Planting Date by Variety Evaluation in Graham County

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Abstract

A single field study was established in 2001 at the Safford Agricultural Center to evaluate the effects of planting date and variety on crop growth and yield. Ten varieties were selected and planted on three separate planting dates in a split-plot randomized complete block design with four replications. Results from this experiment indicated significant differences due to planting date and variety. The interaction between planting date and variety was not significant. Yield trends were increasing with later planting dates which is thought to be a function of the inclement weather conditions surrounding particularly planting date one but also two. This experiment provides some interesting results with respect to seedling vigor, survivability, and ultimately yield for the different varieties tested.

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).

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.

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The objective of this study was to further evaluate planting date windows and use the information for the validation and revision of current UA Extension agronomy recommendations. This evaluation involves an investigation of the effects of planting date management on the growth, development, and yield of cotton.

Materials and Methods

A study was conducted in 2001 at the University of Arizona Safford Agricultural Center to investigate the effects of planting date on growth, development, and yield of ten different commercially available varieties. The experimental design was a split-plot within a randomized complete block design. The mainplots were planting dates with subplots being varieties. Each subplot consisted of 4, 36 inch rows that extended approximately 40ft. Planting dates (PD) were constructed 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 a early, determinate variety (DP422BR) to more indeterminate varieties (DP655BR). All 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 Gomez and Gomez (1984) and the SAS Institute (SAS, 1998).

Results and Discussion

Weather and soil temperature conditions surrounding the dates of planting were marginal, particularly for the first two planting dates. Minimum soil temperatures and daily heat unit accumulations are shown in Figure 2. Soil temperatures were consistently around 60^{o}F just prior to PD1. Within three days of planting a cold front moved into the area and dramatically reduced air and soil temperatures to below 50^{o}F. Under these circumstances it was thought that the first date of planting would have to be replanted. However, the percent germination was relatively high considering the conditions. Planting date two also experienced a drop in soil temperatures shortly after planting but not to the degree experienced at PD1. Planting date three experienced optimum conditions for seed germination and emergence.

Analysis of variance results for the overall experiment resulted in significant differences in yield due to both PD and variety (OSLs 0.0001 and 0.0474 respectively). The interaction term of PD*variety was not significant (OSL=0.0536). Differences among varieties for each planting date are presented in Table 3 along with the ANOVA results. There were no significant differences among varieties for PD1 more than likely due to the variable nature of germination and stand establishment caused by inclement weather conditions. Significant differences among varieties were observed in both PD2 and PD3 (Table 3). Differences in yield as a function of PD for each variety is presented in Table 4. A dramatic increase in yield was experienced for almost all varieties as with the later PD. This is not a typical response. Under optimum planting conditions a decrease in yield is typically observed with later planting dates. The explanation for the results obtained in this experiment would be the weather conditions experiences at PD1 and PD2. This experiment provides good information on seedling vigor and survivability. Several of the varieties performed poorly at both PD1 and PD2 and did not experience a yield increase until PD3 (Figure 3). These varieties (i.e. DP436R, SG521R, DP451BR, and DP422BR) were not able to withstand even moderately sub-optimum conditions (PD2). Other varieties such as DP655, PM1560BR, and the two Stoneville varieties were able to still perform well in conditions that were less than optimum (PD1 and PD2).

This experiment will be conducted again in the 2002 season with a slightly different selection of varieties to evaluate their response to planting date in the upper Gila River valley.

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Table 1. Planting dates with associated heat units accumulated from January 1 for each planting date, Safford Agricultural Center, 2001.

Planting Dates	Heat Units/Jan. 1 (86/55°F Thresholds)
3 April	312
20 April	466
7 May	702

Table 2. Listing of the ten varieties and their characteristics planted at the Safford Agricultural Center 2001.

Company	Variety	Maturity*
Deltapine	DP422BR	Early
Deltapine/Sure Grow	SG521R	Early
Stoneville	ST4892BR	Early – Mid
Stoneville	ST4793R	Early – Mid
Deltapine/Sure Grow	SG501BR	Early – Mid
Deltapine	DP436R	Early – Mid
Deltapine	DP451BR	Early – Mid
Deltapine	DP5690R	Mid – Full
Deltapine	DP655BR	Mid – Full
Deltapine/Paymaster	PM1560BR	Mid – Full

*As classified by the respective seed companies.

Table 3.

Variety	Planting Date		
	PD 1	PD 2	PD 3
	----------Lint Yield (lbs lint/acre)----------		
DP655BR	811 a	1004 a*	1051 a
ST4892BR	789 a	918 abc	945 ab
DP436R	784 a	804 bc	1041 ab
DP422BR	761 a	774 bc	1029 ab
DP451BR	753 a	761 c	1061 a
DP5690R	752 a	918 abc	1041 ab
ST4793R	745 a	908 abc	878 b
SG501BR	722 a	844 abc	928 ab
SG521R	685 a	776 bc	1006 ab
PM1560BR	680 a	952 ab	952 ab
Critical Range*	185	112	103
OSL§	0.8953	0.0006	0.0101
CV(%)¶	17.0	8.9	7.1

*Means followed by the same letter are not significantly different according to the Student Newman Keuls means separation test.
§OSL – Observed Significance Level
¶CV(%) – Coefficient of Variation

Table 4.

	Variety									
	DP 655BR	ST4892BR	DP436R	DP422BR	DP451BR	DP5690R	ST4793R	SG501BR	SG521R	PM1560BR
	Lint Yield (lbs. lint/acre)									
PD 1	811 b*	789 a	784 a	761 a	753 a	752 b	745 b	723 a	685 c	680 b
PD 2	1004 a	918 a	804 a	774 a	761 b	918 ab	908 a	844 a	776 b	952 a
PD 3	1051 a	945 a	1041 a	1029 a	1061 a	1041 a	878 a	928 a	1005 a	952 a
CR*	147	NS	NS	NS	133	194	38	NS	78	112
OSL§	0.0159	0.1868	0.0720	0.0707	0.0020	0.0298	0.0001	0.0862	0.0001	0.0014
CV(%)¶	8.9	12.6	15.9	17.1	8.9	12.4	2.6	12.8	5.5	7.5

*Critical Range – Means followed by the same letter are not significantly different according to the Student Newman Keuls means separation test.
§OSL – Observed Significance Level
¶C.V. (%) – Coefficient of Variation

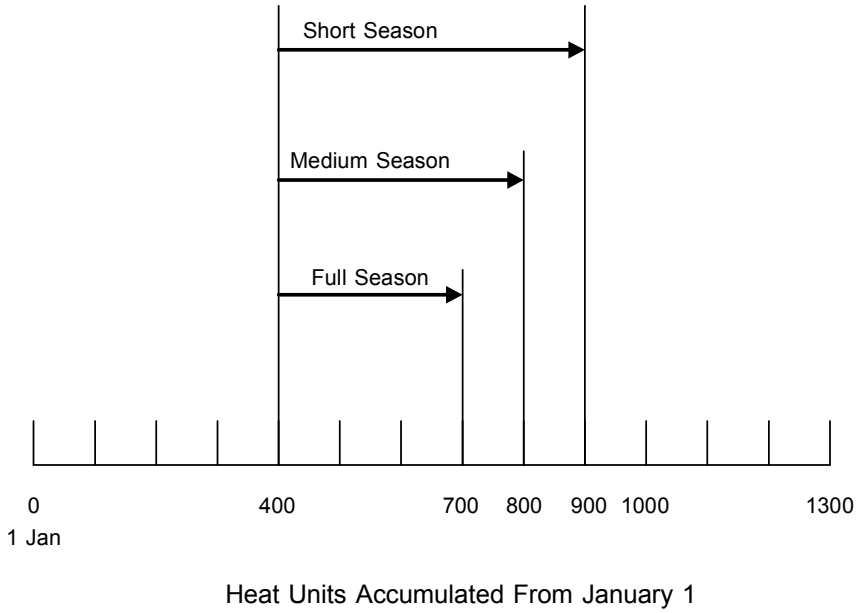

Figure 1. General recommended planting date windows for different maturity type varieties grown in Arizona (J.C. Silvertooth, Univ. of Arizona).

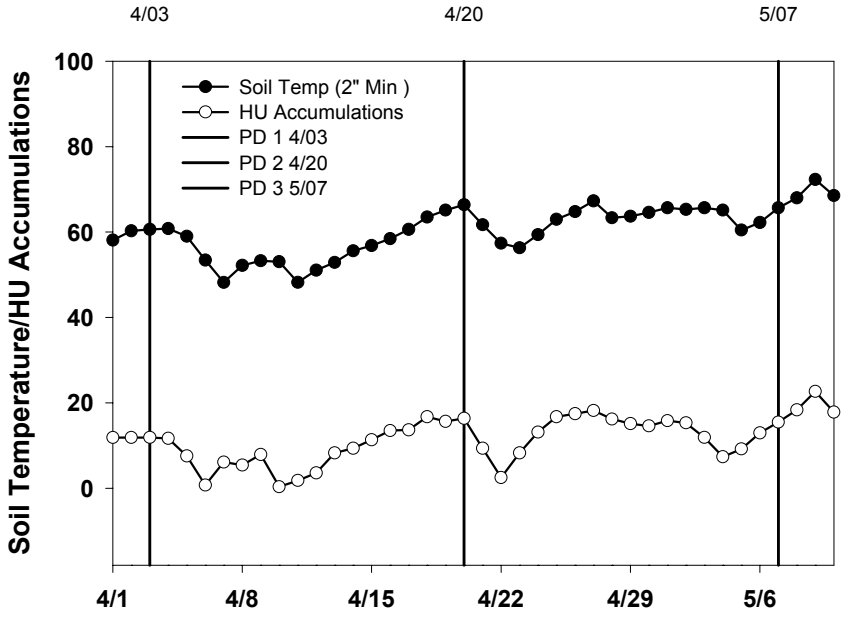

Figure 2. Soil temperature and heat unit accumulations for the three selected planting dates, Safford Agricultural Center, 2001.

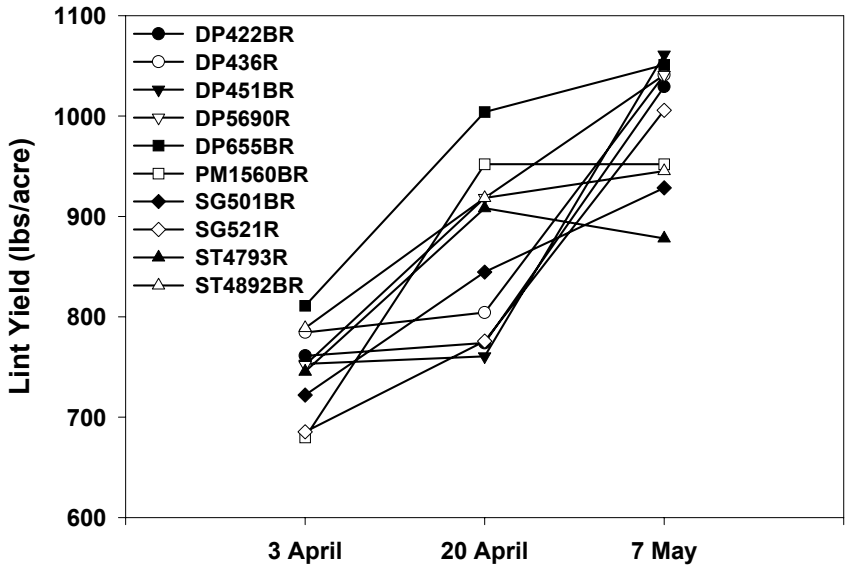

Figure 3. Lint yield results for all ten varieties and three planting dates, Safford Agricultural Center, 2001.