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Cost and benefit of seed treatments and Temik 15G in furrow for seedling disease and nematode control in Virginia, 2008

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Cotton was planted on 61,000 acres in southeastern Virginia and harvested from 60,000 acres according to a March estimate by the Virginia Agricultural Statistics Service. The state average yield estimate was 908 lb/A. Value of lint is estimated to average $0.39/lb.

Disease losses in 2008

Seedling diseases were estimated to reduce yield by only 1% in 2008 (Table 1). Seed quality was good to excellent with cool germ averaging 80% or above. Cotton planting began as early as April 20 and was completed by May 20. Stand losses were caused by Rhizoctonia and Pythium damping-off, but incidence and impact were low. The most troublesome problem was sand blasting of seedlings which damaged emerging leaves and stunted seedling growth.

Southern root-knot nematode, *Meloidogyne incognita*, accounted for the heaviest loss of yield especially in fields planted continuously to cotton for 5 years or longer (Table 1, Fig. 1). The occurrence of damage by reniform nematode, *Rotylenchulus reniformis*, on cotton continues to be limited to a few fields in Southampton County. Instances of yield losses to stubby root were found, but overall were less destructive than southern root knot. Sting nematode continues to cause damage in cotton, but occurrences are spotty and confined to localized areas with sandy-textured soil. As in previous years, the Columbia lance nematode was not detected in 2008.

Minimal losses were estimated for boll rots and foliar diseases. The estimated loss to all diseases totaled 6.6% of yield potential or a total of 3.85 million pounds of lint valued at 1.5 million dollars.

Table 1. Estimated loss of yield to cotton diseases in 2008.

Disease	Causal agent(s)	Percent loss
Seedling disease	*Rhizoctonia solani*, *Pythium* spp.	1.0
Fusarium wilt	*Fusarium oxysporum* f. sp. *vasinfectum*	trace
Verticillium wilt	*Verticillium dahliae*	0
Texas root rot	*Phymatotrichum omnivorum*	0
Ascochyta blight	*Ascochyta gossypii*	0
Bacterial blight	*Xanthomonas* spp.	0.1
Boll rots	*Diplodia* spp., *Fusarium* spp., *Xanthomonas* spp.	0.2
Leaf spots	---various---	0.3
Southern root-knot nematode	*Meloidogyne incognita*	3.5
Reniform nematode	*Rotylenchulus reniformis*	0.1
Other nematodes	*Trichodorus* spp., *Belonolaimus* spp., etc.	1.4
Total loss (%)		6.6*

* The loss estimate equals 3.85 million pounds in Virginia based on production of 54.48 million pounds of lint in 2008. At a value of $0.39 per pound, the loss in revenues at the farm gate would total 1.5 million dollars.

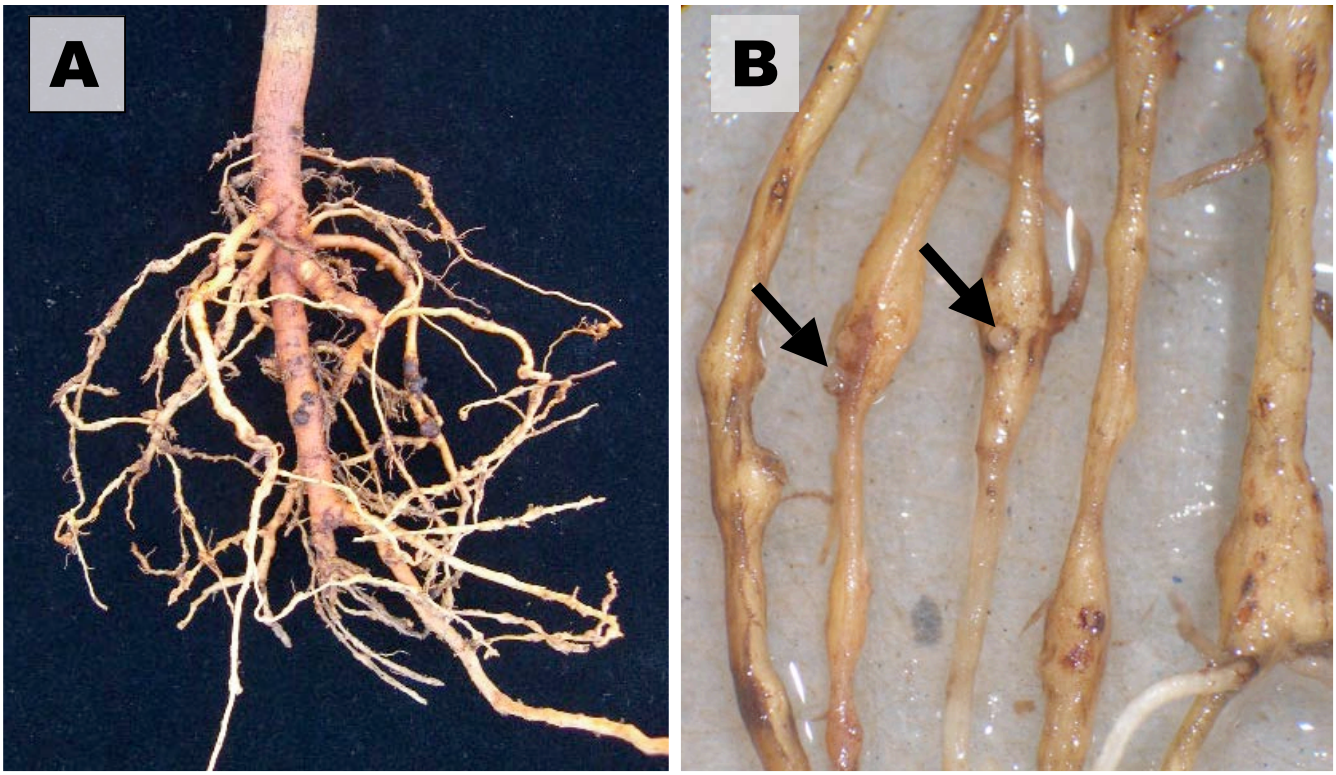

Figure 1. Southern root-knot nematode: A) cotton root system from naturally infested field with root galls, and B) root galls on secondary roots with swollen females protruding from galls (arrows).

Seasonal Degree Days, Rainfall, and Crop Growth in 2008

Rainfall in May, June, July, August and October was 0.39, 2.77, 0.29, 3.53 and 2.67 in. below normal, respectively, and September was 1.54 in. above normal (Table 2). Rainfall during the period totaled 19.63 in., which was 8.11 in. below normal. Average minimum air temperatures were normal (±1°F) in July, August and October, 2°F above normal in September, 3°F above normal in June, and 2°F below normal in May. Maximum air temperatures were near normal in May, August, September and October, 2°F above normal in July, and 8°F above normal in June according to records from a NOAA station at the Tidewater AREC in Suffolk. Planting was delayed until April 20 because minimum air temperatures fell below 45° F on 11 days between April 1 and 18, and weekly soil temperatures averaged below 60° F until the week of April 21 (Table 3). Periods of drought stress in June and August caused some wilting and stunting, especially in fields with sandy textured soils. Harvesting began at the end of September and was nearly complete by the end of November. The first killing frost in the Tidewater area was on 31 October when night-time temperatures ranged in the mid 20's to 30 ºF.

Table 2. Rainfall in the past six years compared to 75-yr average (1933 to 2007).

Month	Rainfall (in.)*							
	2002	2003	2004	2005	2006	2007	2008	Normal
May	3.98	7.14	4.77	4.78	2.86	2.16	3.43	3.82
Jun	1.66	4.10	5.10	2.64	10.08	3.00	1.56	4.33
Jul	5.53	4.98	12.53	5.19	3.66	1.71	5.58	5.87
Aug	2.22	3.50	11.00	4.50	2.50	5.00	2.18	5.71
Sep	2.96	11.81	5.15	3.08	9.16	0.43	6.01	4.47
Oct	4.89	4.40	4.52	5.68	8.14	5.26	0.87	3.54
Total	21.24	35.93	43.07	25.87	36.40	17.56	19.63	27.74

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

Cotton degree-days (DD_{60}) from 1 May to 31 October totaled 2335 or 149 above the 13-yr average (Table 4). Above-average accumulations of degree days were recorded in June (+158), July (+11), and September (+41). Below-average accumulations occurred in May (-25), August (-11) and October (-24). Although vegetative growth was less than observed in years with normal rainfall, several fields showed early maturity and average or better yield potential at harvest.

Table 3. Soil temperatures at 4-in. depth in 2008 compared to the five-year average (2003-2007).

10-day period	Soil temperatures (ºF)*						
	2003	2004	2005	2006	2007	2008	Mean
Apr 1-10	52.3	53.5	57.6	58.1	57.1	57.4	55.7
Apr 11-20	56.9	59.1	55.8	62.0	54.8	61.0	57.7
Apr 21-30	62.7	65.6	60.6	63.9	67.2	64.4	64.0
May 1-10	65.5	66.5	61.2	62.8	64.4	68.0	64.1
May 11-20	65.4	73.6	67.0	65.8	67.2	65.2	67.8
May 21-30	66.2	78.3	66.6	70.2	74.2	68.6	71.1

*Based on daily records at the Tidewater AREC, Suffolk.

Table 4. Cotton degree day accumulations in 2008 compared to 13-yr average (1995 to 2007).

Month	Cotton Degree Days (DD_{60})*							
	2002	2003	2004	2005	2006	2007	2008	Avg.
May	271	216	395	169	221	230	229	254
Jun	513	421	426	433	386	431	585	427
Jul	615	543	523	587	541	508	540	529
Aug	564	536	427	557	542	541	488	499
Sep	373	334	320	393	259	351	367	326
Oct	162	116	100	158	104	273	126	150
Total	2498	2166	2191	2297	2053	2334	2335	2186

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

The relationship of total rainfall and degree days to growth and yield in 2008 showed that from May 1 to October 31, cotton received rainfall that was 8.11 in. below the 13-yr average and 149 degree-days above the average (Table 5, Fig. 2). Pinhead square, first flowers and 1st open bolls appeared within one to four days of the 13-yr average. The March estimate for yield in Virginia was 896 lb/A which was 81 lb above the average. Dry weather stress in June and August was likely a major contributor to yield falling short of the high levels recorded in 2004 and 2005.

Table 5. Relationship of total rainfall and degree-days to growth and yield of cotton over the past 13-yr 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	719
2007	17.56	2334	15-Jun	11-Jul	5-Sep	988
13-yr average	**29.54**	**2186**	**15-Jun**	**11-Jul**	**6-Sep**	**815**
2008	19.63	2335	16-Jun	15-Jul	8-Sep	896 [x]

[z]Rainfall records for May through Oct at the Tidewater AREC in Suffolk, VA.
[y]Lint yields (1995-2007) are for the City of Suffolk according to the Virginia Agricultural Statistics Service.
[x]Yield estimate for 2008 is based on the March estimate for Virginia.

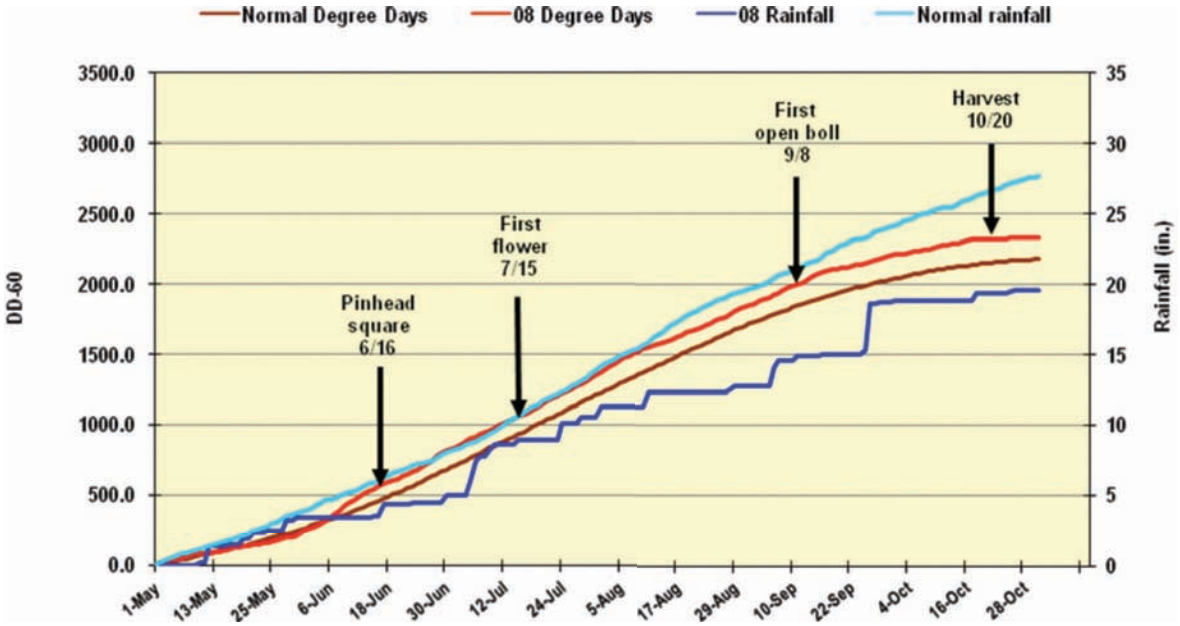

Figure 2. Degree days, rainfall and crop development in 2008 at Suffolk, VA.

Seed Treatment Fungicide Trials

National cotton seed treatment trial (Tidewater Research Farm, Suffolk). The field trial was conducted in Kenansville loamy fine sand. The site was prepared for planting by under the row ripping and strip tillage into a cover crop of wheat. Treatments were replicated in four, randomized complete blocks. Seed of DP 444 BG/RR were planted on 18 April to a depth of 0.5 in. and a rate of 3 seed/ft of row. Plots were two, 30-ft rows spaced 36-in. apart. Temik 15G at 5 lb/A was applied to the seed furrow at planting. The trial was managed according to standard practices in Virginia. Plots were harvested with a two-row harvester on 20 October.

Soil temperature at the 4-in. depth was 62.0º F at planting and averaged 63.4º F up to 7 days after planting. No rainfall occurred in the same period. RTU Baytan-Thiram-Allegiance resulted in the highest stand at 28 days after planting (Table 6). Significant reductions in stand were recorded for seed treated with RTU-PCNB, Vitavax-PCNB-Allegiance, Argent, and untreated seed. RTU-PCNB, Allegiance, Argent and untreated seed produced lower yields than other treatments but only Argent was significantly lower than the RTU Baytan-Thiram-Allegiance seed treatment.

Table 6. Effect of seed treatments on emergence and yield of cotton.

Treatment and rate	Plants/ft* (17 May)	Yield** lb/A	Yield** bales/A
Baytan 30 0.5 fl oz + Allegiance FL 0.75 fl oz + Vortex FL 0.08 fl oz + Trilex FL 0.32 fl oz/cwt seed	1.06 a-c	3854 a	3.14 a
Baytan 30 0.5 fl oz + Allegiance FL 0.75 fl oz + Vortex FL 0.08 fl oz/cwt seed	0.96 a-c	3612 a	2.94 a
Allegiance FL 0.75 fl oz + Vortex FL 0.34 fl oz + Trilex FL 0.64 fl oz/cwt seed	1.14 a	3487 a	2.84 a
Baytan 30 0.5 fl oz + Allegiance FL 0.75 fl oz + Vortex FL 0.17 fl oz/cwt	1.00 a-c	3784 a	3.08 a
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz/cwt seed	1.20 a	3712 a	3.02 a
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz/cwt seed + Dynasty Extreme 0.045 mg a.i./seed	0.94 a-c	3439 a	2.80 a
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz/cwt seed + Bion 0.6 g a.i./100 kg seed	1.14 a	3446 a	2.81 a
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz + Dynasty CST 3.95 fl oz/cwt seed + Bion 0.6 g a.i./100 kg seed	1.12 ab	3872 a	3.15 a
Vitavax-PCNB 6.0 fl oz + Allegiance FL 0.75 fl oz/cwt seed	0.88 b-d	3582 a	2.92 a
RTU-PCNB 14.5 fl oz/cwt seed	0.66 de	3343 a	2.72 a
Allegiance FL1.5 fl oz/cwt seed	1.00 a-c	3452 a	2.81 a
Argent 4.5 fl oz/cwt	0.61 e	2789 b	2.27 b
Non-treated	0.81 c-e	3427 a	2.79 a
P(F)	.0004	.0340	.0340

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

** Weight (lb/A) includes lint + seed; bales/A are weight of lint only. Lint was 39.1% of total weight and 480 lb/bale. Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD (*P*=0.05).

Baytan/Thiram/Allegiance with supplementary fungicides (Tidewater Research Farm, Suffolk). Land preparation included under the row ripping and strip tillage into a wheat cover crop. The soil type was Kenansville loamy sand that was planted to peanut, corn and cotton in 2007, 2006 and 2005, respectively. Black seed (untreated) of FM 9063 B2RF and seed treated with RTU-Baytan/Thiram 3 fl oz + Allegiance-FL 0.75 fl oz/cwt were reference standards. Supplementary fungicides were applied as an overcoat on seed treated with RTU-Baytan/Thiram/Allegiance. Temik 15G 5 lb/A was applied to the seed furrow at planting on 25 April. Seed were planted 0.50 to 0.75 in. deep at a rate of 3 seed/ft of row. Plots were two, 30-ft rows spaced 3-ft apart and treatments were randomized in four complete blocks. Standard practices for cotton production were followed after planting. Counts of emerged seedlings were recorded at 14 and 28 days after planting (DAP). Additional in season records included plant height measurements, flower counts, and open boll counts. Plots were harvested on 20 October with a two-row harvester.

An overcoat of Trilex Advanced with and without Vortex improved plant stand significantly compared to the RTU-Baytan/Thiram/Allegiance standard (Table 7). Plant vigor for treated seed was similar, except for treated seed with an overcoat of Trilex Advanced + Kodiak. Plant height on 18 July and flower counts on 31 July were not affected by treatments. Open boll counts/plant were not different except for untreated seed which had the fewest plants/ft of row. Yields were not significantly different across treatments.

Table 7. Baytan/Thiram/Allegiance with supplementary fungicides.

Treatment and rate/cwt seed	Plants/ft[z] (16 May)	Plant vigor[y] (28 May)	Plant ht. (in.)[x] (18 Jul)	Flower count[w] (31 Jul)	Open bolls/plant[v] (19 Sep)	Yield[u] lb/A	Yield[u] bales/A
Untreated (black seed)	1.29 c	2.0 b	23.8	22.0	10.3 a	3636	3.04
RTU-Baytan/Thiram/Allegiance	1.35 bc	3.0 a	23.3	21.3	7.9 b	3718	3.11
RTU-Baytan/Thiram/Allegiance + Trilex Advanced FS300 1.6 oz	1.72 a	3.0 a	23.3	19.8	7.9 b	3769	3.15
RTU-Baytan/Thiram/Allegiance + Trilex FL 0.64 oz + Baytan 30 0.25 oz + Allegiance-FL 0.75 fl oz	1.60 ab	3.0 a	23.6	23.3	7.4 b	3358	2.81
RTU-Baytan/Thiram/Allegiance +V-10244 100FS 35 g + Dynasty CST 3.95 oz	1.51 a-c	2.5 ab	21.9	23.0	7.4 b	3639	3.04
RTU-Baytan/Thiram/Allegiance + Trilex Advanced FS300 1.6 oz + Vortex FL 0.17 oz	1.75 a	3.0 a	23.2	21.5	7.4 b	3624	3.03
RTU-Baytan/Thiram/Allegiance + Trilex Advanced FS300 1.6 fl oz + Kodiak FL 0.5 oz	1.35 bc	2.0 b	22.9	25.5	8.0 b	3576	2.99
P(F)	.0075	.0018	.1357	.4419	.0208	.6998	.6998

[z]Determined from counts of two, 30-ft rows per plot. [y] Plant vigor rating scale: 0=dead, 10=healthy. [x]Determined from measurements of three randomly selected plants/row in each plot. [w]Data are counts from 6-ft section of row in each plot. [v]Counts of two randomly selected plants/row in each plot. [u]Weight (lb/A) includes lint + seed; bales/A are lint only. Lint was 40.1% of total weight. One bale equals 480 lb. Plots were harvested on 20 Oct. Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD (*P*=0.05).

Baytan/Allegiance/Vortex with and without supplementary fungicides (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 peanut, cotton and corn in 2007, 2006 and 2005, respectively. Personnel at Bayer CropScience applied seed treatments to FM 9063 B2RF. Temik 15G 5 lb/A was applied to the seed furrow in all plots at planting on 25 April. Seed were planted 0.50 to 0.75 in. deep at a rate of 3 seed/ft of row. Plots were two, 30-ft rows spaced 3-ft apart. A randomized complete block design with four replications was used. Standard practices for cotton production were followed after planting. Counts of emerged seedlings were recorded at 14 and 28 days after emergence (DAE). Additional records included plant vigor, plant height, flower counts and open boll counts. Plots were harvested on 20 October with a two-row harvester.

Soil temperatures at the test site averaged 65.1 °F in the 7 days after planting (DAP) and no rainfall occurred during the period. High rates of Baytan/Allegiance/Vortex, half rates of Baytan/Allegiance/Vortex + Trilex Advanced 1.6 oz, and Dynasty CST 3.95 oz resulted in a significant increase in stand at 14 and 28 DAE compared to untreated seed (Table 8). Plant vigor was increased significantly by all treatments except for seed treated with half rates of Baytan-Allegiance-Vortex. None of the seed treatments increased plant height, flower counts, open bolls (not shown) or yield significantly.

Table 8. Baytan/Allegiance/Vortex with and without Trilex.

Treatment and rate/cwt seed	Plants/ft[z]		Plant vigor[y]	Plant height (in.)[x]	Flowers/ 12 ft[w]	Yield[v]	
	16 May	30 May	(28 May)	(18 Jul)	(31 Jul)	lb/A	bales/A
Untreated (black seed)	1.24 b	1.15 c	2.0 b	21.8	23.5	3034	2.49
Baytan 30 0.5 oz + Allegiance FL 0.75 oz + Vortex FL 0.0856 oz	1.46 ab	1.45 bc	2.3 b	20.7	21.3	3137	2.57
Baytan 30 0.5 oz + Allegiance FL 0.75 oz + Vortex FL 0.0856 oz + Trilex Advanced FS300 1.6 oz	1.73 a	1.62 ab	2.8 a	22.0	23.8	3579	2.94
Baytan 30 1.0 oz + Allegiance FL 1.5 oz + Vortex FL 0.17 oz	1.78 a	1.80 a	2.8 a	20.9	21.3	3095	2.54
Baytan 30 1.0 oz + Allegiance FL 1.5 oz + Vortex FL 0.17 oz + Trilex Flowable 0.32 oz	1.56 ab	1.54 ab	2.8 a	21.2	22.8	3542	2.91
Dynasty CST 3.95 oz	1.73 a	1.62 ab	2.8 a	20.9	22.3	3364	2.76
P(F)	.0952	.0853	.0506	.3133	.9800	.2441	.2441

[z]Determined from counts of two, 30-ft rows per plot. [y] Plant vigor rating scale: 0=dead, 10=healthy. [x]Determined from measurements of three randomly selected plants per row in each plot. [w]Data are counts from 6-ft section of row in each plot. [v] Weight (lb/A) includes lint + seed; bales/A are lint only. Lint was 39.4% of total weight. One bale equals 480 lb. Plots were harvested on 20 Oct. Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD (*P*=0.05), except stand counts and plant vigor ratings were analyzed at P=0.10.

Response of low vigor and high vigor seed to seed treatment fungicides (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 peanut, corn and cotton in 2007, 2006 and 2005, respectively. Personnel at Bayer CropScience applied seed treatments to FM 9063 B2RF from low vigor (60% cool germ) and high vigor (80% cool germ) seed lots. Temik 15G 5 lb/A was applied to the seed furrow in all plots at planting on 25 April. Seed were planted 0.50 to 0.75 in. deep at a rate of 3 seed/ft of row. Plots were two, 30-ft rows spaced 3-ft apart. A split-plot design was used with treatment in main plots and subplots of seed lot in four randomized complete blocks. Standard practices for cotton production were followed after planting. Counts of emerged seedlings were recorded at 14 and 28 days after planting (DAP). Additional data included plant vigor, plant height, open bolls and yield. Plots were harvested on 20 October with a two-row harvester.

Soil temperatures at the test site averaged 65.1 °F in the 7 days after planting (DAP) and no rainfall occurred during the period. All treatments increased stand counts at 14 and 28 DAP, but none were significantly different from untreated seed (Table 9). Seedling vigor, plant height, flower counts (not shown), open bolls and yield were not affected significantly by treatments. No differences were detected in comparisons of low vigor and high vigor seed.

Table 9. Effect of seed treatment and quality on emergence of cotton.

Treatment and rate/cwt seed	Plants/ft[z] 9 May	Plants/ft[z] 23 May	Plant vigor[y] (26 May)	Plant height (in.)[x] (18 Jul)	Open bolls[w] (19 Sep)	Lint yield[v] (bales/A)
Treatment mean						
Untreated	1.28	1.14	3.1	24.3	10.7	2.72
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz	1.51	1.56	3.5	23.4	8.3	2.75
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz + Trilex Advanced FS300 1.64 fl oz	1.46	1.45	3.1	24.2	8.3	2.86
RTU Baytan-Thiram 3.0 fl oz + Allegiance FL 0.75 fl oz + Dynasty CST 3.95 fl oz	1.48	1.41	3.3	23.8	9.6	2.78
Seed lot mean						
Low vigor	1.50	1.43	3.1	23.9	8.9	2.74
High vigor	1.37	1.35	3.4	24.0	9.6	2.81
Split-plot analysis **(P value)**						
Treatment	.4899	.2792	.8377	.7510	.2705	.7841
Seed lot	.3829	.5241	.3061	.6383	.1502	.5525
Treatment x seed lot	.6815	.9267	.4463	.0555	.4459	.8395

[z] Determined from counts of two, 30-ft rows per plot.
[y] Plant vigor rating scale: 0=dead, 10=healthy.
[x] Data are measurements of three randomly selected plants per row in each plot.
[w] Counts of two randomly selected plants per row in each plot
[v] Bales/A are weight of lint only. Lint was 40.5% of total weight for low vigor seed and 41.0% of total weight for high vigor seed. One bale equals 480 lb. Plots were harvested on 20 Oct.
Means in a column are not significantly different according to Fisher's Protected LSD (P=0.05).

Nematicide Trials

Response of cotton varieties to seed and in-furrow treatments (Morgan Farm, Suffolk, VA). Soil at the field site was Rumford loamy fine sand and was prepared by ripping and bedding rows in stale beds of cotton from the previous season. Crop history included cotton from 2001 through 2007. Seed treatments with Avicta Complete Pak (CP) and Aeris Seed Applied System (SAS) were applied overtop the vendor's base fungicide treatment by Bayer CropScience and Syngenta Crop Protection, respectively. Treatments were tested in a split-plot design on the same seed lot of each variety. Main plots consisted of one treatment applied to twelve 30-ft rows spaced 38 in. apart and subplots were two rows of each variety in four randomized complete blocks. The treatment with Temik 15G 5 lb/A was applied to the seed furrow at planting on 6 May. Orthene 97S at 8 oz/A was applied to all plots on 3 June for thrips control. Standard practices for cotton production in Virginia were used through the season. Soil samples for determining nematode populations were processed by a soil elutriator and the sugar flotation method. All plots were harvested with a two-row spindle picker on October 29.

Stand counts ranged from 1.63 to 2.55 plants/ft of row on 7 June and only differences in varieties were significant (Table 10). Thrips injury was reduced significantly by seed treatments with Avicta CP and Aeris SAS, and the in-furrow treatment with Temik 15G at 5 lb/A. No significant differences among varieties were found for thrips damage. Plant height was increased significantly by Avicta and Aeris seed treatments, but Temik 15G caused the greatest increase in plant height according to measurements on 21 July (not shown). Flower counts were significantly greater for Temik 15G compared to other treatments on 28 July. Treatments did not have a significant effect on counts of southern root-knot juveniles, or lesion and stubby root nematodes in soil when compared to counts in the untreated check on 11 August. Open bolls on 22 September were increased significantly by Temik 15G in-furrow. ST 5458 B2RF had significantly lower root galling than other varieties on 7 November. Root galling was heaviest on ST4427 B2RF, DP141 B2RF, and PHY370 WR. Root galling was reduced significantly by Temik 15G on DP141 B2RF and ST5458 B2RF, and by Avicta CP on ST4427 B2RF and ST5458 B2RF. Aeris SAS failed to reduced root galling significantly on any of the varieties, but did increase root galling significantly on DP141 B2RF, DP143 B2RF, PHY370 WR, and FM1720 B2RF. All treatments increased yield significantly. The highest yields were recorded for ST5458 B2RF and DP141 B2RF, which were significantly higher than ST4427 B2RF. The yield increase by treatments averaged 0.38 bales/A ($71/A) with Avicta CP, 0.40 bales/A ($75/A) with Aeris SAS, and 0.51 bales/A ($95/A) with Temik 15G.

Table 10. Response of cotton varieties to seed and in-furrow fungicide/insecticide/nematicide treatments.

Variety (cool germ.) and treatment [z]	Plants/ft (7 Jun)[y]	Thrips injury (18 Jun)[x]	Flowers/ 12 ft [w] (28 Jul)	Open bolls[v] (22 Sep)	Root-knot galling [u] (7 Nov)	Root-knot juveniles/ 500 cm^3 soil [t]	Lint yield [s] (bales/A)
ST 4427 B2RF (61% germ.)							
Untreated Check	1.68	3.3 a	21.8	4.8	3.88 a	1650	1.82
Avicta Complete Pak (O)	1.92	0.0 b	29.3	5.7	2.69 b	930	2.00
Aeris Seed Applied System (O)	1.78	0.0 b	21.8	4.3	4.13 a	720	2.06
Temik 15G 5 lb/A (F)	1.63	0.0 b	29.0	5.1	3.44 ab	720	2.25
P(F)	.5721	.0001	.4214	.1056	.0607	--	.5381
ST 5458 B2RF (82% germ.)							
Untreated Check	2.31	3.3 a	21.0 b	2.8 c	2.38 a	240	2.23
Avicta Complete Pak (O)	2.23	0.0 b	26.8 b	3.5 bc	1.56 b	580	2.48
Aeris Seed Applied System (O)	2.47	0.0 b	28.5 b	3.6 b	2.00 ab	170	2.39
Temik 15G 5 lb/A (F)	2.17	0.0 b	39.8 a	4.4 a	1.44 b	1480	2.73
P(F)	.1278	.0001	.0512	.0006	.0271	--	.4487
DP 141 B2RF (81% germ.)							
Untreated Check	2.10	3.0 a	28.0	4.3	3.63 b	670	2.05
Avicta Complete Pak (O)	2.26	0.0 b	26.5	4.4	3.56 b	1440	2.31
Aeris Seed Applied System (O)	1.92	0.0 b	27.5	5.3	4.31 a	1340	2.39
Temik 15G 5 lb/A (F)	2.13	0.0 b	32.3	4.6	3.19 b	610	2.58
P(F)	.1104	.0001	.1866	.2502	.0140	--	.1557
DP 143 B2RF (75% germ.)							
Untreated Check	2.24	3.0 a	27.0	3.8	3.38 b	430	1.77
Avicta Complete Pak (O)	2.35	0.0 b	25.0	4.1	3.38 b	1110	2.45
Aeris Seed Applied System (O)	2.11	0.0 b	25.0	4.1	4.00 a	560	2.36
Temik 15G 5 lb/A (F)	2.28	0.0 b	26.5	4.6	3.06 b	560	2.41
P(F)	.9065	.0001	.9680	.2539	.0810	--	.1663
PHY 370 WR (85% germ.)							
Untreated Check	1.98	3.3 a	18.5	4.3	3.06 b	990	1.82
Avicta Complete Pak (O)	2.00	0.0 b	20.5	4.8	3.13 b	1880	2.24
Aeris Seed Applied System (O)	1.80	0.0 b	23.0	4.6	4.56 a	2060	2.34
Temik 15G 5 lb/A (F)	1.83	0.0 b	29.3	5.3	3.38 b	710	2.44
P(F)	.7010	.0001	.1959	.4087	.0021	--	.2893
FM 1740 B2RF (79% germ)							
Untreated Check	2.55	3.0 a	24.8	4.0 b	2.88 b	990	1.79
Avicta Complete Pak (O)	2.30	0.5 b	28.3	4.6 b	2.69 b	1880	2.27
Aeris Seed Applied System (O)	2.38	0.0 b	26.0	4.4 b	4.38 a	2060	2.30
Temik 15G 5 lb/A (F)	2.43	0.0 b	29.3	5.6 a	2.44 b	710	2.09
P(F)	.2534	.0001	.7867	.0203	.0007	--	.3055
Variety mean							
ST 4427 B2RF	1.75 c	0.8	25.4	4.9 a	3.53 a	1005	2.03 c
ST 5458 B2RF	2.29 a	0.8	29.0	3.6 c	1.84 c	618	2.46 a
DP 141 B2RF	2.10 b	0.8	28.6	4.6 a	3.67 a	1015	2.33 ab
DP 143 B2RF	2.24 ab	0.8	25.9	4.1 b	3.45 ab	665	2.25 a-c
PHY 370 WR	1.90 c	0.8	22.8	4.7 a	3.53 a	1410	2.21 bc
FM 1740 B2RF	2.41 a	0.9	27.1	4.6 a	3.09 b	1220	2.11 bc
Treatment mean							
Untreated Check	2.14	3.1 a	23.5 b	4.0	3.20	720	1.91 b
Avicta Complete Pak (O)	2.18	0.1 b	26.0 b	4.5	2.83	1197	2.29 a
Aeris Seed Applied System (O)	2.08	0.0 b	25.3 b	4.4	3.90	1157	2.31 a
Temik 15G 5 lb/A (F)	2.08	0.0 b	31.0 a	4.9	2.82	882	2.42 a
Split-plot analysis, *P* (F)							
Treatment	.7613	.0001	.0030	.1316	.1242	--	.0822
Variety	.0001	.7786	.1886	.0001	.0001	--	.0078
Treatment x variety	.5475	.5055	.7058	.1943	.0557	--	.9294

[z] O=overcoat treatment, F=in seed furrow at planting. [y] Determined from counts of one 6-ft section in each row. [x] Thrips rating: 0=no damage, 10=severe thrips damage. [w] Number of flowers in 6-ft section of each row. [v] Mean of four plants per plot. [u] Roots of four plants per plot were scored according to percentage of roots with galls: 0=none, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5=76-90%, 6=91-100%. [t] Counts are from a composite of soil samples collected across four replications of each variety/treatment combination on 11 Aug. Square root transformation of population data was made in statistical analysis. [s] Yield of lint was determined by ginning samples of seed cotton. One bale of lint equals 480 lb. Means followed by the same letter(s) in a column and group are not significantly different according to Fisher's Protected LSD at P ≤0.05. Means followed by letters in groups with *P* ≥0.05 but P≤0.10 were based on analysis at P=0.10.

Comparison of seed and in-furrow treatments for nematode control (Morgan Farm, Suffolk, VA).

Soil at the field site was Rumford loamy fine sand and was prepared by ripping and bedding rows in stale beds of cotton from the previous season. Crop history included cotton from 2001 through 2007. Plots were two 30-ft rows spaced 38 in. apart and treatments were replicated in four randomized complete blocks. Seed treatments were applied by Syngenta Crop Protection overtop a base fungicide treatment of A15436 FS 31.0 g/100 kg seed. The treatment with Temik 15G was applied to the seed furrow at planting. All plots were planted with DP143 B2RF on 6 May. Crop management and harvest were the same as the previous trial.

Stand counts ranged from 2.35 to 3.33 plants/ft of row and the effect of treatment was significant (Table 11). All treatments provided good to excellent thrips control. Flower counts on 21 July and numbers of squares on July 22 (not shown) were not significantly different across treatments. Plant height on 21 July (not shown) was affected significantly by treatments; Temik 15G 5 lb/A in furrow was among the highest (24.2 in.), Cruiser 0.342 mg/seed was in the middle (22.3 in.), and Dynasty 0.034 mg +A11615 0.5 mg + ASF271B 0.075 mg/seed was the shortest (20.8 in.). The effect of treatments on open bolls on 19 September was not significant. Nematode counts in soil on 18 June (not shown) and 22 July showed that southern root knot and stubby root nematode were at levels capable of reducing yield. Root gall ratings on 9 July showed root galls on 25 to 75% of the root system (not shown) and little change occurred in ratings on 10 November. The heaviest galling was recorded in the treatment with Cruiser 0.342 mg/seed and the lowest root galling was with Temik 15G 5 lb/A in furrow. Dynasty CST 0.034 mg + Cruiser 0.342 mg + Avicta 0.145 mg/seed showed root galling similar to that with Temik. Yields ranged from 2.17 bales/A to 2.66 bales/A, but were not significantly different (*P*=0.05).

Table 11. Comparison of Seed Treatments and Temik for nematode control.

Treatment, rate and application method [z]	Plants/ft of row (2 Jun) [y]	Thrips damage (18 Jun) [x]	Open bolls (19 Sep) [w]	Nematodes/500 cm^3 soil [v]		Root-knot galling [u] (10 Nov)	Lint yield (bales/A) [t]
				Root-knot juveniles	Stubby root		
Cruiser 5FS 0.342 mg/seed (S)	2.346 e	2.0 a	3.9	2040	40	4.6 a	2.30
Temik 15G 5 lb/A (F)	2.725 d	1.5 ab	4.0	1200	130	2.1 e	2.48
Dynasty 100FS 0.034 mg + Cruiser 5FS 0.342 mg + Avicta 4.17FS 0.145 mg/seed (S)	2.404 e	1.8 ab	3.4	1040	60	2.6 de	2.17
Dynasty CST 125FS 0.034 mg + A16115A SC 0.5 mg/seed (S)	3.329 a	1.0 bc	3.1	2620	150	3.8 b	2.33
Dynasty CST 125FS 0.034 mg + A16115B SC 0.5 mg/seed (S)	2.908 b-d	1.0 bc	3.4	3640	80	2.9 cd	2.66
Dynasty CST 125FS 0.034 mg + A11615C SC 0.5 mg/seed (S)	3.142 ab	1.0 bc	3.1	2570	40	3.4 bc	2.66
Dynasty CST 125FS 0.034 mg + A11615 SC 0.5 mg/seed + EXC3405 SL 29.57 ml/100 kg seed (S)	3.029 bc	1.3 a-c	4.0	2450	90	2.7 c-e	2.26
Dynasty CST 125FS 0.034 mg + A11615 SC 0.5 mg + ASF271B 0.075 mg/seed (S)	3.033 a-c	2.0 a	2.9	970	150	2.8 c-e	2.19
Allegiance LS 15.0 g + Baytan 30FS 5.0 g + Trilex Flowable FS 10.0 g/100 kg seed + STP15273 0.375 mg + STP17217 0.375 mg/seed (S)	2.829 cd	0.5 c	3.6	1490	70	2.9 cd	2.49
P(F)	.0001	.0501	.1396	--	--	.0001	.1025

[z] S=seed treatment, F=in seed furrow at planting. [y] Based on mean for two, 30 ft rows. [x] Thrips damage scale: 0=no damage, 10=severe damage. [w] Mean of four plants/plot. [v] Counts are from composite samples of soil collected across four replications of each treatment on 22 Jul. [u] Roots of four plants/plot were scored according to percentage of roots with galls: 0=none, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5=76-90%, 6=91-100%. [t] Lint was 39.0% of seed cotton weight; one bale = 480 lb. Means followed by the same letter(s) in a column are not significantly different according to Fisher's Protected LSD at $P \leq 0.05$, except thrips damage was at P=0.10 and root galling was analyzed using Student-Newman-Keuls test (P=0.05).

Response of cotton varieties to Temik 15G in furrow (Tidewater Research Farm, Suffolk, VA).

Soil at the field site was Kenansville loamy fine sand and was prepared for planting by ripping and bedding rows. The cropping history was a rotation of corn/peanut/cotton. Plots were two, 30-ft rows spaced 36 in. apart and treatments were replicated in four randomized complete blocks in a split-plot design with variety in main plots and sub-plots of treatment. All seed were treated with Baytan/Thiram/Allegiance + Gaucho. Temik 15G was applied to the seed furrow at planting on 25 April. Crop management include a foliar spray of Orthene 97S at 8 oz/A and standard practices for managing growth and bollworm.

Stand counts ranged from 0.90 to 1.81 plants/ft of row. Temik 15G 5 lb/A in furrow increased stand counts significantly according to the split-plot analysis of data combined across varieties (Table 12). No significant differences in treatment or variety were detected in flower counts, plant height, or open bolls. Root galling was not detected on cotton roots. Counts of stubby root, lesion, ring, and sting nematodes were low, but collectively may have caused some reduction in yield. All varieties showed an increase in yield when treated with Temik 15G, but only that of PHY 370WR was significant. In the combined analysis of data across varieties, the yield response to Temik 15G was significant and amounted to an increase of 0.38 bales/A ($71/A).

Table 12. Response of cotton varieties to Temik 15G in furrow.

Variety and treatment[z]	Plants/ft[y] 15 May	Plants/ft[y] 29 May	Plants/ft[y] 9 Jun	Flowers/ 12 ft[x] (18 Jul)	Plant ht. (in.)[w] (18 Jul)	Open bolls[v] (16 Sep)	Lint yield[u] (bales/A)
ST 5599 BR							
Untreated Check	1.14	1.09	1.09	9.5	25.7	6.8	2.59
Temik 15G 5 lb/A (F)	1.32	1.23	1.24	12.5	24.7	5.8	2.83
ST 4554 B2RF							
Untreated Check	1.40	1.25	1.10	8.0	22.7	6.0 b	2.62
Temik 15G 5 lb/A (F)	1.52	1.33	1.35	11.8	25.9	8.5 a	3.22
ST 5458 B2RF							
Untreated Check	1.72	1.66	1.67	12.3	24.1	6.0	3.08
Temik 15G 5 lb/A (F)	1.81	1.65	1.63	11.5	23.9	6.1	3.25
PHY 370 WR							
Untreated Check	0.90 b	0.79 b	0.75 b	8.3	24.6 b	7.7	2.34 b
Temik 15G 5 lb/A (F)	1.16 a	1.06 a	1.11 a	7.3	27.2 a	7.8	2.89 a
DP 143 B2RF							
Untreated Check	1.02	0.92	1.03	7.5	23.6	5.4 b	2.45
Temik 15G 5 lb/A (F)	1.15	1.08	1.18	9.3	24.0	7.7 a	2.83
Variety mean							
ST 5599 BR	1.24 bc	1.16 bc	1.16 bc	11.0	25.2	6.3	2.71
ST 4554 B2RF	1.46 b	1.29 b	1.22 b	9.9	24.3	7.3	2.92
ST 5458 B2RF	1.76 a	1.66 a	1.65 a	11.9	24.0	6.0	3.16
PHY 370 WR	1.03 c	0.93 d	0.93 c	7.8	25.9	7.7	2.61
DP 143 B2RF	1.08 c	1.00 cd	1.10 bc	8.4	23.8	6.5	2.64
LSD	0.26	0.23	0.24	n.s.	--	--	n.s.
Treatment mean							
Untreated check	1.24 b	1.14 b	1.13 b	9.1	24.1	6.4	2.62 b
Temik 15G 5 lb/A (F)	1.39 a	1.27 a	1.30 a	10.5	25.1	7.2	3.00 a
LSD	0.13	0.12	0.15	n.s.	--	--	0.26
***Split-plot analysis, P*(F)**							
Variety	.0005	.0005	.0035	.4619	.4977	.0153	.1256
Treatment	.0574	.0825	.0301	.2641	.0034	.0259	.0070
Variety x treatment	.9576	.7700	.5353	.6128	.0021	.0084	.7624

[z]F=in furrow. [y]Determined from counts of two, 30-ft rows per plot. [x]Data are number of flowers per two, 6-ft sections of row. [w]Determined from measurements of six plants per plot. [v]Counts of two, randomly selected plants per row in each plot. [u]Lint was determined by ginning each variety and was 480 lb/bale. Plots were harvested on 22 Oct. Means followed by different letter(s) in a column and group are significantly different according Fisher's Protected LSD, (*P*=0.05), n.s. denotes not significant, -- LSD not reported due to significant variety by treatment interaction.

Cost and benefit of seedling disease and nematode control in Virginia, 2008

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SUMMARY:

1. **2008 growing season:** Rainfall in May, June, July, August and October was 0.39, 2.77, 0.29, 3.53 and 2.67 in. below normal, respectively, and September was 1.54 in. above normal. Rainfall during the period totaled 19.63 in., which was 8.11 in. below normal. Cotton degree-days (DD_{60}) from 1 May through October totaled 2335 or 149 above the 13-yr average (1995-2007). Pinhead square, first flower and 1st open boll in 2008 occurred within one to four days of the average. The March estimate for yield in Virginia was 896 lb/A; 81 lb above the 13-yr average for the City of Suffolk.

2. **Seedling disease and nematode damage in 2008:** Seedling diseases were estimated to reduce stand and yield by only 1% in 2008. Rhizoctonia and Pythium damping-off were the most common cause of stand losses.

3. **Seed treatment fungicides:** Baytan/Thiram/Allegiance has been the industry-standard, fungicide treatment for seedling disease control in cotton. Results of the National Cotton Seed Treatment Trial in Virginia showed that Baytan/Thiram/Allegiance continues to provide good protection against stand losses from seedling disease.

4. **Baytan/Thiram/Allegiance with and without supplementary fungicides:** Standard rates of Baytan/Thiram/Allegiance plus Trilex Advanced or Trilex Advanced + Vortex increased stand significantly at 14 and 28 days after planting.

5. **Baytan/Allegiance/Vortex with and without supplementary fungicides:** Baytan/Allegiance/Vortex resulted in a significant increase in stand at 14 and 28 DAE compared to untreated seed. Half rates of Baytan/Allegiance/Vortex supplemented with Trilex Advanced gave similar stand counts. Dynasty CST resulted in stand counts that were similar to Baytan/Allegiance/Vortex + Trilex Advanced.

6. **Response of low vigor and high vigor seed to seed treatments:** Seed with 60% cool germ (low vigor) and seed with 80% cool germ (high vigor) treated with Baytan/Thiram/Allegiance with and without Trilex Advanced or Dynasty CST did not show a differential response to treatments in 2008. All treatments increased stand counts at 14 and 28 DAP, but none were significantly different from untreated, low vigor or high vigor seed. Seed vigor also failed to produce significant differences in growth or yield.

7. **Response of cotton varieties to seed and in-furrow nematicides (Morgan Farm, Suffolk, VA).** Thrips damage was reduced significantly by seed treatment insecticides (Gaucho, Cruiser) and Temik in-furrow. Root galling was heaviest on ST4427 B2RF, DP141 B2RF, and PHY 370WR, and significantly lower on ST5458 B2RF. Root galling was reduced significantly by Temik 15G on DP141 B2RF and ST5458 B2RF, and by Avicta CP on ST4427 B2RF and ST5458 B2RF. Yields were increased significantly by all treatments. The highest yields were recorded for ST5458 B2RF and DP141 B2RF. Yields were increased 0.38 bales ($71/A) by Avicta CP, 0.40 bales ($75/A) by Aeris SAS, and 0.51 bales/A ($95/A) by Temik 15G. The cost of Avicta CP, Aeris SAS including application, and Temik 15G 5 lb/A continues to be similar ($15 to 18/A).

8. **Comparison of seed and in-furrow nematicides (Morgan Farm, Suffolk, VA).** Stand counts ranged from 2.35 to 3.33 plants/ft of row and the effect of treatment was significant. All treatments provided good to excellent thrips control. Nematode counts in soil on 18 June and 22 July showed the southern root knot and stubby root nematodes were at levels capable of reducing yield. Root gall ratings on 9 July showed root galls on 25 to 75% of roots at harvest. The heaviest galling was in the treatment with Cruiser 0.342 mg/seed and was lowest with Temik 5 lb/A in furrow. Dynasty CST 0.034 mg + Cruiser 0.342 mg + Avicta 0.145 mg/seed showed root galling similar to that with Temik. Yields ranged from 2.17 bales/A to 2.66 bales/A, but were not significantly different.

9. **Response of cotton varieties to Temik 15G in furrow (Tidewater Research Farm, Suffolk, VA).** No significant differences in treatment or variety were detected in flower counts, plant height, or open boll counts. Nematode counts included ring, stubby root, lesion, and sting nematode in soil. Southern root-knot nematode was not detected. All varieties showed an increase in yield when treated with Temik 15G. In the combined analysis of data across varieties, the yield response to Temik 15G was significant and amounted to an increase of 182 lb of lint or 0.38 bales/A ($71/A).