

Planting Method and Seeding Rate Evaluation in Graham County

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Abstract

A single field experiment was established in 2001 at the Safford Agricultural Center to evaluate the effects planting method and seeding rate have on plant population and yield of an Upland cotton cultivar Deltapine DP655BR. Two planting methods; planting into moisture (pre-irrigate) and dry plant/water-up, were main effects with three seeding rates of 10, 20, and 30 lbs./acre as sub-effects. These effects were evaluated with respect to stand establishment and yield. Analysis of variance showed no significant differences with respect to planting method for either plant population or yield, so data was combined across main effects. Significant differences were observed in plant population and yield as a function of seeding rate. A linear increase in yield with plant population was observed. These results are not consistent with previous research performed examining plant population effects on yield. This experiment will be conducted again in 2002 in an effort to validate results observed in 2001.

Introduction

Cotton production in the state of Arizona has an extremely wide range of environments. Cotton is produced at elevations that extend from just above sea level to over 4000 feet above sea level. This provides for varying weather conditions throughout the entire season. One particular segment of the production cycle that is affected by these elevational and climatic differences is planting. In the lower elevations, cotton planting may begin as early as the first few weeks in February while the higher elevations may not begin planting until mid-April.

Research has demonstrated the advantages to crop yield by early planting. This, however, needs to be balanced with the risk of planting into conditions with cold soil temperatures, which enhance the probability of seedling disease and mortality. This is of concern in the higher elevations of the state where soil temperatures may be far less than the optimum low of 65°F at planting. Growers will typically plant increased rates of seed in order to insure a sufficient stand of cotton seedlings. When conditions are optimum for seed germination and emergence the high seeding rate can result in plant populations of over 120,000 plants per acre (ppa). Research has also indicated that higher populations of over 75,000 ppa or below 20,000 can lead to decreased yields (Silvertooth, et al., 1994 and Norton, et al., 1995).

Cotton is typically planted in one of two ways. The first and most common method in the upper Gila River Valley is to pre-irrigate and plant into moist soil. The second method involves preparing the seedbed and planting the seed into dry soil and then irrigating to induce germination. This technique has not been widely used in the region due to weed control difficulties associated with weed seed germination along with cotton germination. With the introduction of glyphosate tolerant varieties the latter planting method is gaining in use and acceptance. Results from other research have shown that temperature experienced by the seed is different for the two different planting methods (Norton and Silvertooth, ???).

The purpose of this study was to examine the effects of the two planting methods and seeding rate on plant population establishment and eventual yield of the crop.

Materials and Methods

A field trial was established which consisted of a split plot within a randomized complete block design with planting method as the main effects and seeding rate as the sub-unit effects. Plots consisted of four, 36'' rows extending the full length of the irrigation run (200 feet). Main effect treatments consisted of both a pre-irrigated and planted into moisture, and dry planted then irrigated to germinate the seed. Sub plots consisted of three different seeding rates of 10, 20, and 30 pounds of seed per acre. Plots were planted on 24 April. Temperature data loggers were used to monitor soil temperature near seed placement for both planting methods. Yield estimates were made by harvesting the entire four row plots at season end and weighing in a boll buggy equipped with load cells. Data for plant population and yield were analyzed in accordance with procedures outlined by Gomez and Gomez (1994) and the SAS Institute (1999).

Results and Discussion

Table 1 shows ANOVA results for both plant population and yield with respect to main and sub-effects. Analysis of variance (ANOVA) for both the plant population and yield data revealed no significant differences with respect to planting method (main effect). This could be in part due to the fact that the pre-irrigated main plots had to be re-irrigated after planting in order to obtain seed germination and emergence because the soil had dried out prior to planting. Since the main effects were not significant, data was pooled across main effects. Table 2 shows the results of the ANOVA procedure for the pooled data for plant population. There were no significant differences among measured plant populations. Deltapine DP655BR was the cultivar planted which has an estimated 4350 – 5550 seeds per pound. Using these estimates, percent germination ranged from 44-56%, 62-79%, and 68-87% for the 10, 20, and 30 lbs. seeding rates, respectively. A higher germination rate was obtained with the higher seeding rates.

Soil temperature was monitored in each of the subplots at the location of seed placement. Due to technical errors in the equipment being used, that data was lost and will not be presented in this report. That data will be collected in next years' study.

Yield results differed somewhat from other research performed in Arizona with respect to plant population evaluation (Figure 1 and Table 3). A positive linear relationship in yield and seeding rate was observed. Overall yields of this study were also down compared to other areas of the farm. Another factor to consider is variety effects. Some varieties will perform better under higher populations than others. Deltapine DP655BR is a columnar-type variety that typically will respond better under higher plant population conditions. This experiment will be conducted again in the 2002 season in an effort to validate results obtained in 2001. A similar experimental design will be employed for 2002 with the exception of possibly expanding the varieties evaluated from one to two.

Table 1. ANOVA results for overall data set Safford Agricultural Center, 2001.

Effects	OSL*
Main (Planting Method)	0.2828
Sub (Seeding Rate)	0.0030
Interaction (Planting Method * Seeding Rate)	0.1205

*OSL = Observed Significance Level

Table 2. ANOVA results for plant population from pooled data set Safford Agricultural Center, 2001.

Seeding Rate (lbs. seed/acre)	Population (plants/acre)
10	24,250 c
20	69,142 b
30	114,000 a
LSD*	44,500
OSL¶	0.0001
CV (%)§	21.88

* Means followed by the same letter are not significantly different according to a Fisher's LSD means separation test.

¶OSL – Observed Significance Level

§ C.V.(%) – Coefficient of Variation

Table 3. ANOVA results for lint yield from pooled data set Safford Agricultural Center, 2001.

Seeding Rate (lbs. seed/acre)	Lint Yield (lbs. lint/acre)
10	733 b
20	813 ab
30	888 a*
LSD*	114
OSL¶	0.0335
CV (%)§	13.34

* Means followed by the same letter are not significantly different according to a Fisher's LSD means separation test.

¶OSL – Observed Significance Level

§ C.V.(%) – Coefficient of Variation

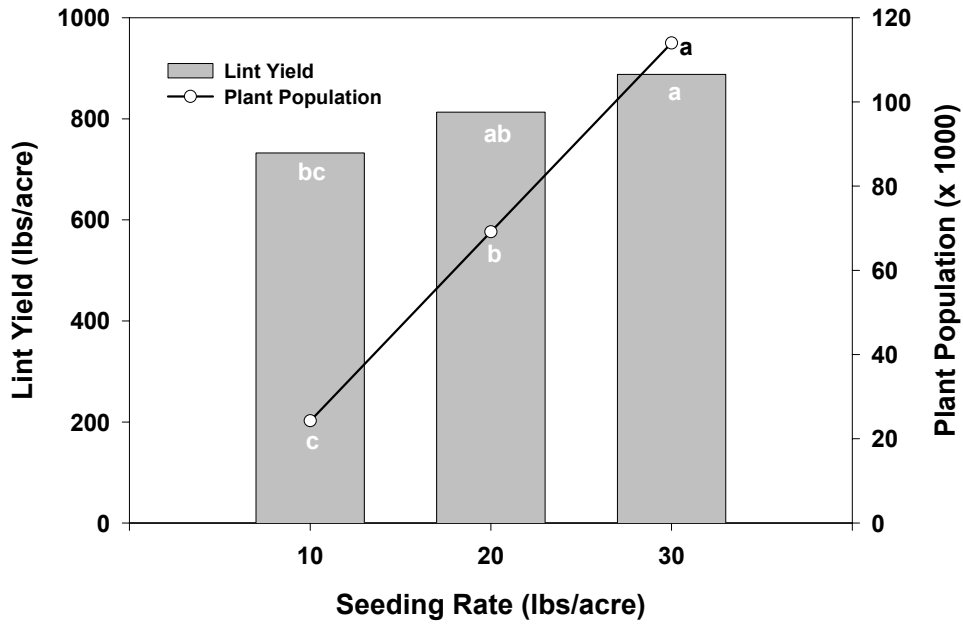


Figure 1. Yield and plant population results for each of the three seeding rates, Safford Agricultural Center, 2001.