FACTORS INFLUENCING YIELD VARIABILITY IN THE ARKANSAS COTTON RESEARCH VERIFICATION TRIALS (CRVT)

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Abstract

The relationship of twenty-two factors were analyzed from nine fields per year for the 1996 and 1997 cotton growing seasons in Arkansas. An above average production was seen during each year throughout the state. Regression analysis were performed on data collected from the Cotton Research Verification Trials conducted by the Cooperative Extension Service in each of those years to determine whether any of the 22 factors directly correlated to yield. Analysis indicated that the variables studied did not correlate well with yield for either year. The lack of correlation may have been due to (1) most fields being planted within the optimum planting window for the state, (2) good emergence followed by moderate weather, especially temperatures during the fruiting and boll development periods.

Introduction

Yield variability is a yearly concern for Arkansas cotton growers. In the decade of the '90's frequent yield variability in cotton has often resulted in devastating economic losses for cotton growers. This same trend has also been noted in the production trials conducted by the Cooperative Extension Service through the Cotton Research Verification Trials (CRVT). A number of factors are normally considered each year to explain why yields are low, average or high. These factors may be associated with production systems, management, environment or pest outbreaks.

Objective

To determine which of twenty-two environmental, morphological, or physiological factors correlate the highest to yield through analysis of data obtained from the CRVT program from two years with above average to very high yields.

Discussion

A correlation analysis from CRVT fields across two years of good (1996) to very high yields (1997) are presented in this paper. Data were analyzed to determine how planting date, days between developmental events after planting, heat unit accumulations from planting to certain events, days between developmental events, and the number of ten day and older bolls (TDOB) counted near the end of August were correlated to yield. The COTMAN computer program provided the cutout date in each year. Cutout is defined as either the date a field reached Nodes Above White Flower of 5 (NAWF=5) or the latest possible cutout date (LPCD) if fields were late in maturity. Information on heat unit accumulation was taken from COTMAN or a DD60 Summary computer program for each year.

Results

Planting dates in the 1996 CRVT fields ranged from April 26 to May 10. All were within the optimum range for planting date (Table 1) for their location in the state. The 1996 weather at planting allowed most growers to plant early in the optimum planting date window. In 1997 the planting dates ranged from May 7 to May 14 because of a cold, wet spring and delayed planting. Two of the nine irrigated fields in 1997 were planted just beyond the optimum planting date window. A correlation analysis of planting date as related to yield showed no correlation in either 1996 nor 1997. Similarly the TDOB counts showed no correlation in either year.

In 1996, correlation analysis of days from planting to certain events showed a negative correlation of days to first bloom to yield (Table 2). All 1996 CRVT fields reached date of first bloom slightly ahead of the average expected.

In 1996 two fields varied significantly from the mean of days from first bloom to date of cutout, yet there was no correlation to yield. A positive correlation was seen when the relationship of date of cutout was compared to heat units at cutout in 1996, but not in 1997 (Table 3). In 1997, a positive correlation between yield and number of days from date of first bloom to date of cutout was observed (Table 4). Positive correlations between heat unit accumulations and yield during this same time frame were also noted in 1997. These data reflect the effects of 1997's long growing season.

In 1996 a comparison of days between developmental events with the heat unit accumulations between those events did show a correlation from first bloom to date of cutout and heat units accumulated (Table 5). In 1997 there were positive correlations for four time periods analyzed with the corresponding heat unit accumulations. These data suggest that after a slow start due to cool conditions near planting that crops responded to more seasonable temperatures in June through August. A late fall with warm temperatures into mid-October also allowed bolls to mature in at least three of the nine fields during 1997.

Summary

Of the 22 factors that were compared to yield, only one factor correlated in 1996 and two factors correlated in 1997. The negative correlation of date of first bloom to yield in

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:634-637 (1999)
National Cotton Council, Memphis TN

1996 suggests that the longer it took for a field to reach date of first bloom the lower the yield. One of the nine fields which was planted very early had management problems due to irrigation timing, overwatering and nitrogen deficiency which caused lowered yields and a delay in bloom. This field also cutout early. Analysis of the Monroe county field in both 1996 and 1997 does not reflect the high reniform nematode pressures for the fields in those years which impacted days between events and therefore heat unit accumulations.

Neither planting date or ten day old boll counts had an impact on yield in either year. No correlations between days required for crop development and yield were observed in either year.

When days between events and the subsequent relationship of heat unit accumulations between those events were analyzed some correlations emerged, especially in 1997 after a slow start due to a cool spring followed by a near normal summer and a warm fall.

In years when cotton yields are above average to very high, factors which were not analyzed may have impacted yields more than the factors which were analyzed. Possibly a further analysis of low to average yield years should be compared to above average yield years to see if correlations can be made which affect yield variability.

References

Plunkett, D.E., Robertson, W.C. and Bryant, K.J. 1996. Annual Report, Cotton Research Verification Trials.

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Table 1. Yield as influenced by days from planting to stages of crop development, 1996-1997 CRVT.

	1996		
	Days from planting to		
County	Planting Date	Date of Harvest	Yield
Chicot	May 3	Oct 10	982
Crittenden	May 2	Oct. 5	985
Greene	May 9	Oct. 16	849
Jackson	May10	Oct. 10	1041*
Jefferson-Pipkin	Apr 26 *	Sep. 25	659
Jefferson-Ward			
Lee	May 6	Oct. 6	937
Monroe			
Poinsett	May 2	Sep 23	894
	May 6	Oct. 19	809
	May 10	Oct. 14	972
Year mean	May 5	Oct 7	903
Std. dev.	4.6	9.3	117

	1996				
	Days from planting to				
County	Emerg	1st Sq	1st Bloom	Cutout	Defol
Chicot	5	28	55	81	138
Crittenden	5	27	55	81	133
Greene	7	32*	56	92	146*
Jackson	9*	31*	56	91	137
Jefferson-Pipkin	8	29	59*	78*	131
Jefferson-Ward	7	27	56	83	128*
Lee	5	27	56	83	128*
Monroe	7	31*	58*	100*	148*
Poinsett	9*	28	53	91	144
Year mean	7	29	56	87	137
Std. dev.	1.6	1.96	1.73	7.15	7.6

	1997		
	Days from planting to		
County	Planting Date	Date of Harvest	Yield
Chicot	May 10	Oct 8	1146
Greene	May 9	Oct 17	928
Jefferson-Pipkin	May 7	Oct 8	1018
Jefferson-Ward			
Lee	May 10	Oct 7	951
Monroe			
Phillips	May 10	Oct 8	1203*
Poinsett	May 12	Oct 20*	891*
St. Francis	May 14	Oct 20*	1179
	May 10	Oct 5	983
	May 9	Oct 20*	1231*
Year Mean	May 11	Oct 13	1059
Std. dev.	1.9	6.48	131

	1997				
	Days from planting to				
County	Emerg	1st Sq	1st Bloom	Cutout	Defol
Chicot	7	35*	59*	84	130*
Greene	8	40	68	85	140
Jefferson-Pipkin					
Jefferson-Ward	8	38	63	85	132
Lee					
Monroe	7	39	62	84	131*
Phillips	7	35*	59*	84	140
Poinsett	6	36	70*	94*	141
St. Francis	5*	42	65	92	148*
	7	41	67	88	135
	9*	44*	67	96*	144
Year Mean	7.1	40	64	88	138
Std. dev.	1.2	3.74	3.94	4.76	6.23

* Significant at the 0.05 level

Table 2. Relationship of days from planting and heat unit accumulation to stages of crop development compared to yield, 1996-1997 CRVT.

	Yield	
Days from planting to	1996	1997
Date of emerg.	0.09	0.08
Date of first sq.	-0.24	0.29
Date of first bloom	-0.80*	-0.49
Date of cutout	0.07	0.17
Date of defol.	-0.01	0.35

	Yield	
Heat unit accumulation from planting to	1996	1997
Date of emerg.	0.48	0.28
Date of first sq.	0.40	0.01
Date of first bloom	0.12	-0.32
Date of cutout	0.30	0.30
Date of defol.	0.10	0.15

Table 3. Relationship of stages of crop development to heat unit accumulation at stages of crop development 1996-1997 CRVT.

	1996				
Stage of development	Heat units at date of emerg	Heat units at date of first sq.	Heat units at date of first blm.	Heat units at cutout	Heat units at date of defol.
Date of emerg.	0.49	-	-	-	-
Date of first sq.	-	0.52	-	-	-
Date of first blm.	-	-	0.13	-	-
Date of cutout	-	-	-	0.91*	-
Date of defol.	-	-	-	-	0.45

	1997				
Stage of development	Heat units at date of emerg	Heat units at date of first sq.	Heat units at date of first blm.	Heat units at cutout	Heat units at date of defol.
Date of emerg.	0.23	-	-	-	-
Date of first sq.	-	0.50	-	-	-
Date of first blm.	-	-	0.58	-	-
Date of cutout	-	-	-	0.57	-
Date of defol.	-	-	-	-	-0.60

*Significant at the 0.05 level.

Table 4. Relationship of days between stages of crop development to yield, and heat unit accumulation between stages of crop development to yield, 1996-1997 CRVT.

	Yield	
Days from	1996	1997
emerg. to first sq.	0.17	0.29
First sq. to first blm	-0.44	-0.52
First blm. to cutout	0.25	0.78*
cutout to defol.	-0.18	0.22

	Yield	
Heat units from	1996	1997
emerg. to first sq.	0.16	-0.17
first sq. to first blm	-0.46	-0.50
first blm. to cutout	0.31	0.76*
cutout to defol.	-0.22	0.22

*Significant at the 0.05 level.

Table 5. Relationship of days between and heat unit accumulations between certain events, 1996-1997 CRVT.

	Heat units from			
1996 Days from	emerg. to first sq.	first sq. to first blm.	First blm. to cutout	cutout to defol.
emerg. to first sq.	0.73	-	-	-
first sq. to first blm.	-	0.56	-	-
first blm. to cutout	-	-	0.99*	-
cutout to defol.	-	-	-	0.52

	Heat units from			
1997 Days from	emerg. to first sq.	first sq. to first blm.	First blm. to cutout	cutout to defol.
emerg. to first sq.	0.77*	-	-	-
first sq. to first blm.	-	0.92*	-	-
first blm. to cutout	-	-	0.84*	-
cutout to defol.	-	-	-	0.66*

*Significant at the 0.05 level.