

2007 Project Report

Title: Evaluation of Variable-Rate Seeding for Cotton

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Objective: The objective of this project is to evaluate opportunities for increased yield or profits through variable-rate (VR) seeding for cotton production.

Methods:

The cooperative farmer identified in 2005 allowed for the on-farm study in Northern Alabama to continue during the 2006 and 2007 growing seasons. This farmer utilizes a cotton and corn rotation while also managing center pivot irrigation on a select portion of farmland permitting the comparison of irrigated and dryland cotton production. Selected seeding rates, based on the farmer's traditional seeding rates and recommendations from consultants for both dryland and irrigated fields, included 35K, 50K, 65K, and 80K seeds/ac. A 24-row planter equipped with a VR drive system was used in this study. A study site within each field was blocked to provide 4 replications of the cotton treatments. Treatments were then randomly assigned within each block with a single pass of the planter representing a specific population treatment within the block.

Subsequent to planting, stand counts were measured to determine the actual germinated population. Stand count measurements were gathered on each of the 12-row sections of the planter, collecting counts at 3 or more places along the 12 rows depending upon terrain variability. A cotton picker equipped with an AgLeader yield monitor was used to obtain spatial performance data for each plot. Analyses included summarizing stand counts along with spatially segregating yields based on the various seeding treatments to determine the effect of seeding rate on cotton yields. Yield and stand count data were statistically analyzed, using T-tests and Least Significant Difference ($\alpha = 0.1$) to determine if differences existed between seeding treatments.

Results:

Results showed that stand counts were all significantly lower, in both irrigated and non-irrigated fields than the targeted seeding rate with the exception of one (35,000 seeds/ac treatment within the non-irrigated plot). The seed populations being consistently lower than the target application rate may be tied to calibration and planter setup along with poor emergence. However, the reason for the lower than expected actual populations is unknown. Statistically comparing the actual populations indicated that there were not any significant differences between the four average populations for field 1, however differences were reported in field 2 (Table 1). In field 2, the actual population of the 35K treatment was significantly different than the actual population of the 50K and 65K treatments. These results for each field were expected considering the differences between the seeding rate treatments.

In the non-irrigated field, there was not a significant difference in lint yield between the four seeding rates (Table 1). These results reflect the same outcomes as in 2005 and 2006 for the non-irrigated field. This result was expected since there was not a significant difference in actual population between the four treatments, a result not reported in 2006. Similarly, for the irrigated

plots, a correlation existed between yield and actual population indicating the importance of seedling emergence on final yield (Table 1).

As expected, irrigated cotton yields were significantly higher than dryland cotton yields. They were around 49% or higher for the various treatments. The value of the average yield response for irrigated cotton was slightly greater than the increased cost, returning on average \$0.50 for every dollar spent on additional 1000 seeds, while yield response on dryland cotton was poor, returning on average, a profit loss (\$-1.25/1000). Further, the change in seeding rate response from one year to the next has been statistically significant; however, extrapolation outside the range of the experiment is not recommended. Profit increase and decrease were determined using the following cost breakdown:

- **Irrigated Cotton:**

Cost of seed: \$2/1000; Yield response: 5-lb lint/1000;

Profit increase (\$.50 cotton): \$2.50-\$2 = **\$.50 per 1000**

- **Dryland Cotton:**

Cost of seed: \$2/1000; Yield response: 1.5-lb lint/1000;

Profit increase (\$.50 cotton): \$0.75-\$2 = **-\$1.25 per 1000**

In summary, similarities were reported for the 2005, 2006 and 2007 growing seasons. On the non-irrigated treatments the actual seeding populations were all significantly less than the target population during the three growing seasons except for the lowest seeding rate (35K) in the 2006 and 2007 growing season. While some significant differences between actual populations did exist in the non-irrigated treatments (80K in 2006), no significant differences in lint yields were reported for the 2005, 2006, and 2007 growing seasons. For the irrigated treatments, a linear correlation existed between lint yield and actual populations and lint yields differing from the non-irrigated results. Finally, lint yields were at least 49% higher on irrigated treatments compared to non-irrigated treatments.

Due to the atypical growing conditions in 2007, it has been decided to repeat this study in 2008 in an effort to draw more conclusive results, particularly within irrigated treatments.

Table 1. Irrigated and Non-Irrigated Data for the 2006 and 2007 Growing Seasons.

Treatment (Seeds/ac)	2007				2006			
	---- Non-Irrigated ----		----- Irrigated -----		---- Non-Irrigated----		----- Irrigated -----	
	Actual (seeds/ac) ¹	Yield (lbs lint/ac)*	Actual (seeds/ac) ¹	Yield (lbs lint/ac)*	Actual (seeds/ac) ²	Yield (lbs lint/ac)*	Actual (seeds/ac) ²	Yield (lbs lint/ac)*
35,000	38,714 a	662 a	27,080 a	984 a	33,251 d	660 c	26,455 d	1383 ab
50,000	32,815 a	657 a	31,508 b	1098 ab	40,874 c	621 c	37,679 c	1093 b
65,000	39,986 a	761 a	42,979 b	1145 b	54,813 b	624 c	47,335 b	1171 b
80,000	56,701 b	765 a	52,490 b	1140 b	62,944 a	645 c	52,199 a	1592 a

¹ Means with similar letters in this column for 2007 indicates they are not statistically different at the 90% confidence level.

² Means with similar letters in this column for field 2 indicates they are not statistically different at the 90% confidence level.

* Mean lint yields with similar letters in each column for fields 1 and 2 indicates they are not statistically different at the 90% confidence level.