopped from the lack of an alternative for litter disposal. An alternative to on farm disposal is the application of litter on crops that demand large volumes of nutrients. Upland soils require annual applications of N, P, and K for successful cotton production. Nitrogen from broiler litter has been used to replace inorganic nitrogen by a limited number of cotton producers. However, most remain skeptical that broiler litter will replace the need for inorganic nitrogen for cotton. In our study we compared three rates of broiler litter to five rates of inorganic nitrogen for cotton on upland soils in the Brown Loam area of Mississippi to determine if nitrogen from the broiler litter would substitute for the need of inorganic nitrogen applications.

Materials and Methods

In the fall of 2000, the cotton stalks were shred in the plot area immediately after harvest. After the shredding of the stalks, the plot area was hipped and the beds knocked down. The entire plot area was sprayed the last week of March with Roundup (glyposate) 1.0 lb ai/A. A commercial blend of fertilizer 0-78-90/A was broadcast over the entire plot area in mid-April. The experimental design was a randomized complete block design with 4 replications. Plots were eight 38-inch rows, 50 feet long. Litter rates of 2, 4, and 6 tons/A, which represents approximately 40, 80, and 120 lb N/A, were spread over the designated litter plots in late April of 2001 and 2002. Cotton, Paymaster 1218 BG/RR in 2001, and Sure-Grow 215 BG/RR in 2002 was planted the first week of May at the rate of four seeds per foot of row. Terrachlor Super X 18.8G (Pentachloronitrobenzene) 1.5 lb ai/A + Temik 15G (aldicarb) 0.75lb ai/A were applied as granules in furrow at planting. Cotoran (fluometuron) and Gramoxone (paraquat) at 1.0 lb ai/A + 0.625 lb ai/A were broadcast sprayed over the entire plot area behind the planter. Roundup 1.0 lb ai/A was broadcast sprayed over the plot area at two weeks after emergence. Nitrogen fertilizer rates (AN 34% N) of 0, 30, 60, 90, and 120, lbs N/A were applied on designated plots two weeks after emergence. Nitrogen was applied using a tractor mounted Gandy calibrated for each N rate. Bidrin (dicrotophos) 0.2 lb ai/A was applied at 4, 6, and 8 weeks after planting. Staple (pyrithiobac) at 1.02 oz ai/A was broadcast over the entire plot area in early June. Bladex (cyanazine) at 0.75 ai/A was directed sprayed over the plot area as a layby treatment. Chlorophyll fluorescence measurements were made using a Minolta Spad 502 hand held fluorescence meter on the leaves of twenty plants selected at random within each plot and averaged across the plants for a single plot reading. Leaf readings were taken on the fifth expanded leaf below the terminal of the plant. Cotton was defoliated in late September 2001, and early October in 2002 using Prep (ehtephon) 1.5 lb ai/A + Def 6 (tribufos) 1.5 lb ai/A. Harvest was completed in mid-October both years and stalks were shred immediately after harvest.

Results and Discussion

The recommended rate of Nitrogen for cotton production in upland soils of the Brown Loam is 75 lb N/A. Chlorophyll fluorescence Minolta Spad 502 readings at the first week of bloom for the two N rates below 75 lb/A were 50% higher than the 0

N/A rate. For the two rates above 75 lb N/A chlorophyll readings were 57% higher than the 0 N/A rate. Minolta Spad 502 readings at the fourth week of bloom for the two N rates below 75 lb N/A were 41.1% higher than the 0 N/A rate. For the two rates above 75 lb N/A, the Spad readings were 40.6 % higher than the 0 N/A rate. Broiler litter plots Spad readings were 30% higher at the first week of bloom than the 0 N/A rate. Spad reading for the 0 N/A decreased by 25% from the first week of Bloom to the fourth week of bloom. Minolta Spad readings between the first and fourth week of bloom for the broiler litter plots were decreased 7.9%, 5.6%, and 10.6% for the 2, 4, and 6 tons/A rate, respectively. The decrease in Spad readings during the growing season for all litter rates was much less than the inorganic nitrogen Figure 1 and 2.

Yields were lower for 0 N/A than the inorganic nitrogen or litter rates Figure 3. Plots receiving the 30 lb N /A were lower than the 60, 90, 120, and 150 lb N/A and the 2, 4, and 6 tons of litter/A. Yields were lower for 0 lb N/A than the 2, 4, and 6 tons/A for both years. There was no yield difference in the 2, 4, and 6 tons/A and the 60, 90, and 120 lbs N/A in both years Table 1.

Table 1. Lint yields for 2001 and 2002 comparing inorganic N rates and Litter rates.

Nitrogen/Litter	Lint/Acre 2001	Lint/Acre/2002	Average Lint/Acre
Nitrogen 0 lb/ac	314	383	348
Nitrogen 30 lb/ac	497	501	499
Nitrogen 60 lb/ac	769	677	723
Nitrogen 90 lb/ac	891	722	806
Nitrogen 120lb/ac	945	688	817
Litter 2 tons/ac	710	693	702
Litter 4 tons/ac	871	697	784
Litter 6 tons/ac	902	714	808
LSD 0.05	214	112	

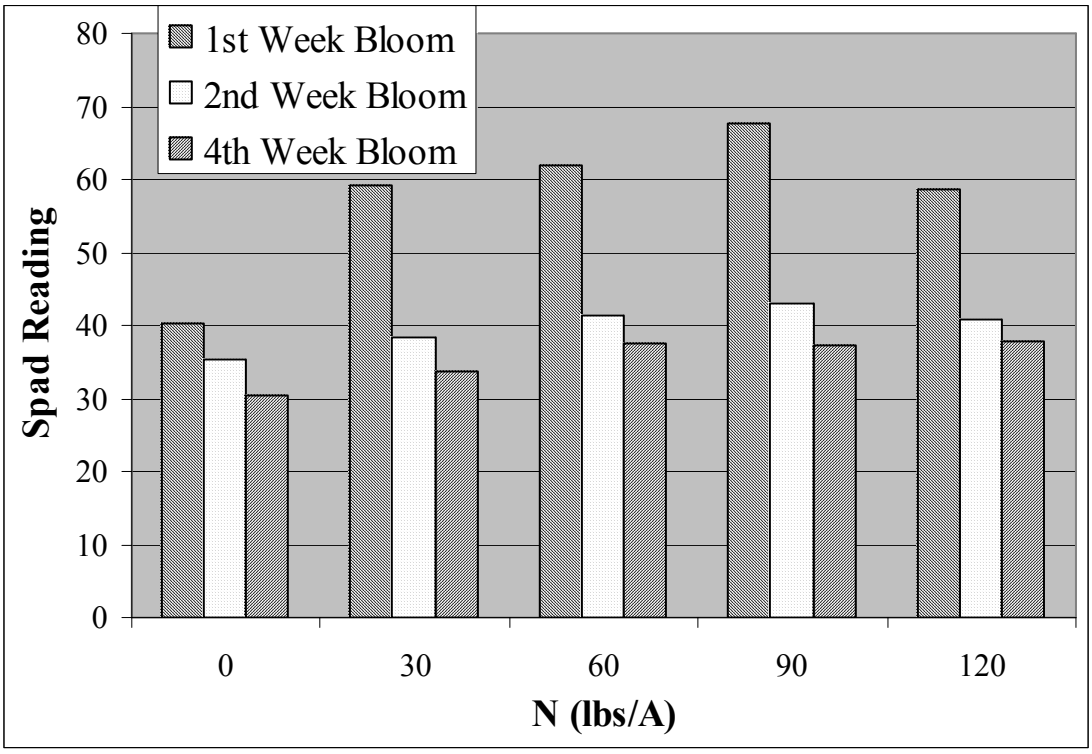

Figure 1. Leaf chlorophyll fluorescence readings for the four N rates.

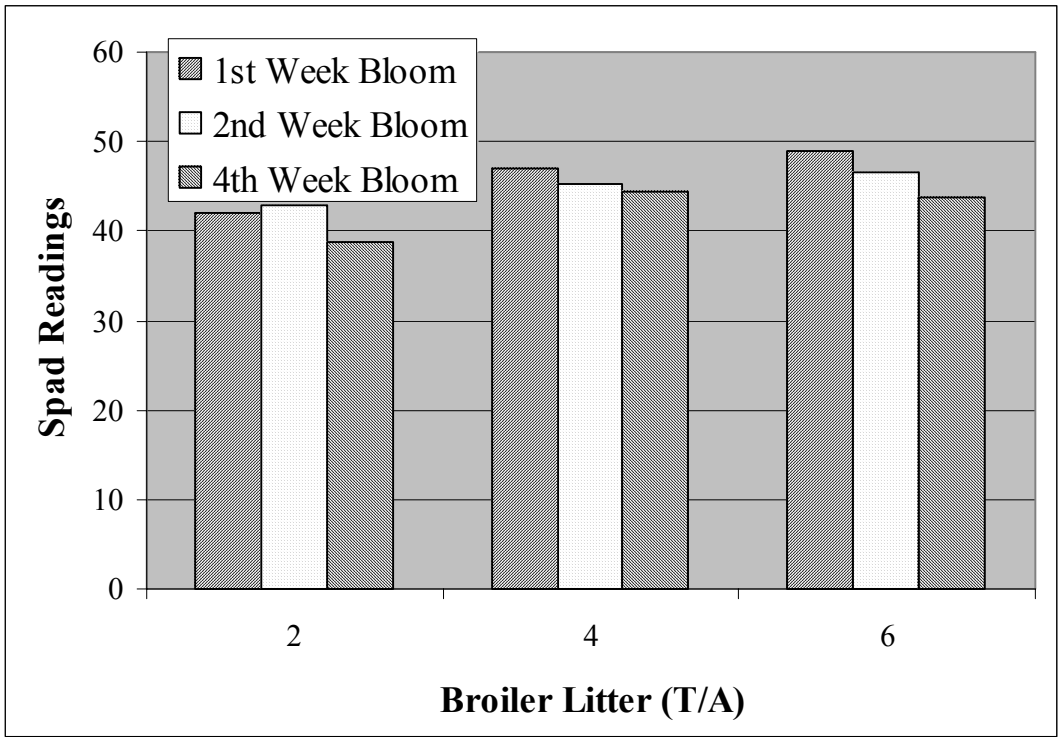

Figure 2. Leaf chlorophyll fluorescence readings for the three broiler rates.

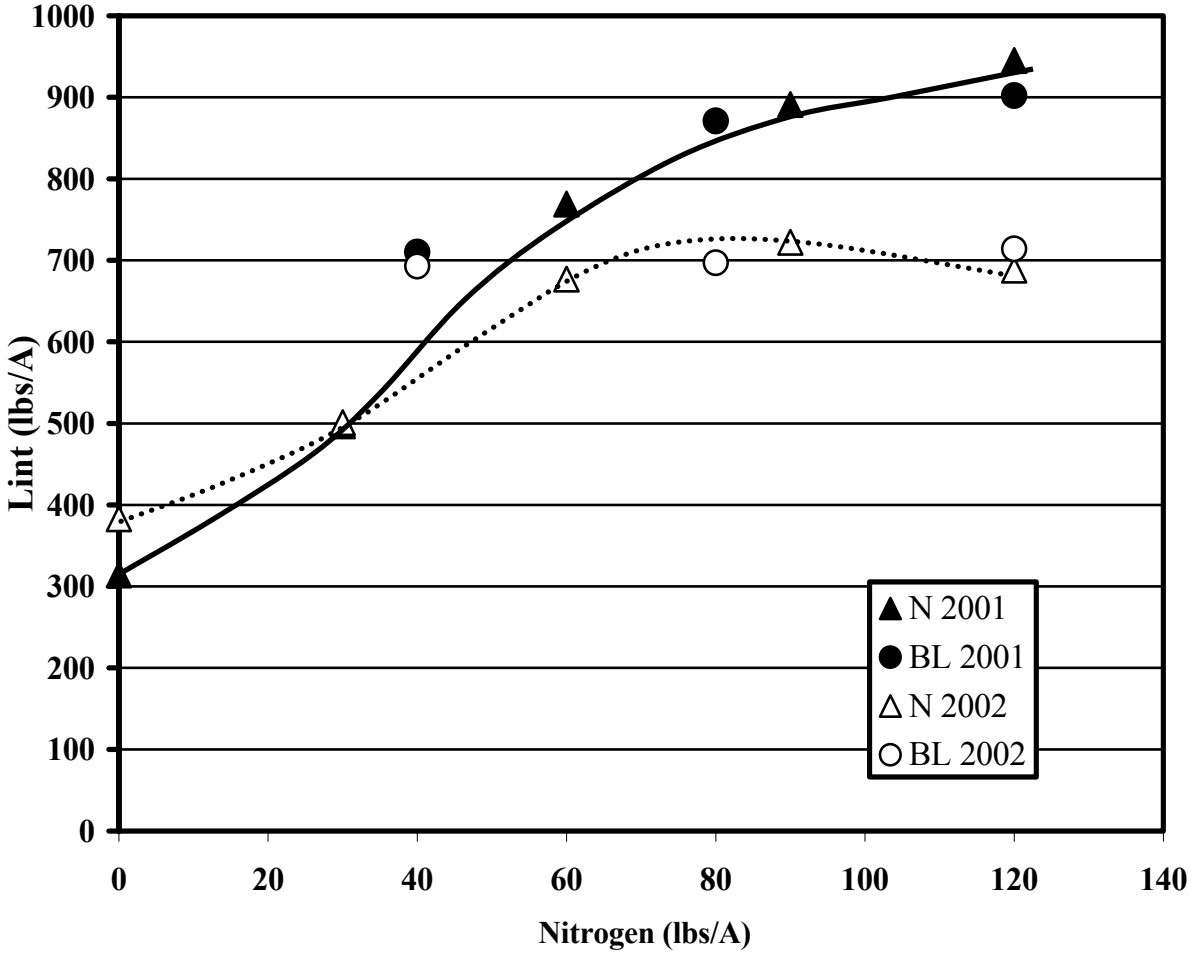

Figure 3. Cotton lint yield for 2001 and 2002.