

## **Determining Optimum Sidedress Nitrogen Requirements for Corn Receiving Preplant Applications of Broiler Litter**

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**Summary of Results of 2007 Study – Prepared January 22, 2008**

Studies were conducted in Lamar, Washington and Franklin counties in 2007 to assess optimum rates of commercial nitrogen to apply to corn as a supplement to broiler litter. Litter was not incorporated after application in Franklin and Lamar counties, but it was incorporated in Washington county. The results of this research project will be presented in two sections – one for the studies done in northwest Alabama and one for the study done in southwest Alabama.

**Northwest Alabama Activities and Results-** Four tests were conducted in northwest Alabama. All litter used contained 3 to 3.4% N. All tests were planted in 30 inch rows and planted with Pioneer 33M57. All preplant commercial N was applied as liquid 32% N-Sol using a John Deere Hi-Cycle. All sidedress N was applied as ammonium nitrate using a RoGator 1254C spreader. A non-irrigated test was conducted in Franklin county and another non-irrigated test was conducted in Lamar county. The seeding rate for the dryland tests was 28,000 seed per acre. Two irrigated tests were conducted in Lamar county under adjacent pivots, near the dry land study in that county. The seeding rate in the irrigated tests was 33,000 seed per acre. General information about these studies is given in Table 1. The plots in the dry land study in Lamar county all received 2 tons of litter and either 0, 40 or 80 pounds of sidedress N. There were 4 replications of each treatment with individual plots 24 rows wide and 355 to 691 feet long (0.24 to 0.48 acres). In the dry land study in Franklin county 7 plots received 75 pounds of preplant N and another 80 pounds of sidedress N. Another 7 plots received the same amounts of fertilizer plus 2 tons of litter per acre applied preplant. Plot size was 9 to 12 rows wide and 821 to 922 feet long (0.42 to 0.635 acres). In one irrigated test, plots received 100 pounds of preplant N and 2 tons of broiler litter plus 120 pounds of sidedress N. This treatment was compared to plots that received no preplant N, 2 tons of litter and 120 pounds of sidedress N. There were 10 replications of each of the two treatments. Plots were 12 rows wide and ranged in length from 71 feet to 264 feet (0.049 to 0.18 acres). In another irrigated study all plots received 2 tons of broiler litter and 100 pounds of preplant N and either 0, 60 or 120 pounds of sidedress N. There were 3 replications of each sidedress N rate. Plots were 24 rows wide and with row lengths ranging from 100 feet to 507 feet (0.14 acres to 0.7 acres). Due to dry weather corn had to be irrigated under the pivots to provide germination and seedling emergence. Rainfall amounts in Lamar County fields were April – 0”, May- 1”, June- 0.5”, July- 5”. Rainfall amounts at the test field in Franklin county were: last week of April -1”, May -1.1”, June- 0.8”, July-6”. The irrigated studies received 2.5 inches of water /week when natural rainfall did not total this amount. Easter freeze damage thinned the stand significantly in the low lying portions of the non-irrigated test field in Lamar county. Many portions of plots averaged as few as 0.5 plants/row ft. (range 0.35 to 0.58) Stand loss was not a major problem in the

irrigated tests. The Franklin county test field had to be replanted due to the freeze and a mixture of different varieties of seed was used.

**TABLE 1. Planting, Fertilizer and Harvest Information for 2007 Corn/Litter /Commercial N Studies in Northwest Alabama.**

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TEST #	County	Date Litter Applied	Date Preplant N Applied	Date Planted	Date Side-Dressed	Harvest Date
1	Lamar No Irrigat. Variable N	2/25	None applied	3/20	5/2	8/12-13
2	Lamar Irrigated No Preplant Vs. Preplant N	2/24	3/14	3/18	5/3	8/14
3	Lamar Irrigated Variable Side-Dress N	2/24	3/14	3/18	5/3	8/14
4	Franklin Litter vs. No litter	3/1	3/16	3/20 replanted 4/16	5/10	8/24

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**In the dry land study in Franklin county no yield increase was obtained when a fertilizer treatment of 75 lbs of N preplant plus 80 lbs of sidedress N (105.8 bu/ac) was supplemented with 2 tons of litter (104.1 bu/ac). Tissue analysis of leaf samples collected on July 6 showed total N was 2.37% where litter was applied and 2.34% where no litter was applied. In the dry land study in Lamar county 2 tons of litter plus 0, 40 and 80 lbs/ac of sidedress N applications all yielded about 75 bu/acre. Total N from leaf tissue analysis was 2.42%, 2.36%, and 2.49% in the 0, 40, and 80 N plots, respectively. Since rainfall amounts were similar in the Lamar and Franklin**

county non-irrigated tests, the 30 bu/acre yield difference was probably influenced by the thinner stand in Lamar county.

In an irrigated study in Lamar County with 2 tons of litter / acre with 75 lbs of N preplant plus variable sidedress N/acre, average yields for the 3 reps of each treatment were 155.6, 173.3, and 178.1 bu/ac for the 0, 60 and 120 lbs of sidedress N respectively. Leaf tissue analysis showed total N was 2.27%, 2.12% and 2.29% in the 0, 60 and 120 N treatments, respectively. In the other irrigated study that compared the yields of preplant vs. no preplant N, the treatment with preplant N yielded an average of 170 bu/acre and the treatment without preplant N yielded an average of 157 bu/acre, a difference of 13 bu/acre. Leaf tissue analysis showed total N was 2.2% in the no preplant N treatment and 2.46% where preplant N was applied. There were 10 reps of each of these two treatments and the Preplant N treatment out yielded the No Preplant N treatment in 7 of the 10 paired comparisons. The table below shows the different treatments and yields obtained in the irrigated studies.

**Table 2. Irrigated Yields\* in corn fertilized with litter and varying rates of N.**

Treatment #	1	2	3	4	5
<b>Pounds of N or Tons of Litter</b>					
Preplant N	100 lbs	100 lbs	100 lbs	0 lbs	100 lbs
Litter	2 tons	2 tons	2 tons	2 tons	2 tons
Sidedress N	0 lbs	60 lbs	120 lbs	120 lbs	120 lbs
<b>Avg Yield</b>	<b>155.6 bu/ac</b>	<b>173.3 bu/ac</b>	<b>178.1 bu/ac</b>	<b>157 bu/ac</b>	<b>170 bu/ac</b>

- \*Treatments 1,2 and 3 were located under a different (but nearby) pivot than treatments 4 and 5.

**Table 3 summarizes the economic impact of the different fertilizer treatments (under test conditions) assuming value of corn is \$4.50 per bu. and cost of N is 50 cents per lb.**

**Table 3. Economic consequences of irrigated corn production using different amounts of commercial N fertilizer with 2 tons of litter.**

<b>N Input Variables</b>	<b>Additional Cost</b>	<b>Yield Response bu/acre</b>	<b>Value of Corn</b>	<b>Difference of Value Minus Cost/Acre</b>
<b>60 lbs sidedress N + 100 lbs pp N</b>	<b>\$30</b>	<b>17.7</b>	<b>\$79.65</b>	<b>+ \$49.65</b>
<b>120 lbs sidedress N + 100 lbs pp N</b>	<b>\$60</b>	<b>22.5</b>	<b>\$101.25</b>	<b>+ \$41.25</b>
<b>100 lbs preplant N + 120 lbs Sidedress N</b>	<b>\$50</b>	<b>13</b>	<b>\$58.50</b>	<b>+ \$8.50</b>

**This is the first year of this study in which data was derived from irrigated plots and caution must be used in interpreting results. Statistical analysis of the data have not yet been conducted to determine if numerical differences between means are different due to the effect of treatments or experimental error. Under the conditions in which this test was conducted numerical differences in yield indicated the most profitable commercial fertilizer treatment to use with 2 tons of litter was 100 lbs of preplant N plus 60 lbs of sidedress N.**

**Washington County Activities and Results-** Three tons of broiler litter per acre was applied to the plots in alternating strips 80 feet wide and 1200 feet long. A pre-plant commercial fertilizer consisting of 13-40-90 analysis was applied to the other strips. This was replicated four times. The corn hybrid was Pioneer 33M53RR2 and was planted on March 8, 2007. Two hundred pounds of 10-34-0 starter fertilizer was used *on all plots (both commercial fertilizer and all litter-treated plots)*. The corn in the commercial plots was side dressed with 440 lb. of 28-0-0-5. The side dress in the broiler litter plots was Nitrogen at 0, 40 N and 80 N rates. Leaf Tissue Samples taken at mid silk stage. Rainfall was good up until tassel. Three weeks of no rain at that time greatly reduced yields. Estimate 50 % yield loss. Rains came again just as the corn was drying down. Harvest was on August 2, 2007

**Broiler Litter** at the rate of 3 tons per acre was applied. The analysis of this litter was very good. The nutrient content of the litter was Nitrogen 3.18 %, Phosphorous 4.37 %, Potassium 2.38 %, Calcium 2.61 % and Magnesium 0.43 %. One ton of this litter delivers N 64lb., P205 87 lb and K20 48 lb. Three tons delivers N 192 lb., P205, 261 lb., and k20

144 lb. Costs: Broiler litter cost \$25 per ton plus \$6.00 for spreading. Total cost \$31 per ton. **Total Cost for 3 Tons Broiler = \$93 per acre.**

**Commercial Fertilizer** (Farmer’s Choice)

Pre-plant: 13-40-90 costs \$54 per acre

Starter: 10-34-0 + minor elements. Applied 20-64 + Minors costs \$35 per acre

Side-dress: 28-0-0-5. Applied 40 gallons or 440 lb. which delivered Nitrogen 123 lb. and Sulfur 22 lb. per acre. Cost \$56 per acre.

Total N = 156 lb., Total P = 104 lb., Total K = 90 lb.

**Total Cost for Commercial = \$145 per acre.**

**Comparison of Nutrients:**

	<b>Nitrogen</b>	<b>Phosphorous</b>	<b>Potassium</b>	<b>Cost</b>
<b>3 Tons Broiler</b>	<b>192</b>	<b>261</b>	<b>144</b>	<b>\$93</b>
<b>Commercial</b>	<b>156</b>	<b>104</b>	<b>90</b>	<b>\$145</b>

**Cost per treatment:**

1. Commercial (Farmer’s Choice) = \$145 = \$145
2. 3 Tons Broiler + 0 Nitrogen = \$ 93 + starter = \$128
3. 3 Tons Broiler + 40 N = \$111 + starter = \$146
4. 3 Tons Broiler + 80 N = \$129 + starter = \$164

Table of Test Results

Treatment	Bushels/A adjusted to 15.5 % Moisture	Difference in Yield	Cost of Treatment	Difference in Cost of Treatment	Profit @ \$4.50
Commercial	68.14	+ 5 Bu/A	\$145	\$17	\$ 5.5 Profit
Broiler + 0	63.24		\$128	\$ 0	\$ 0 loss
Broiler + 40	63.17		\$146	\$18	\$ 18 loss
Broiler + 80	63.45		\$164	\$36	\$ 36 loss

Commercial N cost \$0.45 per lb.

Starter fertilizer was added to the broiler litter plots as well. Typically when using broiler litter no starter fertilizer is added.

**Results:** *This is the first year that broiler litter had ever been applied to the the land used in this study.. Research conducted by Dr. Charles Mitchell showed that for dryland corn three tons of broiler litter with a 3-3-2 analysis provided yields equal to or better than corn fertilized with an equivalent rate of commercial fertilize when the litter was applied within 30 days of planting. The yield obtained in this study in all three litter treatments was the same and showed that no yield benefit was obtained by applying supplemental sidedress nitrogen. Yield obtained using commercial fertilizer was numerically greater than that obtained using broiler litter. This average yield difference of 5 bushels per acre resulted in a net return of \$5.50 per acre for the commercial fertilizer plot in comparison with the broiler litter plot that was not sidedressed with*

*supplemental commercial nitrogen. Statistical analysis of the data have not yet been conducted and the analysis will provide additional insight into the probability that this yield difference is due to the effect of the treatment (commercial fertilizer vs litter) or due to experimental error (i.e. possible variability in the land on which different treatments were assigned).*

