Virginia Cooperative Extension

2007 PUBLICATION 424-232

Virginia Cotton Report, 2006

Effect of Planting Date and Plant Populations on Growth and Yield of Cotton

Patrick M. Phipps
Plant Pathology, Tidewater AREC
6321 Holland Rd.
Suffolk, VA 23437

Email: pmphipps@vt.edu
Phone: (757) 657-6450, Ext. 413

Darcy E. Partridge
Plant Pathology, Tidewater AREC
6321 Holland Rd.
Suffolk, VA 23437

Email: departri@vt.edu
Phone: (757) 657-6450, Ext. 423

Acknowledgements

The applied research described in this publication was supported by grants from Cotton Incorporated and private industry. The authors thank Fred M. Shokes. Director, Tidewater AREC; Joel Faircloth, Extension Cotton Specialist, Tidewater AREC; and Glenn Chappell, Prince George County Extension Agent, for reviewing this publication. The authors also recognize Steve Byrum, Barron Keeling, and Ed Hobbs for their help in carrying out each field trial and data processing.

Disease Incidence and Losses

Rhizoctonia and Pythium damping-off were the most common causes of seedling disease and reduced plant populations (Table 1). Although stand losses were as much as 30 percent, the impact on yield was minimal because of the crop's remarkable ability to compensate. One plant every 12 to 18 inches is generally enough to achieve a good yield, except in years with heavy crop stress caused by weather, insects, weeds, or diseases. Other factors that contributed to slow emergence and poor stands in 2006 were seed with low cool germ, periods with soil temperatures below 60ºF or air temperatures below 40ºF after planting, heavy rainfall, and/or planting seed too deep (0.75 inch or deeper). The optimum depth of planting is usually about 0.25 to 0.5 inches. Crop damage by southern root-knot nematode, *Meloidogyne incognita*, accounted for the heaviest loss of yield in fields planted continuously to cotton for 5 years or longer. No significant losses to reniform nematode, *Rotylenchulus reniformis*, were detected in 2006. Instances of yield losses to stubby root were found, but overall were less destructive than southern root knot. Sting nematode continues to cause severe damage in cotton, but occurrences are usually spotty and confined to localized areas in sandy-textured soil. As in previous years, the Columbia lance nematode was not detected in 2006. Below normal rainfall in July and August, and below-average accumulations of degree days (DD_{60}) in May, June, September, and October were thought to account for cotton not achieving record yields in 2006.

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Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University

VT/0507/W/424232

Table 1. Estimated loss of yield to cotton diseases in 2006.

Disease	Causal agent(s)	Percent loss
Seedling disease	*Rhizoctonia solani*, *Pythium* spp.	0.75
Fusarium wilt	*Fusarium oxysporum* f. sp. *vasinfectum*	Trace
Verticillium wilt	Verticillium dahliae	0
Texas root rot	Phymatotrichum omnivorum	0
Ascochyta blight	Ascochyta gossypii	Trace
Bacterial blight	*Xanthomonas* spp.	0.1
Boll rots	*Diplodia* spp., *Fusarium* spp., *Xanthomonas* spp.	1.0
Leaf spots	---various---	0.1
Southern root-knot nematode	Meloidogyne incognita	2.0
Reniform nematode	Rotylenchulus reniformis	0.1
Other nematodes	*Trichodorus* spp., *Belonolaimus* spp., etc.	1.9
Total loss (%)		5.85*

*The loss estimate equals 4.63 million pounds in Virginia based on production of 74.568 million pounds of lint in 2006. At a value of $0.417 per pound, the loss in revenues at the farm gate would be 1.93 million dollars in 2006.

Seasonal Degree Days, Rainfall, and Crop Growth in 2006

Rainfall in June, September, and October was 5.75, 4.64, and 4.62 inches above normal, and in May, July, and August was 0.96, 2.21, and 3.21 inches below normal, respectively (Table 2). Rainfall during the period totaled 36.4 inches, which was 8.7 inches above normal. Minimum air temperatures averaged near normal (±1°F) in June, July, and September, 2°F above normal in October, 3°F above normal in August, and 2°F below normal in May. Maximum air temperatures were near normal (±1°F) in May, June, July, and October, 2°F below normal in September and 4°F above normal in August, according to records from a NOAA station (44-4044) at the Tidewater AREC in Suffolk. Cool temperatures in April and May slowed the speed of emergence in fields planted to cotton. Below normal rainfall in March (-3.16 inches), April (-1.44 inches) and May (-0.96 in) allowed land preparation and planting to proceed in a timely manner across most of southeastern Virginia. Cotton showed good emergence and vigor after air temperatures reached into the 70s and 80s in May. Periods of drought stress in July and August caused wilting and stunting of crops, especially in fields with sandy-textured soils and without irrigation. Above normal rainfall in September (+4.64 inches), October (+4.62 inches) and November (+2.96 inches) caused major delays in completion of harvest. Frost occurred in western portions of the Tidewater area on 14 October. Freeze occurred on 26 October when nighttime temperatures dropped into the upper 20ºF range.

Cotton degree days (DD_{60}) from 1 May to 31 October totaled 2053, or 120 below the 12-year average (Table 3). As the harvest season approached, many fields exhibited delayed maturity, but good yield potential. Months with below-average accumulations of degree days included May, June, September, and October.

The relationship of total rainfall and degree days to growth and yield of cotton in 2006 showed that the cotton crop received rainfall that was 5.9 inches above normal and 120 degree days below the 12-year average (Table 4, Fig. 1). While pinhead square was about a week late, the first flowers and first open bolls appeared within 3 days of the 12-year average. Dry weather stress in July and August likely accounted for reduced yield and suppressed incidence of hardlock.

Table 2. Rainfall in the past five years compared to 74-year average (1933 to 2006).

	Rainfall (in.)*					
Month	**2002**	**2003**	**2004**	**2005**	**2006**	**Normal**
May	3.98	7.14	4.77	4.78	2.86	3.82
Jun	1.66	4.10	5.10	2.64	10.08	4.33
Jul	5.53	4.98	12.53	5.19	3.66	5.87
Aug	2.22	3.50	11.00	4.50	2.50	5.71
Sep	2.96	11.81	5.15	3.08	9.16	4.52
Oct	4.89	4.40	4.52	5.68	8.14	3.52
Total	21.24	35.93	43.07	25.87	36.40	27.77

*Based on daily records from NOAA weather station 44-4044 at the Tidewater AREC, Suffolk.

Table 3. Cotton degree day accumulations compared to the 12-year average (1995 to 2006).

	Cotton Degree Days (DD_{60})*					
Month	**2002**	**2003**	**2004**	**2005**	**2006**	**Avg.**
May	271	216	395	169	221	256
Jun	513	421	426	433	386	427
Jul	615	543	523	587	541	531
Aug	564	536	427	557	542	496
Sep	373	334	320	393	259	324
Oct	162	116	100	158	104	139
Total	2498	2166	2191	2297	2053	2173

* Based on daily records posted on the Peanut/Cotton InfoNet (www.ipm.vt.edu/infonet).

Table 4. Relationship of total rainfall and degree days to growth and yield of cotton over the past 12-year period in the City of Suffolk.

Year	**Rainfall[z] (in.)**	**Degree days (DD_{60})**	**Pinhead square**	**1st flower**	**1st Open boll**	**Lint[y](lb/A)**
1995	23.83	2162	7-Jun	10-Jul	6-Sep	703
1996	35.43	2068	11-Jun	10-Jul	5-Sep	662
1997	20.09	1900	16-Jun	15-Jul	15-Sep	587
1998	24.94	2303	12-Jun	8-Jul	1-Sep	821
1999	49.71	2056	14-Jun	13-Jul	13-Sep	697
2000	27.27	2132	12-Jun	10-Jul	10-Sep	948
2001	22.72	2255	15-Jun	13-Jul	5-Sep	922
2002	21.24	2498	17-Jun	7-Jul	2-Sep	473
2003	35.93	2166	27-Jun	18-Jul	14-Sep	831
2004	43.07	2191	4-Jun	2-Jul	30-Aug	1159
2005	25.87	2297	27-Jun	13-Jul	6-Sep	1082
2006	36.40	2053	21-Jun	13-Jul	3-Sep	717[x]
12-yr AVERAGE	**30.54**	**2173**	**15-Jun**	**11-Jul**	**6-Sep**	**800**

[z]Rainfall records for May through Oct at the Tidewater AREC in Suffolk.
[y]Lint yields are for the City of Suffolk as reported by the Virginia Agricultural Statistics Service.
[x]Yield in 2006 is based on an estimate of statewide yield by the Virginia Agricultural Statistics Service.

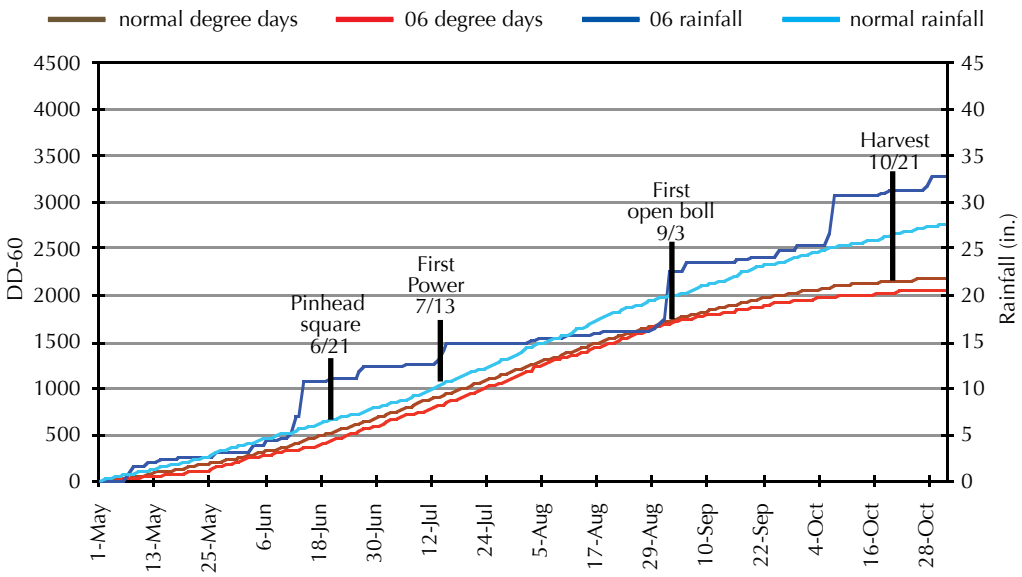

Figure 1. Degree days, rainfall, and crop development in 2006 at Suffolk.

Seedling Disease Control Trials

National cotton seed treatment trial (Tidewater Research Farm, Suffolk). The field trial was conducted at the Tidewater Research Farm in Kenansville loamy fine sand. Plots were two 30-foot rows spaced 36 inches apart. Treatments were replicated in four randomized complete blocks. The site was planted to a cover crop of wheat in the fall of 2005, strip tilled with an under-the-row ripper and treated with Cotoran 1 quart plus Prowl 1 pint per acre on 10 April. Seed of DP 444 BG/RR was planted on 19 April with a KMC planter to a depth of 0.5 inch and a rate of 3 seeds per foot of row. The cover crop was sprayed with Roundup Ultra Max at 22 fluid ounces per acre on 14 April and 19 May. Temik 15G at 5 pounds per acre was applied to the seed furrow at planting. Thereafter, plots were managed according to standard practices. The plots were harvested with a two-row harvester on 21 October.

Soil temperature at the 4-inch depth was 62.3ºF at planting and averaged 65.4ºF up to 7 days after planting. Rainfall totaled 0.84 inch over the same period. Baytan/Allegiance/Argent resulted in the highest stand on 18 May and was significantly greater than the reference standard treatment with RTU Baytan/Thiram/Allegiance. Dynasty CST-M produced stands that were similar to the best treatment and resulted in the highest yield (Table 5).

Table 5. Effect of seed treatment on emergence and yield of cotton, 2006 (Tidewater Research Farm, Suffolk).

Treatment and rate/cwt seed	Plants/ft* 18 May		Yield** lb/A		Yield** bales/A	
WECO 4054 1.0 oz + WECO 0319 2.0 oz + NuFlow M 2.5 oz + Nusan 30 2.0 oz	0.89	b-f	2759	ab	2.44	ab
WECO 4054 1.0 oz + WECO 0250 1.2 oz + Nuflow M 2.5 + Nusan 30 2.0 oz	0.91	b-e	2620	bc	2.32	bc
WECO 4254 1.0 oz + WECO 0250 1.2 oz + Nuflow M 2.5 oz + NuFlow ND 8.0 oz	1.06	a-c	2807	ab	2.49	ab
WECO 4054 1.0 oz + NuFlow ND 14.5 oz + Nuflow M 2.5 oz	1.08	a-c	2450	b-d	2.17	b-d
RTU Baytan Thiram 3.0 oz + Allegiance FL 0.75 oz	0.94	b-e	2396	b-e	2.12	b-e
Baytan 30 0.5 oz + Allegiance FL 0.75 oz + Argent 30 1.0 oz	1.28	a	2532	b-d	2.24	b-d
Baytan 30 0.5 oz + Allegiance FL 0.75 oz + Vortex 0.08 oz + Trilex 0.64 oz	1.17	ab	2605	bc	2.31	bc
L0037 0.25 oz Thiram 42S 1.5 oz + Allegiance FL 0.75 oz	1.04	a-c	2741	ab	2.43	ab
Baytan 30 0.5 oz + Vortex 0.08 oz + Allegiance FL 0.75 oz	1.13	ab	2680	a-c	2.37	a-c
Dynasty CST 4 oz	0.91	b-e	2471	b-d	2.19	b-d
Dynasty CST-M 4 oz	1.17	ab	3143	a	2.78	a
Dynasty CST-D 4 oz	0.60	g	1718	f	1.52	f
Apron Maxx-M 3 oz	1.00	a-d	2565	bc	2.27	bc
Vitavax-PCNB 6.0 oz + Allegiance 0.75 oz	0.75	d-g	2220	c-e	1.97	c-e
RTU-PCNB 14.5 oz	0.67	e-g	1927	ef	1.71	ef
Allegiance 1.5 oz	0.81	c-g	2441	b-d	2.16	b-d
Argent 4.5 oz	0.61	fg	2072	d-f	1.83	d-f
Nontreated	0.73	d-g	—		—	
LSD	**0.28**		**491**		**0.43**	

*Determined from counts of two 30-ft rows per plot.

**Weight (lb/A) includes lint + seed; bales/A are lint only. Lint was 42.5% of seed cotton weight according to gin samples (one bale of lint=480 lb). Plots were harvested on 21 Oct.

Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD (P=0.05), "—" =plots not harvested due to removal of seedlings for microbial assay.

Effect of seed treatments and in-furrow fungicide treatment on seedling emergence, growth, and yield of cotton (Tidewater Research Farm, Suffolk). Land preparation included under-the-row ripping and strip tillage into a cover crop of wheat. The soil type was Kenansville loamy sand that was planted to cotton in a 2-year rotation with peanut. Personnel at Bayer CropScience applied seed treatments to DP 444 BG/RR. Included were base treatments (B) that were applied to untreated (black) seed and overcoats (O) that were applied on top of the base treatment. To increase disease pressure, millet seed colonized by *Rhizoctonia solani* and *Pythium ultimum* was applied to the seed furrow at planting on 24 April. The in-furrow fungicide was mixed in water and delivered in a volume of 5 gallons per acre by a microtube to each seed furrow. Seed were planted 0.50 to 0.75 inch deep at a rate of 3 seeds per foot of row. Plots were two 30-foot rows spaced 3 feet apart. A randomized complete block design with four replications was used. Temik 15G at 5 pounds per acre was applied to the seed furrow in all plots at planting. Standard practices for cotton production were followed after planting. Counts of emerged seedlings were recorded at 14 and 28 days after planting (DAP). Four plants per plot were selected at random for assessing plant height. Flower counts were from 12 feet of row. Plots were harvested on 17 October with a two-row harvester.

Soil temperatures at the test site averaged 60°F and 1.71 inches of rainfall occurred at 3 DAP and totaled 1.72 inches by 7 DAP. None of the treatments had a significant effect on plant counts at 28 DAP, or yield (Table 6). All treatments increased plant height and flower counts, and some were significantly greater than untreated seed.

Table 6. Effect of in-furrow fungicide treatments on seedling emergence, growth and yield of cotton, 2006 (Tidewater Research Farm).

Treatment and rate[z]	Plants/ft, (22 May)[y] Healthy	Diseased/ dead	Plant height[x] (14 Jul)	Flowers/ 12 ft of row[w] (20 Jul)	Open bolls[v] (15 Sep)	Yield[u] (bales/A)
Untreated seed	1.09	0.51	17.6 c	17.0 b	4.0	1.39
RTU Baytan Thiram 3 fl oz + Allegiance 0.4 fl oz/cwt (B)	1.53	0.46	19.4 a-c	26.0 ab	3.5	1.67
RTU Baytan Thiram 3 fl oz + Allegiance 0.4 fl oz/cwt (B) Trilex 0.64 fl oz + Vortex 0.08 fl oz + Allegiance 0.75 fl oz + Baytan 0.25 fl oz/cwt (O)	1.69	0.46	20.0 ab	35.0 a	3.7	1.94
RTU Baytan Thiram 3 fl oz + Allegiance 0.4 fl oz/cwt (B) Trilex 0.64 fl oz + Allegiance 0.75 fl oz + Baytan 0.25 fl oz/cwt (O)	1.65	0.43	19.3 bc	25.3 ab	3.8	1.64
RTU Baytan Thiram 3 fl oz + Allegiance 0.4 fl oz/cwt (B) Dynasty CST 3.95 fl oz/cwt (O)	1.74	0.47	20.0 ab	34.0 a	3.4	2.10
RTU Baytan Thiram 3 fl oz + Allegiance 0.4 fl oz/cwt (B) Quadris 2.08SC 0.6 fl oz + Ridomil Gold 0.12 fl oz/1000 ft of row (F)	1.49	0.43	21.3 a	31.5 a	4.6	1.95
LSD	**n.s.**	**n.s.**	**1.9**	**10.7**	**n.s.**	**n.s.**

[z]B=base treatment; O=overcoat, F=in furrow.
[y]Determined from counts of two 30-ft rows per plot.
[x]Determined from measurements of six plants per plot.
[w]Determined from counts of two 6-ft sections of row.
[v]Determined from counts of four plants per plot.
[u]Lint was 41.4% of total weight and 480 lb/bale. Plots were harvested on 21 Oct. Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD (*P*=0.05), "n.s." = not significant.

Effect of planting date and in-furrow fungicide on seedling disease, crop emergence, growth, and yield (Tidewater Research Farm, Suffolk). The field trial was planted in a peanut/cotton/cotton rotation and land preparation included ripping under rows and strip tillage into a wheat cover crop. A split-plot design with seven randomized complete blocks was used. Planting dates were main plots and in-furrow fungicide treatments were subplots of two 30-foot rows spaced 3 feet apart. DP 455 BG/RR (cool germ 83 percent, warm germ 88 percent) were planted about 0.5 inches deep at 3.6 seeds per foot of row and Temik 15G at 5 pounds per acre was applied in the seed furrow at planting. The in-furrow fungicide (Quadris 2.08F 0.6 fluid ounces + Ridomil Gold 0.12 fluid ounces per 1,000 feet of row) was mixed in water and applied at a volume of 5 gallons per acre. Standard practices were followed after planting and plots were harvested on 21 October.

Rainfall and soil temperatures (Table 7) were recorded by a Field Weather Monitor. Rainfall up to 7 days after planting (DAP) totaled <1 inch after each planting date, except for 3 May (1.55 inches). The 7 DAP average soil temperature was <60°F only after the 6 April planting. Other plantings had 7 DAP average soil temperatures of 62.3° to 66.3°F. Minimum air temperatures below 40ºF in the period up to 7 DAP may have caused chilling injury after plantings on 6 April and 27 April. Planting date had a significant effect on plants per foot of row, plant height, nodes per plant, flower count, open boll count, and yield (Table 8). In-furrow fungicide had little effect on these factors except for a small but significant increase in nodes per plant. The interaction of planting date and fungicide treatment was significant

only for plant height. Plant numbers were greatest in the 3, 10, and 17 May plantings. Flowering on 14 July and open bolls on 12 September were significantly higher in early plantings. Yields were near 2 bales per acre or higher except for the late planting on 17 May.

Table 7. Rainfall, soil temperature, and max./min. air temperature after planting cotton, 2006 (Tidewater Research Farm, Suffolk).*

	Days after planting								
Planting date	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Rainfall (in.)									**Total**
6 Apr	0.00	0.00	0.38	0.14	0.00	0.00	0.00	0.00	0.52
12 Apr	0.00	0.00	0.00	0.13	0.00	0.05	0.00	0.00	0.18
19 Apr	0.00	0.00	0.02	0.05	0.02	0.00	0.00	0.75	0.84
27 Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02
3 May	0.02	0.00	0.00	0.05	0.70	0.78	0.00	0.00	1.55
10 May	0.00	0.58	0.00	0.00	0.35	0.01	0.00	0.00	0.94
17 May	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Soil temp. (F)									**Mean**
6 Apr	56.5	59.5	60.6	56.7	56.3	58.3	59.6	62.5	58.8
12 Apr	59.6	62.5	62.7	65.3	64.5	60.7	60.5	62.3	62.3
19 Apr	62.3	63.5	63.6	67.9	66.0	67.3	68.0	64.5	65.4
27 Apr	61.1	60.7	60.3	59.2	58.5	59.6	62.3	64.1	60.7
3 May	62.3	64.1	65.1	67.9	64.6	60.1	62.3	63.6	63.8
10 May	63.6	65.5	66.3	66.3	64.6	66.0	66.0	65.5	65.5
17 May	65.5	66.0	65.5	65.9	67.1	67.3	66.7	66.7	66.3
Max/Min Air temp. (F)									**Mean**
6 Apr	68/32	83/56	76/45	57/36	67/31	71/34	73/43	81/56	72/42
12 Apr	73/43	81/56	79/50	85/58	75/56	59/48	69/43	79/43	75/50
19 Apr	79/43	83/44	79/57	82/61	81/59	82/59	83/57	71/49	80/54
27 Apr	62/48	68/43	63/39	64/37	62/42	77/38	76/54	81/52	69/44
3 May	76/54	81/52	83/56	82/61	64/52	56/52	69/50	75/47	73/53
10 May	75/47	79/58	75/48	76/48	68/51	75/55	69/50	76/49	74/51
17 May	76/49	78/51	71/52	80/52	81/49	72/50	71/48	78.44	76/49

*Weather data from Peanut/Cotton InfoNet (www.ipm.vt.edu/InfoNet) weather station at Tidewater AREC research farm. Soil temperature was measured at 4-in. depth under managed turf at test site. Air temperature was recorded at 12 inches above managed turf.

Table 8. Effect of planting date on growth, development and yield of cotton, 2006 (Tidewater Research Farm, Suffolk).

Variable[z]	Plants/ft (28 DAP)[y]	Plant height (14 Jul)[x]	No. of nodes/plant (14 Jul)[x]	No. of flowers/12 ft (14 Jul)[w]	Open bolls/plant (12 Sep)[v]	Yield (bales/A)[u]
Planting date						
6 Apr	1.82 de	21.3	11.3 a	27.7 ab	4.7 a	2.03 b-d
12 Apr	1.89 cd	22.0	11.4 a	31.9 a	5.0 a	2.21 ab
19 Apr	1.66 ef	19.4	10.3 bc	22.7 bc	3.8 b	1.95 cd
27 Apr	1.56 f	19.3	10.6 b	17.4 c	2.7 c	2.11 bc
3 May	2.34 a	19.6	10.1 cd	24.6 b	2.9 c	2.37 a
10 May	2.04 bc	19.3	9.8 d	10.4 d	1.9 d	2.24 ab
17 May	2.20 ab	15.7	8.9 e	0.6 e	0.6 e	1.81 d
Fungicide treatment						
Quadris + Ridomil	1.95	19.4	10.2 b	19.1	3.0	2.07
Untreated check	1.91	19.6	10.5 a	19.5	3.1	2.14
Split-plot analysis, *P*(F)						
Plant date (PD)	.0001	.0001	.0001	.0001	.0001	.0001
Fungicide treatment (FT)	.2953	.2632	.0138	.7958	.6597	.2531
PD x FT	.3124	.0002	.3098	.9769	.2565	.1110

[z] Data for planting dates are the mean of untreated and fungicide in-furrow.
[y] Determined from counts of two 30-ft rows per plot.
[x] Data represent measurements of six plants per plot.
[w] Data are number of flowers per 6-ft sections in each row.
[v] Determined from counts of four plants per plot.
[u] Lint was 43.8% of seed cotton according to gin samples. One bale of lint equals 480 lb. Plots were harvested on 21 Oct. Means followed by the same letter(s) in a column and group are not significantly different according to Fisher's Protected LSD (*P*=0.05).

Effect of planting date and stand reductions on growth and yield of cotton (Tidewater AREC, Suffolk). The soil type was Kenansville loamy fine sand that was planted in a cotton/corn/peanut rotation. Land preparation included under-the-row ripping and strip tillage into a cover crop of wheat. ST 4575 BR (cool germ 72 percent, warm germ 94 percent) treated with RTU Baytan/Thiram/Allegiance was planted on 19 April, 3 May, and 17 May. Plots were two 40-foot rows spaced 3 feet apart. A split-plot design with four replications was used. Main plots were planting dates and subplots were plant stand reductions. Seed were planted 0.25 to 0.5 inch deep at a rate of 4 seeds per foot of row. Temik 15G at 5 pounds per acre was applied to the seed furrow at planting. Standard practices for cotton production were followed after planting. Stand reductions were made by manually removing plants from 4-foot sections of each row on 9 June as follows: two sections per row or 20 percent of plot, four sections per row or 40 percent, and six sections per row or 60 percent to mimic the effect of damping off on reducing cotton stand. Counts of plants after reducing stands were used to define the final population. Six plants at least 1 foot away from sections without plants were arbitrarily selected for assessing plant height on 19 July; four plants were used to assess number of nodes and number of bolls on 27 September. Plots were harvested on 21 October with a two-row picker.

Final plant populations were significantly higher in the 3 May and 17 May plantings compared to 19 April (Table 9). Final stand reductions for 20 percent, 40 percent, and 60 percent treatments on 9 June were 18.6 percent, 40.2 percent, and 48.7 percent, respectively. Plant height in the 3 May planting was significantly greater in the 60 percent stand reduction treatment compared to no stand reduction or the 40 percent stand reduction. No significant differences were detected in plant heights by stand reduction treatments in plantings on 19 April or 17 May. The 19 April planting date had significantly higher numbers of nodes per plant compared to other plantings, while the 40 percent and 60 percent stand reduction treatments significantly reduced the number of nodes per plant. There was a significant interaction between planting date and stand reduction on bolls per plant on 27 September. Bolls per plant were significantly reduced by treatments that reduced the stand in the 17 May planting, but there were no differences in

the 19 April and 3 May plantings. The 40 percent and 60 percent stand reductions significantly reduced cotton yield. The 20 percent stand reduction produced yields similar to the no stand reduction treatment. The 3 May planting date had a significantly higher yield than other planting dates. This study demonstrated that cotton can tolerate a 20 percent stand reduction while stand reductions of 40 percent to 60 percent significantly reduced yield by 0.37 and 0.43 bales per acre, respectively.

Table 9. Effect of planting date and stand reductions on growth and yield of cotton, 2006.

Planting date and stand reduction[z]	Plants/ft[y] (9 Jun)	Plant height, in.[x] (19 Jul)	Nodes/ plant[w] (27 Sep)	Bolls/plant[w] (27 Sep)	Yield[v] lb/A	Yield[v] bales/A
19 Apr						
No stand reduction	1.56 a	16.7	14.8 a	14.5	2008	1.78
20% stand reduction	1.23 b	16.3	14.1 ab	12.8	1747	1.55
40% stand reduction	0.90 c	17.5	12.7 b	11.2	1697	1.50
60% stand reduction	0.73 c	16.7	14.0 ab	15.1	1531	1.36
LSD	0.19	n.s.	1.5	n.s.	n.s.	n.s.
3 May						
No stand reduction	2.24 a	16.5 c	13.3	9.6	2430	2.15
20% stand reduction	1.87 b	17.9 ab	12.9	11.1	2382	2.11
40% stand reduction	1.39 c	16.6 bc	11.8	8.3	1865	1.65
60% stand reduction	1.18 c	18.7 a	11.8	10.4	1931	1.71
LSD	0.28	1.4	n.s.	n.s.	n.s.	n.s.
17 May						
No stand reduction	2.17 a	14.0	13.7 a	12.8 a	2151	1.90
20% stand reduction	1.78 b	12.8	13.4 a	10.3 b	1749	1.55
40% stand reduction	1.29 c	13.4	11.3 b	9.5 b	1742	1.54
60% stand reduction	1.16 d	14.0	11.1 b	8.1 b	1643	1.45
LSD	0.09	n.s.	1.1	2.5	n.s.	n.s.
Plant date mean						
19 Apr	1.11 b	16.8	13.9 a	13.5	1746 b	1.55 b
3 May	1.67 a	17.4	12.4 b	9.8	2152 a	1.91 a
17 May	1.60 a	13.6	12.4 b	10.2	1821 b	1.61 b
LSD	0.09	--	0.6	--	210	0.19
Stand reduction mean						
No stand reduction	1.99 a	15.7	13.9 a	12.3	2196 a	1.94 a
20% stand reduction	1.62 b	15.7	13.5 a	11.4	1959 ab	1.73 ab
40% stand reduction	1.19 c	15.8	11.9 b	9.7	1768 bc	1.57 bc
60% stand reduction	1.02 d	16.5	12.3 b	11.4	1702 c	1.51 c
LSD	0.11	--	0.7	--	242	0.22
Split-plot analysis						
Plant date	.0006	.0038	.0271	.0114	.0323	.0323
Stand reduction	.0001	.1155	.0001	.0111	.0012	.0012
Plant date x stand reduction	.4113	.0075	.1952	.0122	.6579	.6579

[z]Stand was reduced in 4-ft sections/row as follows: two sections or 20%, four sections or 40%, and six sections or 60%.
[y]Based on numbers of plants in two 40-ft rows/plot.
[x]Data are from six plants per plot.
[w]Data are from four plants per plot.
[v]Yield in lb/A seed cotton and bales of lint/A. Percent lint was determined by ginning samples of seed cotton from each plant date. One bale equals 480 lb of lint. Plots were harvested on 21 Oct. Means followed by the same letter(s) and within a grouping are not significantly different according to Fisher's Protected LSD ($P \leq 0.05$). "n.s."=not significant; "--" denotes LSD not appropriate because of significant interaction of plant date and stand reduction.

Control of Hardlock with Foliar Fungicides

Effect of Quadris fungicide with and without Pix Plus on hardlock (Tidewater AREC, Suffolk). Land was prepared by strip tillage into a cover crop of wheat. Plots were four 30-foot rows spaced 3 feet apart. The soil type was Nansemond fine sandy loam and was planted in a cotton/corn/peanut rotation. The experimental design was a randomized complete block with five replications. The field was planted on 4 May to DP 555 BG/RR at 3.5 seeds per foot of row and 0.50 to 0.75 inch deep. Fungicide treatments were applied at 30 psi and 16.5 gallons per acre with a LeeSpider sprayer using a 12-foot spray boom and 8002VS nozzles spaced 18 inches apart. Applications of Pix and Quadris alone were compared to a tank mix of Pix and Quadris at early flowering on 18 July and 50 percent bloom on 1 August. The study evaluated two rates of Quadris 2.08SC either alone or tank-mixed with Pix. When sprayed alone, Pix was applied 3 days after the application of Quadris to minimize potential interactions of the two products.

Flower counts in Pix-treated plots averaged 9.6 per 12 feet of row on 17 July and 91.6 per 12 feet of row on 31 July (Table 10). Fungicide treatments did not have a significant effect on flower counts on 14 August (Table 11). Yield was not affected significantly by any treatment.

Table 10. Plant populations and flower counts in Pix-treated plots, 2006 (Tidewater AREC, Suffolk).

	Plants/ft*	Flowers/12 ft**	
Replication	(17 Jul)	17 Jul	31 Jul
I	2.7	10	106
II	3.0	3	82
III	2.5	12	77
IV	2.3	14	97
V	3.3	9	96
Mean	2.8	9.6	91.6

*Data are counts of two 30-ft rows per plot.
**Data are number of flowers in two 6-ft sections of row per plot.

Table 11. Effect of treatments on flower counts and yield, 2006 (Tidewater AREC, Suffolk).

	Flowers/12 ft*	Yield**	
Treatment, rate/A and application date	(14 Aug)	lb/A	bales/A
Pix 42EC 8 fl oz (6/30, 7/18, 8/1)	52.4	3265	3.09
Pix 42EC 8 fl oz (6/30) Pix 42EC 8 fl oz + Quadris 250SC 6 fl oz (7/18, 8/1)	46.8	3279	3.11
Pix 42EC 8 fl oz (6/30, 7/21, 8/4) Quadris 250SC 6 fl oz (7/18, 8/1)	44.4	3337	3.16
Pix 42EC 8 fl oz (6/30) Pix 42EC 8 fl oz + Quadris 250SC 9 fl oz (7/18, 8/1)	45.0	3146	3.00
Pix 42EC 8 fl oz (6/30, 7/21, 8/4) Quadris 250SC 9 fl oz (7/18, 8/1)	48.8	3473	3.29
LSD	**n.s.**	**n.s.**	**n.s.**

*Data are number of flowers in two 6-ft sections of row per plot.
**Weight (lb/A) includes lint + seed; bales/A are weight of lint only. Lint was 45.5% of total weight and 480 lb/bale. Plots were harvested on 1 Nov. "n.s." = not significantly different according to Fisher's Protected LSD (*P*=0.05).

Effect of fungicides on hardlock of cotton (Tidewater AREC, Suffolk). Soil in the field trial was Nansemond fine sandy loam that was planted in a cotton/corn/peanut rotation. Land was prepared by strip tillage into a cover crop of wheat and plots were four 30-foot rows spaced 3 feet apart. A randomized complete block design with five replications was used. The field was planted on 4 May to DP 555 BG/RR at 3.5 seeds per foot of row and 0.50 to 0.75 inch deep. Fungicide treatments were applied at 30 psi and 16.5 gallons per acre with a LeeSpider sprayer using a 12-foot spray boom and 8002VS nozzles spaced 18 inches apart. Pentia was applied at pinhead square and thereafter as needed. Fungicide treatments were applied at early flowering on 18 July and repeated in two additional sprays at 14-day intervals; corresponding to 50 percent bloom on 1 August and full bloom on 11 August.

Flower counts per 12 feet of row at the first, second, and third fungicide application averaged 18, 96 and 76, respectively (Table 12). Fungicide treatments did not increase the number of open bolls significantly compared to the untreated check on 27 September (Table 13). Hardlock incidence was low and widely scattered in all treatments on 27 September and at harvest on 1 November. No significant differences in yield of seed cotton or lint were found.

Table 12. Flower counts in untreated plots at the time of fungicide application, 2006 (Tidewater AREC, Suffolk).

	Flowers/12 ft*		
Replication	**17 Jul**	**31 Jul**	**11 Aug**
I	18	94	80
II	17	105	71
III	21	104	86
IV	24	87	83
V	8	92	60
Mean	18	96	76

*Data are number of flowers in two 6-ft sections of row per plot.

Table 13. Plant populations and the effect of treatments on boll opening, total bolls, and yield, 2006 (Tidewater AREC, Suffolk).

	Plants/ft[y]	Bolls/6 ft (27 Sep)[x]		Yield[w]	
Treatment and rate/A[z]	**(27 Sep)**	**Open**	**Total**	**lb/A**	**bales/A**
Check	2.6	47.4	125.6 ab	3507	3.38
Headline 250EC 6.14 fl oz	2.8	53.0	126.8 ab	3386	3.27
Headline 250EC 9.2 fl oz	2.5	53.2	125.4 ab	3574	3.45
Caramba 90SL 8.2 fl oz	2.7	47.8	117.0 a-c	3335	3.22
BAS 55601F 210EC 5.5 fl oz	2.6	50.0	129.4 a	3584	3.46
BAS 55601F 210EC 6.8 fl oz	2.7	43.2	116.0 bc	3531	3.41
BAS 55601F 210EC 8.6 fl oz	2.8	44.6	109.8 c	3398	3.28
BAS 50000F 250EC 4.4 fl oz + Caramba 90SL 5.3 fl oz	2.7	47.4	115.4 bc	3292	3.17
Quadris 250SC 9.2 fl oz	2.9	55.8	125.4 ab	3260	3.14
LSD	**n.s.**	**n.s.**	**12.6**	**n.s.**	**n.s.**

[z]All treatments were applied at early flowering (7/18), and thereafter at 14 day intervals (8/1, 8/11).
[y]Number of plants in two 3-ft sections of row.
[x]Number of bolls in two 3-ft sections of row.
[w]Weight (lb/A) includes lint + seed; bales/A are weight of lint only. Lint was 46.3% of total weight and 480 lb/bale. Plots were harvested on 1 Nov. Means followed by the same letter(s) in a column are not significantly different (LSD, *P*=0.05), "n.s." = not significant.

Effect of Planting Date and Plant Populations on Growth and Yield of Cotton, 2006

Summary:

1. **2006 growing season.** Rainfall in June, September, and October was 5.75, 4.64, and 4.62 inches above normal and May, July, and August was 0.96, 2.21, and 3.21 inches below normal, respectively. Total rainfall from May through October was 36.4 inches or 8.7 inches above normal. A total of 2,053 DD_{60} units were accumulated in the 2006 growing season or 120 units below the 12-year average from 1995 to 2006. The state average yield was 717 pounds per acre or 1.5 bales per acre in 2006.

2. **Seed treatment and in-furrow fungicides.** Baytan/Thiram/Allegiance has been the industry-standard fungicide treatment for seedling disease control in cotton. Results in 2006 indicated that Baytan/Allegiance/Argent, Baytan/Allegiance/Vortex/Trilex, and Dynasty CST-M resulted in significantly higher stand counts than Baytan/Thiram/Allegiance.

3. **Planting dates.** In weekly plantings from 6 April through 17 May, in-furrow fungicide (Quadris 0.6 fluid ounces + Ridomil Gold 0.12 fluid ounces per 1,000 feet of row) did not significantly improve seedling emergence or yield. Plantings from 6 April to 27 April produced stands that were lower than plantings from 3 May to 17 May. Flower counts on 14 July were greatest in the 12 April planting (32 per 12 feet of row) and lowest in the 17 May planting (0.6 per 12 feet of row). The earliness of boll opening was greatest in the 12 April planting and lowest in the 17 May planting according to counts on 12 September. Yields were highest and essentially equal in the 12 April, 3 May, and 10 May plantings and significantly higher than the 19 April and 17 May plantings.

4. **Impact of reduced stand.** Late-season boll counts were reduced significantly in plots with reduced stand (20 percent, 40 percent, and 60 percent) in the 17 May planting, but there were no differences in counts for the 19 April and 3 May plantings. A 20 percent reduction in stand resulted in yields that were similar to no stand reduction, while stand reductions of 40 percent to 60 percent reduced yield by 0.37 and 0.43 bales per acre, respectively.

5. **Control of foliar, stem, and boll diseases.** Foliar applications of Quadris, Headline, and several experimental fungicides did not have a significant effect on flowering, earliness of open bolls, or yield of cotton. The incidence of hardlock was very low in 2006, which may be a result of below normal rainfall during the period of flowering and pollination.