1998 Seed Treatment Evaluations

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Abstract

Cottonseed was treated with several fungicide treatments in an effort to protect the seed and seedling from disease. Seed germination and vigor was evaluated in three Arizona locations; Maricopa, Marana, and Safford. Stand counts were taken after emergence at all three locations and percent emergence (PEM) was calculated. Significant differences in percent emergence due to seed treatments were observed in the both sample dates at Marana. Maricopa and Safford showed no statistically significant differences due treatment.

Introduction

One of the most important factors involved in producing a high yielding crop of cotton is being able to establish a uniform and vigorous stand early in the season. There are many factors that may affect the accomplishment of this goal. Weather is one of the most influential factors in seedling development. Cool temperatures can slow down the germination and growth of a cotton seedling resulting in poor seedling vigor and 'skippy' stands. Another factor is that of seedling diseases and soil-borne fungi that can slow down growth and development of a seedling, and in a worst case scenario, lead to the death of the seedling. In an effort to curb the effects of seedling diseases on emergence and vigor, cottonseeds treated with a variety of fungicides, and at different rates, were evaluated from the standpoint of seedling emergence and viability. This project is an extension of similar work conducted in Arizona in recent years (Silvertooth and Malcuit,1990; Silvertooth and Malcuit, 1991; Silvertooth and Malcuit, 1992; Silvertooth and Malcuit, 1993; Norton and Silvertooth, 1994; Norton and Silvertooth, 1995; Norton and Silvertooth, 1996, Norton and Silvertooth, 1997, and Norton and Silvertooth, 1998).

Materials and Methods

Separate experiments were conducted at the University of Arizona agricultural experiment stations located at Maricopa, Marana, and Safford, AZ. Plots were planted on 18 March at Maricopa, 7 April at Marana, and 3 April at Safford. Heat units accumulated since 1 January were 219, 332, and 207 heat units accumulated since 1 January ($86/55^{o}$ F thresholds) for Maricopa, Marana, and Safford respectively. Experiments were arranged in a randomized complete block design with each of the 5 treatments (Table 1) being replicated four times. Plots consisted of four, 40" rows that extended 40' in length. Exactly 200 seeds were planted in each of the four rows for every experimental unit. Percent emergence (PEM) was calculated based upon number of emerged, viable seedlings as a percentage of 200 seeds planted (Table 2) for two sampling dates at each location except for the Safford location where only one count was taken. Percent emergence values obtained were subjected to analysis of variance according to guidelines put forth in Gomez and Gomez (1984) and the SAS institute (1994). Due to missing values, the data set obtained was unbalanced. The general linear models (GLM) statement was used for analysis of variance along with a pairwise comparison t-test using least square means data for a given two treatment comparison. The resultant observed significance level from the t-test was used to determine if the differences between any two given treatments were significant. Differences were declared significant at the α=0.05 level.

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Results and Discussion

Maricopa

Soil temperatures for the duration of the study are shown in Figure 1. Mean soil temperatures at the time of planting were approximately 63^{o}F. Temperatures rose slightly for the 3 days following planting. On the 4th day after planting temperatures began to fall and continued on a downward trend and remained below optimum temperature for the next week. Between the dates of 26 March and 1 April approximately 1.04 inches of precipitation was received. The decrease in temperature and precipitation appears to have had and overall impact on germination with rates of only 49-58% germination but treatments appeared to respond similarly to the adverse conditions (Table 3). Results obtained from the Maricopa location were similar to results obtained from previous years. Table 3 outlines the analysis of variance results for both sample dates. Results show no significant differences due to treatment on either of the sample dates. Observed significance levels (OSL) of 0.0667 and 0.0643 for the first and second sample dates respectively indicate that differences among treatments were not significant at α=0.05 but were only slightly less than significant. Similar trends were observed between the two sample dates with treatment 3 performing the best and treatment 2 providing the least amount of protection. The control treatment, 5, performed better than treatment 2 for both sample dates.

Marana

Soil temperatures at the Marana location are shown in Figure 2. At the time of planting soil temperatures were at approximately 60^{o}F. Soil temperatures continued to increase slightly over the course of the study but remained rather cool (<70^{o}F) over the duration of the experiment. Only trace amounts of precipitation were received during the experiment. Overall germination rates were extremely low at Marana (Table 4). Rates ranged from only 14-25%. Significant differences were observed at both sampling dates. The control treatment, 5, had significantly lower germination that any of the other treatments. Treatment 4 appeared to provide the most protection resulting in the highest germination for both sample dates.

Safford

Soil temperatures for the Safford location are shown in Figure 3. Mean soil temperatures at the time of planting were approximately 58^{o}F. Soil temperatures continued with an upward trend for the duration of the study. However, mean soil temperatures never rose above 70^{o}F for the duration of the study. No measurable precipitation was received during the study period. PEM results are shown in Table 5. No significant differences were detected but trends were similar to those seen at the Maricopa location. Treatment 3 appeared to have provided the best protection. Overall PEM was also low (29-34%).

Summary

At all locations, the benefit of planting chemically treated seeds is demonstrated with the untreated seed (Treatment 5) having low PEM at all locations. Different treatment combinations also performed differently across the three locations. Treatment 3 performed well at both Maricopa and Safford but not as well at Marana while treatment 4 performed well at Marana but not at Maricopa and Safford. Treatment 2 performed poorly at Maricopa and Marana while performing well at Safford. The potential for improved PEM with region specific seed treatment is demonstrated by this and previous seed treatment studies. Another important consideration from these studies is that the overall PEM never exceeded 60%. It is common to use an estimate of 80% emergence when making decisions on seeding rates at planting. The evidence presented in this study indicates a more conservative estimate may be appropriate especially when planting under less than optimum conditions.

Acknowledgment

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Table 1. Treatment compositions for seed treatment experiments conducted at Maricopa, Marana, and Safford, 1998.

Treatment #	Treatment and Rate fluid ounces/cwt.
1	Maxin 0.08 oz./cwt. Apron XL 0.32 oz/cwt. Nu-Flow M 1.25 oz/cwt.
2	Nu-Flow ND 7.5 oz./cwt.
3	Nu-Flow M 1.25 oz./cwt. Apron XL 0.32 oz./cwt. Maxin 0.08 oz./cwt. Nusan 2.25 oz./cwt.
4	Nusan 2.25 oz./cwt. Apron XL 0.32 oz./cwt. Nu-Flow M 1.25 oz./cwt.
5	Untreated

Table 2. Planting and sample dates with accumulated heat units.

Planting Date (HU/1 January)	First Sample Date (HUAP)	Second Sample Date (HUAP)
Maricopa		
18 March (219)	10 April (141)	25 April (301)
Marana		
7 April (332)	27 April (187)	14 May (421)
Safford		
3 April (207)	----	15 May (419)

Table 3. Percent emergence data for seed treatment study at Maricopa, 1998.

Date 10 April	Treatment	Percent Emergence
	3	58.44 a*
	4	56.21 a
	1	55.78 a
	5	53.81 a
	2	49.19 a
	Critical Range	NS
	C.V (%)§	7.466
	OSL†	0.0667
25 April		
	3	58.09 a*
	1	55.00 a
	4	53.22 a
	5	50.66 a
	2	47.31 a
	Critical Range	NS
	C.V (%)§	9.038
	OSL†	0.0643

* Means followed by the same letter are not significantly different (α=0.05) using a Duncan's means separation test.

§ Coefficient of Variation

† Observed Significance Level

Table 4. Percent emergence data for seed treatment study at Marana, 1998.

Date 27 April	Treatment	Percent Emergence
	4	19.97 a*
	1	19.47 a
	3	18.47 a
	2	18.47 a
	5	14.66 b
	Critical Range	3.273
	C.V (%)§	11.668
	OSL†	0.0305
14 May		
	4	24.94 a*
	3	23.81 a
	1	23.47 a
	2	23.22 a
	5	17.16 b
	Critical Range	3.132
	C.V (%)§	9.027
	OSL†	0.0013

* Means followed by the same letter are not significantly different (α=0.05) using a Duncan's means separation test.

§ Coefficient of Variation

† Observed Significance Level

Table 5. Percent emergence data for seed treatment study at Safford, 1998.

Date 15 May	Treatment	Percent Emergence
	3	34.13 a*
	2	34.00 a
	1	32.13 a
	5	30.50 a
	4	29.46 a
	Critical Range	NS
	C.V (%)§	12.776
	OSL†	0.4319

* Means followed by the same letter are not significantly different (α=0.05) using a Duncan's means separation test.

§ Coefficient of Variation

† Observed Significance Level

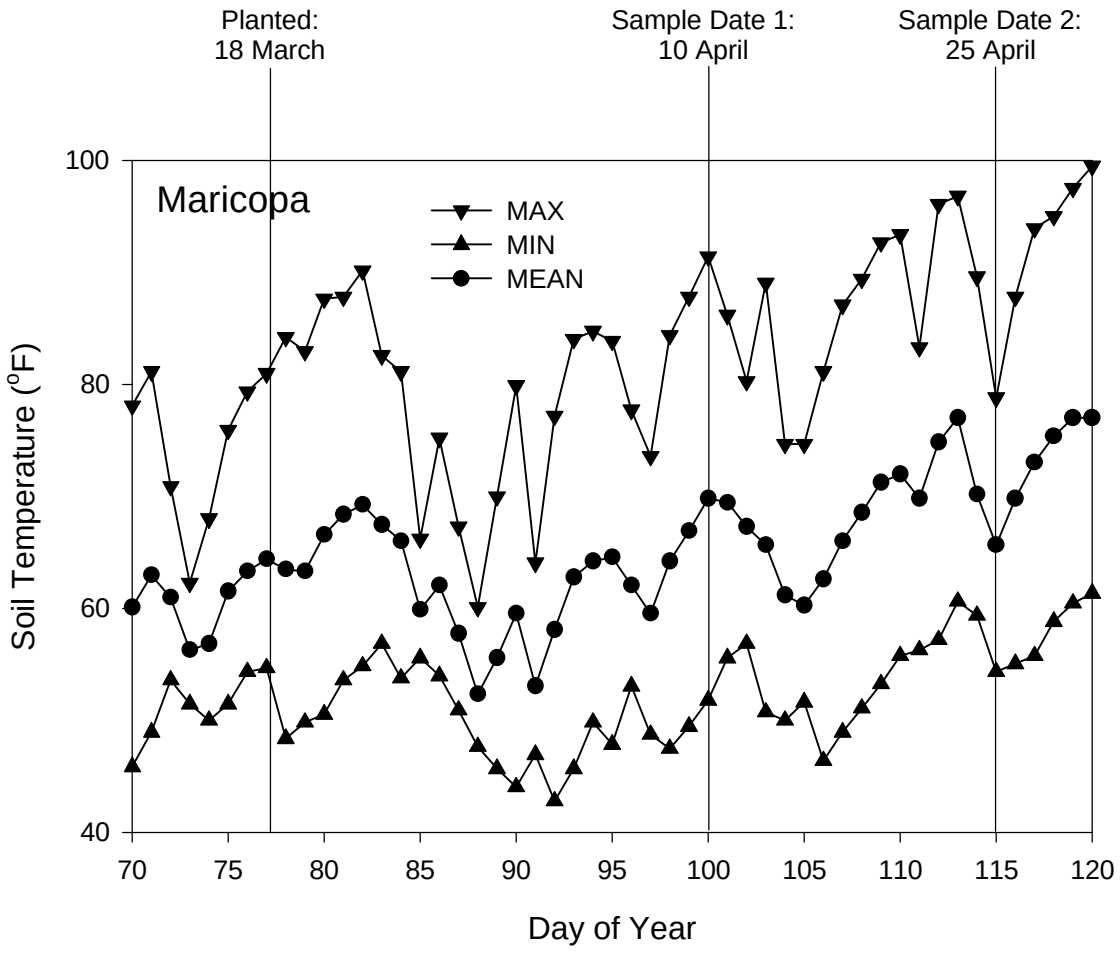

Figure 1. Maximum, mean and minimum soil temperature at a depth of 2.5" as a function of time for the duration of the seed treatment study at the Maricopa Agricultural Center, 1998.

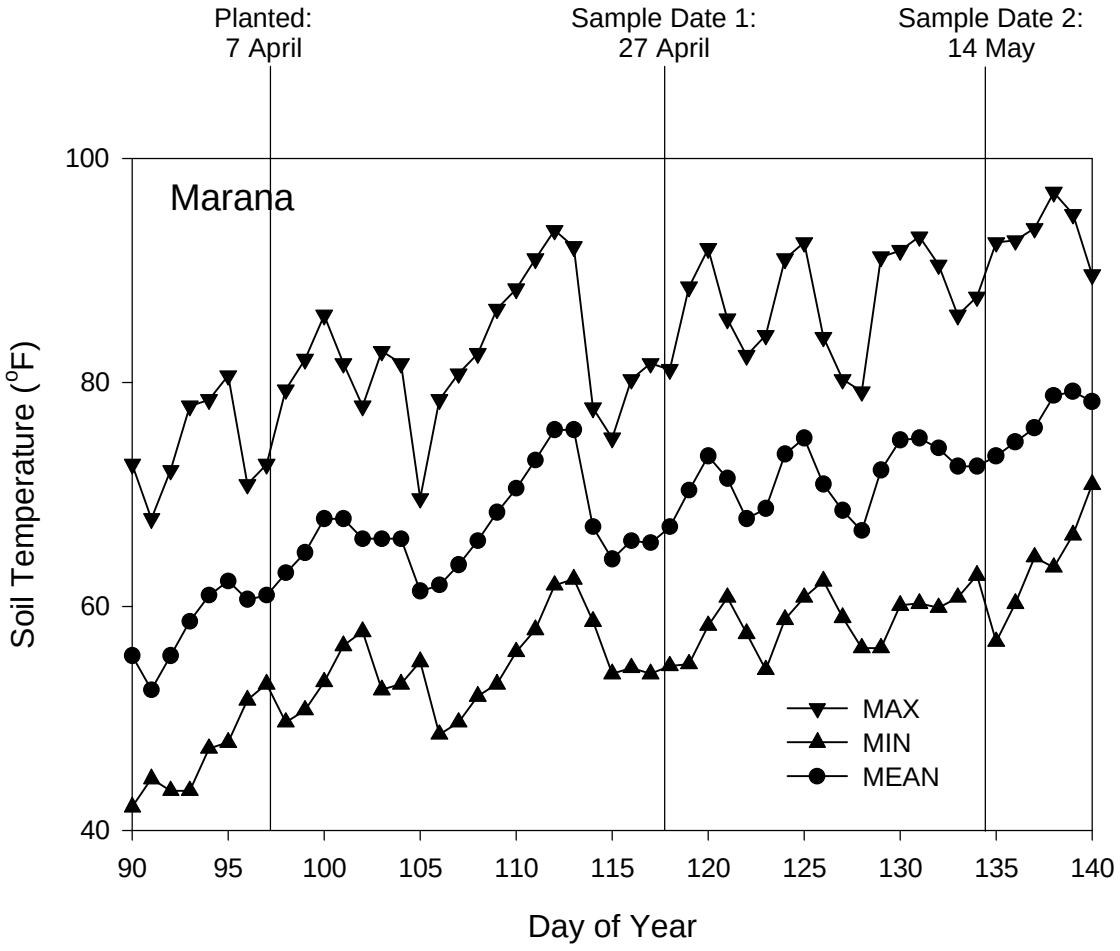

Figure 2. Maximum, mean and minimum soil temperature at a depth of 2.5" as a function of time for the duration of the seed treatment study at the Marana Agricultural Center, 1998.

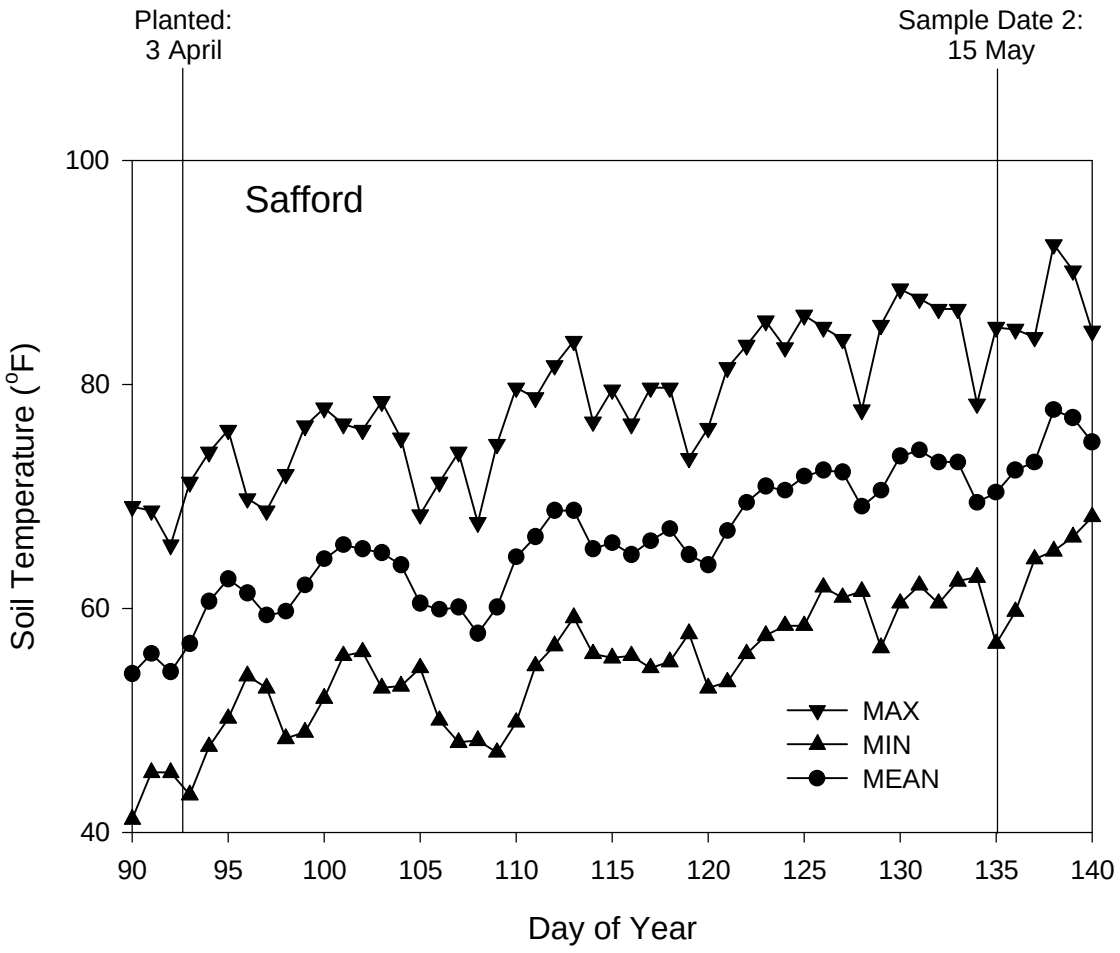

Figure 3. Maximum, mean and minimum soil temperature at a depth of 2.5" as a function of time for the duration of the seed treatment study at the Safford Agricultural Center, 1998.