2002 Planting Date by Variety Evaluation in Graham County

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Abstract

A single field study was established during the 2002 growing season to evaluate the effects of planting date (PD) on the yield and fiber quality characteristics of several cotton varieties commonly grown in the Upper Gila River Valley of Safford. Seven varieties were chosen for evaluation in 2002 ranging from early to medium-full varieties. These seven varieties were planted on three separate planting dates (2 April, 15 April, and 3 May) in a split-plot within a randomized complete block design with four replications. Overall analysis of variance revealed significant differences due to PD (OSL=0.0291) but no significant differences among varieties (OSL=0.5164) or in the interaction between PD and variety (OSL=0.4052). Four of the varieties evaluated produced the highest yield with the later PD (3 May). The remaining three varieties performed best with the 2nd PD (15 April).

Introduction

There are numerous factors that contribute to the realization of a successful cotton crop in Arizona. Two major management decisions, variety selection and planting date management can have a profound effect on the development and final outcome of the crop. Selection of a specific variety will have a large impact on the way in which planting date should be managed. Similarly, the time frame in which a crop can be planted due to weather and/or other circumstances should have a large impact on the selection of a suitable variety.

Previous research in Arizona has shown that delayed plantings often result in higher vegetative growth tendencies at the expense of yield. Optimum planting date windows have been developed for different variety maturity groups (Figure 1) based upon heat units accumulated from January 1 (Silvertooth et al., 1989; Silvertooth et al., 1990; Silvertooth et al., 1991; Silvertooth et al., 1992; Silvertooth et al., 1993; Silvertooth et al., 1994; Unruh et al., 1995; Norton et al., 1997; Silvertooth et al., 1997, and Silvertooth et al., 1998). Planting date management not only has a large effect on crop growth, development, and yield but it also impacts insect pest management (Brown et al. 1992, 1993, 1994, 1995, 1996, 1997, and 1998). Reduced season management, of which early planting plays a major role, has become increasingly important in recent years. The ability to plant and establish a crop early, carry it through the primary fruiting cycle in a timely and efficient manner, followed by early termination; has become increasingly important with increased late-season insect pressures in Arizona. This approach to earliness management has also been important in terms of avoiding inclement weather conditions commonly associated with the summer monsoon season, which creates higher humidities (higher dew point temperatures) and higher night temperatures, resulting in accelerated rates of fruit loss and abortion (Brown and Zeiher, 1997).

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Another method used for insect pest management is delayed planting. Delayed plantings have been utilized by many producers in some parts of Arizona to aid in the management of pink bollworm (PBW, Pectinophora gossypiella (Saunders)) populations. Delayed plantings are intended to encourage suicidal emergence of overwintering PBW populations, theoretically lowering early season infestation levels. However, with the increasing use of transgenic cotton varieties that provide resistance to PBW pressures this method of pest management is becoming less common.

The objective of this study is to further evaluate planting date windows and use the information for the validation and refinement of current UA Extension agronomy recommendations particularly as they apply to the higher elevations of southeastern Arizona.

Materials and Methods

A study was conducted in 2002 at the University of Arizona Safford Agricultural Center to investigate the effects of planting date on yield and fiber quality characteristics of seven different commercially available varieties. The experimental design was a split-plot within a randomized complete block design. The main-plots consisted of three planting dates with sub-plots being the seven different varieties. Each sub-plot consisted of 4, 36-inch rows that extended approximately 40ft. Planting dates were planned so as to have three representative points along the recommended planting date range (Figure 1). Table 1 summarizes planting dates and respective heat units accumulated since 1 January (HU/1Jan., 86/55^{o}F thresholds). Varieties selected for this study (Table 2) ranged in maturity from an early, determinate variety (SG215BR) to more indeterminate varieties (DP655BR), as classified by the seed companies. Plots were planted into moisture for all varieties and planting dates. All inputs such as fertilizer, water, and pest control were managed on an as-needed basis. Climatic conditions were also monitored using an Arizona Meteorological Network (AZMET) site located at the station. Lint yields were obtained for each treatment by harvesting the center two rows of each plot with a two row mechanical picker. Results were analyzed statistically in accordance to procedures outlined by Steele and Torrie (1980) and the SAS Institute (SAS, 1998).

Results and Discussion

Soil temperatures at the time of the first PD were less than ideal for seed germination and stand establishment (Figure 2). Minimum soil temperatures hovered around 60^{o}F. Shortly after the first PD a cold front weather system passed over Arizona sharply dropping temperatures to the mid 50's. This weather system severely compromised the first PD on 2 April. Conditions surrounding the second PD (15 April) were much closer to ideal with minimum soil temperatures in the mid 60's. Six days late another cold front moved through Arizona lowering soil temperatures to the high 50's but for a very short time. This provided sufficient time for the seeds to germinate and for seedling emergence. The 3rd PD (3 May) occurred at time when soil temperatures were rebounding from a cold spell. Minimum soil temperatures were only near 60^{o}F at the time of planting but experienced a sharp, steady increase from then on, and within 3 days were in the upper 60's. Similar results in soil temperature patterns were experienced in 2001 (Norton et. al., 2002).

Overall analysis of variance for this experiment revealed significant differences due to the main effects (PD) but neither the sub effect (variety) nor the interaction (PD by variety) were significant (Table 3). A high degree of variability within the study area was experienced as evidenced by the high coefficients of variation (Tables 4 and 5). The analysis of variance for differences among varieties as a function of PD is contained in Table 4. No significant differences among varieties were detected in any of the three PD's. A general trend was observed in that the more full season varieties tended to perform better than the more reduced season varieties regardless of the PD. Analysis of variance for differences among PD as a function of variety is presented in Table 5. Significant differences were only observed in two of the seven varieties. Both ST4892BR and SG215BR had significantly lower yields with the early PD (2 April). Both varieties

are classified as early to early-mid season. They appear to have had a more lingering impact from the cool conditions experienced at planting than the other more indeterminate type varieties. Figure 3 graphically shows the results in lint yield for each of the seven varieties as a function of the three PD's.
Fiber quality data for each of the seven varieties and three PD's is displayed in Table 6. A lack of replicated samples prevented a statistical analysis of the data. However, several trends are evident in the data. In general, fiber micronaire decreases with later plantings. Fiber strength produced a positive relationship with PD. Later PD's resulted in higher fiber strength. Fiber length also demonstrated a positive relationship with PD. Later plantings produced longer fiber.

Summary

Results form this study and previous studies conducted in this valley (Norton et. al., 2002) reaffirm the planting recommendations using soil temperature and heat unit accumulations. Mid-April has proven to be the most effective planting date for the Upper Gila River Valley. More determinate varieties seem to be affected more by the earlier planting conditions that tended to be cooler. This is likely due to the fact that a more determinate variety has less capability to compensate for early season stress placed upon it. This study will be conducted again in the 2003 season to continue to evaluate planting date effects on new and existing varieties.

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Table 1. Planting dates with associated heat units accumulated from January 1 for each planting date, Safford Agricultural Center, 2002.

Planting Dates	Heat Units/Jan. 1 (86/55°F Thresholds)
2 April	341
15 April	525
3 May	779

Table 2. Listing of the ten varieties and their characteristics planted at the Safford Agricultural Center 2002.

Company	Variety	Maturity*
Arizona Cotton Growers Assoc.	AG3601	Mid-Full
Deltapine	DP555BR	Mid-Full
Deltapine	DP5690RR	Mid-Full
Deltapine	DP655BR	Mid-Full
Fiber Max	FM989BR	Medium
Deltapine	SG215BR	Early
Stoneville	ST4892BR	Early-Mid

*As designated by seed company.

Table 3. Overall analysis of variance for main-plot (PD), sub-plot effects (variety), and interaction (PD by variety), Safford Agricultural Center, 2002.

Effect	Observed Significance Level (OSL)
Main Effects (Planting Date)	0.0291
Sub Effects (Variety)	0.5164
Interaction (PD by variety)	0.4052

Table 4. Analysis of variance results for differences among varieties as a function of PD, Safford Agricultural Center, 2002.

Variety	Planting Date		
	2 April	15 April	3 May
	----------Lint Yield (lbs lint/acre)----------		
DP5690RR	1169	1219	1127
DP655BR	1117	1215	1281
FM989BR	1091	1242	1295
DP555BR	1083	1317	1344
AG3601	1032	1157	1140
ST4892BR	995	1365	1315
SG215BR	981	1331	1344
LSD†	NS	NS	NS
OSL§	0.6472	0.4333	0.3100
CV(%)¶	15.1	11.7	12.8

*Means followed by the same letter are not significantly different according to the Fisher's LSD means separation test.
†LSD – Least significant difference
§OSL – Observed Significance Level
¶CV(%) – Coefficient of Variation

Table 5. Analysis of variance results for differences among PD as a function of variety, Safford Agricultural Center, 2002.

Planting Date	Variety AG3601	DP555BR	DP5690RR	DP655BR	FM989BR	SG215BR	ST4892BR
	Lint Yield (lbs. lint/acre)						
2 April	1032	1083	1169	1117	1091	981 b*	995 b
15 April	1157	1317	1219	1215	1242	1331 a	1365 a
3 May	1139	1344	1128	1281	1295	1343 a	1314 a
LSD†	NS	NS	NS	NS	NS	208	263
OSL§	0.1431	0.2507	0.7974	0.5621	0.2199	0.0084	0.0270
CV(%)¶	7.4	17.4	16.1	17.2	12.5	9.9	12.4

*Means followed by the same letter are not significantly different according to the Fisher's LSD means separation test.
†LSD – Least significant difference
§OSL – Observed Significance Level
¶C.V. (%) – Coefficient of Variation

Table 6. Fiber quality results for each PD by variety scenario, Safford Agricultural Center, 2002.

Planting Date	Variety AG3601	DP555BR	DP5690RR	DP655BR	FM989BR	SG215BR	ST4892BR
	Fiber Grade						
2 April	21	31	21	11	21	21	21
15 April	11	11	21	21	31	31	21
3 May	21	11	11	11	11	21	21
	Fiber Micronaire						
2 April	5.1	5.0	5.1	4.7	5.2	5.2	5.4
15 April	5.4	4.9	5.3	4.7	5.1	5.5	5.0
3 May	5.0	4.4	5.0	5.0	4.6	5.4	5.5
	Fiber Strength (g/tex)						
2 April	28.1	26.9	29.3	28.8	28.1	25.5	26.4
15 April	28.7	26.8	28.7	28.7	26.0	25.4	29.1
3 May	28.5	28.7	29.4	29.9	29.7	26.4	27.7
	Fiber Length (1/100 of an inch)						
2 April	110	104	106	110	106	103	104
15 April	105	109	106	111	108	104	103
3 May	108	107	106	112	112	105	109

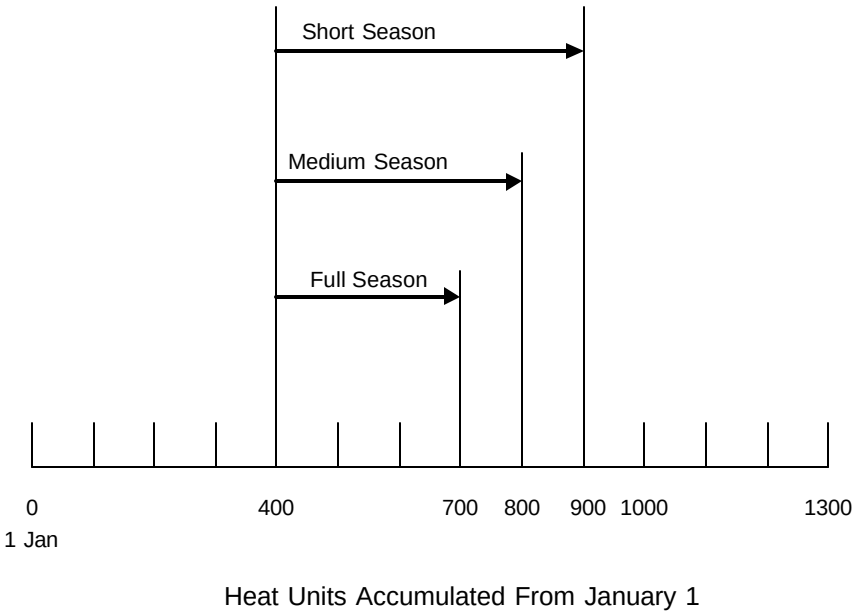

Figure 1. General recommended planting date windows for different maturity type varieties grown in Arizona (J.C. Silvertooth, Univ. of Arizona).

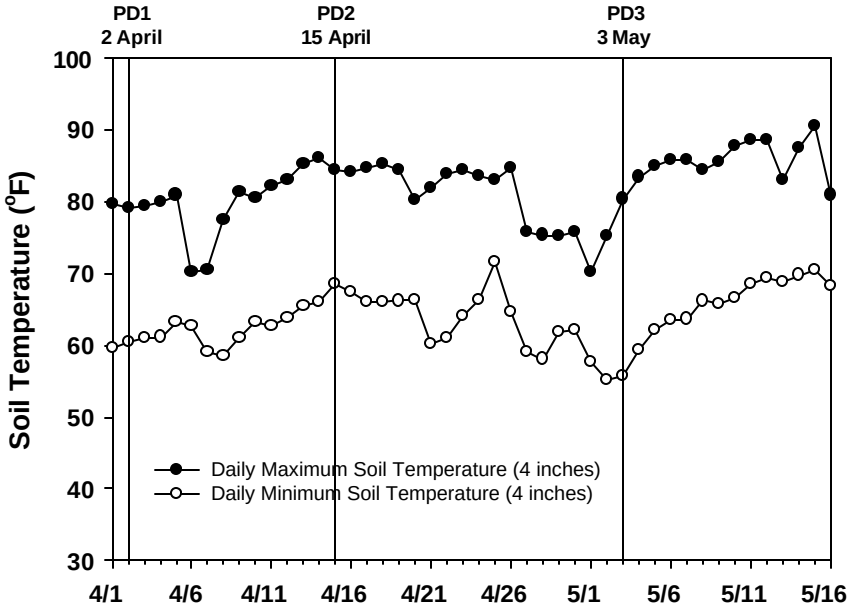

Figure 2. Maximum and minimum soil temperature for the three selected planting dates, Safford Agricultural Center, 2002.

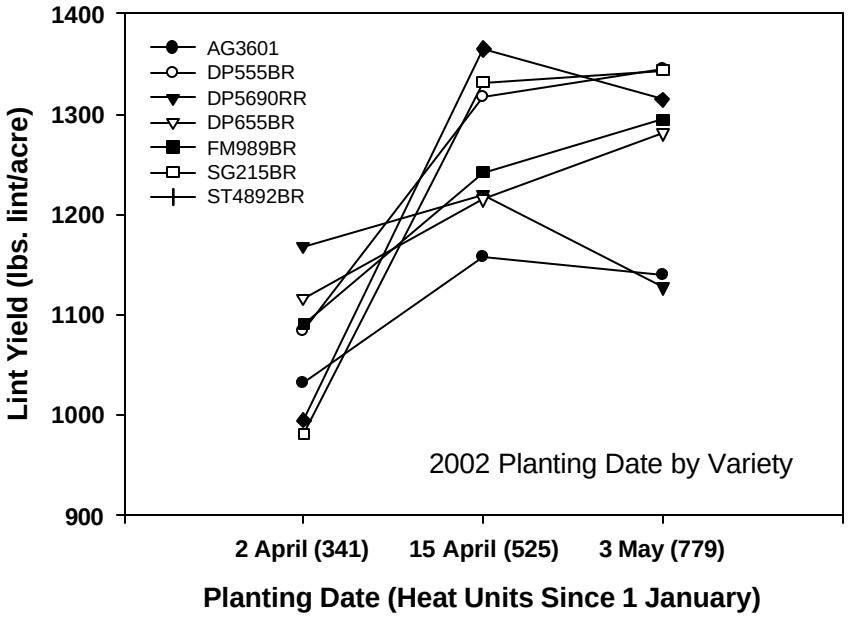

Figure 3. Lint yield results for all seven varieties and three planting dates, Safford Agricultural Center, 2002.