THE EFFECTS OF VERTICILLIUM WILT ON COTTON CULTIVARS

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Abstract

Verticillium wilt has become the most serious disease in the cotton producing region of the Southern High Plains of Texas. Management recommendations include planting tolerant or partially resistant cultivars, planting appropriate seed densities (4/ft. row), not over watering, and using rotation with sorghum when possible. New varieties are being introduced each year, and advanced breeding lines are also tested before deciding on whether to bring germplasm forward as a variety. A combination of new breeding lines, new varieties, and older varieties were tested in small plots in six Verticillium wilt infested cotton fields. The standard recommended variety for Verticillium wilt that was included in all sites was Fibermax (FM) 9180B2F. New varieties or breeding lines that ranked higher in relative value after averaging over all sites, than FM 9180B2F included: NexGen (NG) 3348B2RF, NG 2549B2RF, NG 712B2RF, NG 8021RF, NG 3410RF, ST 4288B2F, FM 9160B2F and FM 9170B2F.

Introduction

Verticillium wilt, which is caused by the fungus *Verticillium dahliae*, has become the most yield limiting disease problem for cotton in the Southern High Plains of Texas. Planting tolerant or partially resistant varieties is the number one management tool emphasized. Other recommendations include using an appropriate seed density (4 seed/ft. with 40-inch centers), not over watering the crop, particularly in August and September, and using rotation with non hosts like sorghum to keep the density of the fungus from becoming too high in fields.

This disease has been present in the Southern High Plains for many years, and in some decades adequate management was obtained because popular varieties had partial resistance to the fungus. However, starting around 2001, there was a migration from planting the partially resistant stripper varieties Paymaster (PM) HS-26 and PM 2326RR, to planting picker varieties, many of which were much more susceptible to this disease. The relative increase in susceptibility was not obvious until 2004 when the perfect weather for the disease occurred. Since 2004, Verticillium wilt has been the most yield limiting disease in this region, even in years when weather is not very conducive for disease.

During the last six years when Verticillium wilt has been so important to cotton yield and quality, there has been a large number of picker-type varieties planted. There has also been a rapid change with older varieties being replaced with new ones. The producers in the Southern High Plains of Texas have indicated that an intensive screening program for varieties is a high priority and have generously funded a program to conduct small plot trials in Verticillium wilt fields. The cotton seed companies (All-Tex, Americot (including Americot and NexGen varieties), Bayer Crop Sciences (including AFD, Fibermax, and Stoneville varieties), Cropland Genetics, Deltapine (Monsanto), and Phytogen (Dow Agrosciences)) have been equally generous in providing seed of existing varieties as well as advanced breeding lines for testing.

Materials and Methods

Sites for testing were obtained in the northern part of the Southern High Plains near Plainview (center pivot irrigation), Lockney (furrow irrigated), and Floydada (center pivot irrigation). In the middle part of the Southern High Plains, a site was obtained near Slaton (drip irrigated), and in the Southern part sites were obtained near Brownfield (center pivot irrigation) and Seminole (center pivot irrigation). At each site, there were 32 cultivars included, arranged in a randomized complete block design with four replications. At each site, the varieties Fibermax (FM) 9180B2F, Fibermax 9160B2F, Stoneville (ST) 4554B2F, and NexGen (NG) 3348B2F were included. Plots were 35 ft. long and 2-rows wide, with 40-inch centers. Seed was planted at a density of 4/ft. row. At approximately 35 to 45 days after planting, stand counts were taken on each row of every plot.

Incidence of Verticillium wilt was taken at 2 to 3 dates during the growing season, with Seminole ratings made during July, and all other ratings made during August. Defoliation ratings were made for each plot during the last week of September at all sites. Defoliation ratings were 0 = no defoliation, 1 = 1 leaf up to 32% of the plants defoliated, 2 = 33 to 66% of the plants defoliated and 3 = > 66% of the plants defoliated. Ratings were made on each row for each pace as the rater walked through the plots, resulting in up to 22 ratings for a plot. If there were skips within a plot, then no rating was assigned to those spots. Plots were harvested with a modified John Deere 484 cotton stripper, where harvested cotton was weighed by load cells in a cage that was built into the cotton basket. A subsample of cotton was collected from two of the four replications and ginned to determine the percentage of the sample which was lint. Lint samples were sent to Texas Tech Fiber and Biopolymer Research Institute for HVI analysis and a loan value was obtained based on the results.

Analysis of each site was conducted using PROC GLM, SAS (version 9.1), SAS Institute, Cary, NC for wilt incidence, defoliation, yield (lbs of lint/acre), and value/acre (yield x loan value) – seed and tech fees obtained from the web site http://www.plainscotton.org.. A relative rating of wilt incidence, defoliation, yield and value were obtained by dividing the value for each plot, by the highest average rating for a cultivar at that site. That placed all the relative values on a 0 to 1 scale, with the higher relative values for wilt incidence and defoliation being "bad", and the higher relative values for yield and value/acre being "good". All data sets were combined and analyzed with PROC MIXED, with the model statement relative value = cultivar/DDFM = Satterth. The random statement included site rep(site) site x cultivar. A least squares means was calculated for each cultivar. This value was placed in a spread sheet and ranked from 1 to 67 with 1 being the best cultivar for that measurement and 67 being the worst relative rating for that cultivar.

Results and Discussion

Plainview: The top valued cultivars were NG 3348B2RF, ST 4288B2F, NG 2549B2RF, and Deltapine (DP) 104B2RF (Table 1). The top yielding cultivars at this site were NG 3348B2RF, NG 2549B2RF, DP 104B2RF, ST 4288B2F, FM 9180B2F, FM 1740B2F, FM 9160B2F, and NG 3410RF. The cultivars with the lowest wilt ratings on 26 August included: NG 3348B2RF, DP 104B2RF, ST 4288B2F, FM 9160B2F, Phytogen (PG) 367WRF, DP0920B2RF, NG 1551RF, and NG 2549B2RF. The cultivars with the lowest defoliation rating was FM 9160B2F. The cultivars with the highest loan value were NG 1551RF, NG 1556RF, NG 3348B2RF, AFD 5065B2F, DP EXP, FM 1740B2F, and DP 104B2RF. The cultivars with a micronaire greater than 3.4 were NG 1551RF and NG 1556RF.

Lockney: The top valued cultivars were: NG 712B2RF, DP 0912B2RF, and ST 4288B2F (Table 2). The top yielding cultivars were DP 0912B2RF, NG 712B2RF, FM 9160B2F, ST 4288B2F, FM 1740B2F, NG 3410RF, NG 2549B2RF, DP 0920B2RF, DP 0924B2RF, and DP EXP. The cultivars with the lowest wilt ratings on 25 August were NG 712B2RF, DP 0920B2RF, NG 3348B2RF, NG 3410RF, NG 2549B2RF, ST 4288B2F, All-Tex Patriot RF, and FM 9160B2F. The cultivars with the lowest defoliation rating were NG 3348B2RF, FM 9160B2F, NG 712B2RF, DP 0920B2RF, and NG 8015B2RF. The cultivars with the highest loan values were NG 712B2RF, FM 9180B2F, ST 4288B2F, NG 1551RF, All-Tex Patriot RF, FM 1740B2F, DP 0924B2RF, and DP 0920B2RF. The cultivars with micronaires greater than 3.4 were NG 1551RF and FM 9180B2F.

Floydada: The top valued cultivars were NG 3348B2RF, NG 712B2RF, FM 9160B2F, ST 4288B2F, DP EXP, FM 9180B2F, and NG 723RF (Table 3). The top yielding cultivars were NG 3348B2RF, FM 9160B2F, NG 712B2RF, and NG 2549B2RF. The cultivars with the lowest wilt ratings on 24 August were: DP 0920B2RF, FM 9160B2F, DP 0935B2RF, NG 3348B2RF, DP EXP, PG 367WRF, NG 1551RF, and NG 2549B2RF. The cultivars with the lowest defoliation ratings was FM 9160B2F. The cultivars with the highest loan value were DP EXP, NG 723RF, ST 4288B2F, NG 1551RF, DP EXP, NG 9180B2F, ST 4498B2F, NG 712B2F. Cultivars with micronaire greater than 3.4 were NG 1551RF, NG 3348B2RF, ST 4498B2F, DP EXP, DP EXP, ST 4288B2F, NG 723RF, and DP EXP.

Slaton: The top valued cultivar was NG 8021RF (Table 4). The top yielding cultivars were NG 8021RF, FM 9170B2F, FM 9160B2F, and NG 3348B2RF. The cultivars with the lowest incidence of wilt on 25 Aug. were FM 9160B2F, NG 3348B2RF, All-Tex Marathon B2RF, NG 3273B2RF, ST 5288B2F, DP 1044B2RF, NG 2549B2RF, and DP 0924B2RF. The cultivars with the least defoliation were NG 8021RF, FM 9170B2F, FM 9160B2F, NG 8015B2RF, and FM 9180B2F. Cultivars with the highest loan values were NG 8021RF, All-Tex Marathon B2RF,

NG 1551RF, NG 3348B2RF, DP EXP, FM 9180B2F, DP 1028B2RF, NG 8015B2RF. No cultivars had a micronaire value greater than 3.35.

Brownfield: The top valued cultivars were DP 1032B2RF, FM 9170B2F, FM 1740B2F, FM 1880B2F, NG 3348B2RF, FM 9180B2F, NG 8021RF, and ST 4554B2F (Table 5). The top yielding cultivars were DP 1032B2RF, FM 9170B2F, ST 4554B2F, FM 1740B2F, NG 3348B2RF, DP 174RF, ST 5288B2F, and DP 0935B2RF. The cultivars with the lowest incidence of wilt on 31 Aug. were NG 3348B2RF, FM 1880B2F, All-Tex Orbit RF, ST 4554B2F, FM 9160B2F, DP 164B2RF, DP 0935B2RF, and FM 820F. The cultivars with the least defoliation were FM 9160B2F and FM 9170B2F. The cultivars with the highest loan values were FM 9180B2F, FM 1880B2F, NG 8021RF, All-Tex Orbit RF, DP 1044B2RF, FM 9160B2F, All-Tex Titan B2RF, and NG 3348B2RF. There were 11 cultivars with micronaire greater than 3.4.

Seminole: The highest valued cultivars were DP EXP, DP 1034B2RF, DP 1028B2RF, and DP 1032B2RF (Table 6). The top yielding cultivars were DP EXP, FM 9160B2F, DP 1034B2RF, FM 9180B2F, DP 1028B2RF, DP 1032B2RF, DP 174RF, and DP 0935B2RF. The cultivars with the lowest incidence of wilt on 30 July were All-Tex Orbit RF, FM 1880B2F, ST 4498B2F, NG 3348B2RF, BAYER EXP, DP 141B2RF, DP 0949B2RF, and ST 5288B2F. This was the only site where there was a positive correlation between yield and wilt incidence. At all others sites, there was a negative correlation. This site also did not defoliate much compared with the other 5 sites and could be characterized primarily as a nondefoliating type field. The least amount of defoliation were found with FM 9160B2F, DP 141B2RF, and FM 9180B2F. Loan values were highest for Bayer EXP, DP 1032B2RF, All-Tex Orbit RF, DP 1028B2RF, AM 1532B2RF, DP EXP, DP 1034B2RF, and DP EXP. This field was harvested a bit too quickly after the defoliation spray (5-6 days). Leaf was the primary factor affecting loan value. Cultivars with leaf ratings $\geq$ 6 were DP 161B2RF, DP 174RF, DP EXP, NG 3348B2RF, PG 425RF, ST 4554B2F, ST 5288B2F, and ST 5458B2F. There were 15 cultivars with micronaire values greater than 3.4.

Combined relative ranking: The top 10% of the cultivars when combining across tests, in term of value were NG 712B2RF, NG 8021RF, FM 9170B2F, ST 4288B2F, FM 9160B2F, NG 3348B2F, and AFD 5065B2F (Table 7). The top 10% in terms of yield were NG 2549B2RF, NG 712B2RF, FM 9170B2F, NG 3410RF, FM 9160B2F, NG 3348B2RF, and DP 104B2RF. The cultivars with the least amount of wilt were FM 1880B2F, All-Tex Orbit RF, NG 3348B2RF, DP 0920B2RF, NG 712B2RF, PG 367WRF, and FM 9160B2F. The cultivars with the least amount of defoliation were FM 9170B2F, FM 9160B2F, NG 8015B2RF, DP 141B2RF, NG 8021RF, FM 9180B2F, and NG 3348B2RF.

Summary

FM 9180B2F is a cultivar that has performed well for a number of years in Verticillium wilt fields in the Southern High Plains of Texas. In the trials presented, this cultivar ranked from 5th to 9th in value in the various tests and ranked 10th in relative value (Table 7). Some new varieties available that look promising include FM 9160B2F, NG 3348B2RF, and ST 4288B2F. There are also several new breeding lines from Americot that should be available to producers in 2011 that look promising (NG 712B2RF and NG 8021RF) and FM 9170B2F should also be available in 2010 or 2011. For the more southern sites, more information is needed to make variety recommendations. Some new varieties from Deltapine that will be available in 2010 that look promising in the longer season sites are DP 1028B2RF, DP 1032B2RF, and DP 1034B2RF, however more testing is necessary. Micronaire was a serious problem for most cultivars at all the middle and northern sites tested. NG 1551RF had the highest micronaire consistently of any cultivar except NG 1556RF. However, the yield potential limits the utility of these cultivars.

Acknowledgements

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Table 1. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Plainview, TX (Hale county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants/ ft. row	Loan Value ($/lb)	Mic[e]
NG 3348B2RF	701	1,471	16	2.8	2.3	0.523	3.20
ST 4288B2F	624	1,358	20	2.9	2.8	0.511	2.95
NG 2549B2RF	618	1,424	24	2.8	2.4	0.482	3.00
DP 104B2RF	612	1,372	19	3.0	2.7	0.495	3.00
FM 1740B2F	571	1,289	26	2.7	2.5	0.497	3.00
NG 3410RF	566	1,276	26	2.9	2.4	0.488	2.85
FM 9160B2F	561	1,289	21	2.3	2.0	0.489	2.60
FM 9180B2F	543	1,312	26	2.7	2.4	0.467	2.90
DP 0912B2RF	524	1,222	31	2.8	2.0	0.485	2.83
AFD 5065B2F	522	1,122	26	2.8	1.8	0.519	3.15
DP EXP	500	1,219	31	3.0	2.5	0.467	2.65
NG 1551RF	499	1,015	23	2.8	2.3	0.548	3.75
NG 8021RF	481	1,161	37	2.6	1.1	0.464	2.65
PG 367WRF	475	1,185	21	2.8	2.7	0.458	2.65
DP 0920B2RF	470	1,124	22	2.6	1.8	0.480	2.83
PG 375WRF	459	1,179	26	2.9	2.5	0.446	2.80
ST 4554B2F	436	1,054	26	2.8	2.2	0.480	2.97
AT SummittB2RF	433	1,062	33	2.9	1.6	0.472	2.70
DP 0924B2RF	372	919	37	2.8	1.5	0.480	3.00
NG 1556RF	371	787	37	2.9	1.9	0.544	3.60
AM 1504B2RF	369	958	31	2.9	1.9	0.457	2.65
PG 315RF	358	995	31	2.9	1.5	0.418	2.43
NG 3331B2RF	356	926	36	3.0	2.2	0.458	2.80
AT MarathonB2RF	319	855	36	2.8	1.5	0.453	2.45
NG 1572RF	314	865	49	3.0	2.0	0.427	2.40
DP EXP	304	743	38	2.8	1.5	0.503	2.90
Bayer EXP	300	789	36	2.8	1.1	0.469	2.40
NG 723RF	290	730	38	2.6	0.8	0.475	2.70
NG 3538RF	260	691	42	2.7	1.1	0.459	2.50
NG 3273B2RF	234	654	44	2.9	1.0	0.462	2.50
DP EXP	218	698	43	3.0	1.6	0.411	2.65
DP 1050B2RF[f]	212	610	51	2.9	1.5	0.460	2.50
LSD (0.05)	110	231	14	0.1	0.5	0.057	0.53

[a]NG = NexGen, ST = Stoneville, DP = Deltapine, FM = Fibermax, PG = Phytogen, AT = All-Tex, AM = Americot.
[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.
[c]% Wilt = incidence of wilt on 26 August.
[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 30 Sept.
[e]Mic = micronaire.
[f]This is a mid to full season variety and should not have been tested at this short season site.

Table 2. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Lockney, TX (Floyd county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants /ft. row	Loan Value ($/lb)	Mic[e]
NG 712B2F	662	1,301	4	1.7	2.6	0.561	3.40
DP 0912B2RF	610	1,312	8	1.9	2.7	0.518	3.30
ST 4288B2F	597	1,230	7	2.0	3.0	0.542	3.40
FM 9160B2F	583	1,262	7	1.7	2.7	0.517	3.05
FM 1740B2F	580	1,218	8	2.0	3.0	0.534	3.40
NG 3410RF	563	1,215	6	1.8	2.6	0.511	3.10
DP 0920B2RF	563	1,207	4	1.7	2.6	0.524	3.25
DP 0924B2RF	562	1,188	8	1.9	2.3	0.531	3.40
FM 9180B2F	561	1,146	9	1.8	2.8	0.550	3.45
NG 2549B2RF	543	1,215	7	1.8	2.7	0.503	3.15
DP EXP	507	1,169	14	2.4	2.8	0.493	3.00
NG 1551RF	507	1,039	14	2.0	2.9	0.542	3.90
AT Patriot RF	505	1,046	7	1.9	2.6	0.537	3.30
NG 3348B2RF	492	1,148	4	1.6	2.7	0.488	3.15
DP EXP	492	1,096	10	1.8	2.2	0.512	3.05
NG 8015B2RF	487	1,106	10	1.7	2.2	0.502	3.10
AM 1504B2RF	485	1,077	10	2.0	2.5	0.513	3.05
ST 4554B2F	484	1,117	10	2.0	2.8	0.496	3.00
DP 104B2RF	455	1,080	12	2.4	2.6	0.483	2.65
DP 1050B2RF[f]	441	1,023	12	2.3	2.1	0.498	2.85
AT MarathonB2RF	438	979	10	1.8	2.2	0.517	3.05
CG 3035RF	430	998	16	2.4	2.5	0.489	2.85
PG 375WRF	425	1,065	14	2.2	2.9	0.463	2.60
DP 1028B2RF	419	963	15	2.5	2.4	0.507	3.00
AT SummittB2RF	408	966	9	2.1	2.5	0.493	2.93
NG 3273B2RF	397	902	12	1.9	2.2	0.515	3.05
DP EXP	394	955	12	2.1	1.4	0.485	2.90
NG 1572RF	390	1,039	17	2.6	2.6	0.430	2.50
CG 3220B2RF	369	895	12	2.3	2.3	0.488	2.75
Bayer EXP	364	886	11	2.1	2.1	0.489	2.80
DP EXP	353	898	14	2.4	2.3	0.470	2.65
DP EXP	336	842	12	2.1	1.7	0.481	2.70
LSD (0.05)	72	151	8	0.2	0.5	0.081	0.84

[a]NG = NexGen, DP = Deltapine, ST = Stoneville, FM = Fibermax, AT = All-Tex, AM = Americot, CG = Cropland Genetics, PG = Phytogen,.

[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.

[c]% Wilt = incidence of wilt on 25 August.

[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 28 Sept.

[e]Mic = micronaire.

[f]This is a mid to full season variety and should not have been tested at this short season site.

Table 3. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Floydada, TX (Floyd county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants /ft row	Loan Value ($/lb)	Mic[e]
NG 3348B2RF	777	1,654	17	2.1	2.7	0.511	3.70
NG 712B2RF	762	1,559	24	2.6	2.9	0.533	3.40
FM 9160B2F	755	1,628	16	1.8	2.7	0.506	3.25
ST 4288B2F	748	1,510	25	2.2	3.0	0.541	3.50
DP EXP	737	1,502	18	2.5	2.4	0.536	3.45
FM 9180B2F	735	1,505	27	2.1	2.7	0.535	3.40
NG 723RF	717	1,424	37	2.5	1.2	0.544	3.50
DP 0920B2RF	701	1,526	13	2.5	2.8	0.505	3.10
DP 0912B2RF	701	1,513	26	2.7	2.9	0.509	3.20
DP 1028B2RF	699	1,483	33	2.8	3.1	0.518	3.20
PG 367WRF	694	1,511	19	2.7	3.0	0.504	3.10
NG 1551RF	688	1,384	22	2.4	2.7	0.539	4.15
ST 4498B2F	686	1,417	24	2.7	2.8	0.533	3.65
DP EXP	670	1,328	31	2.8	2.3	0.557	3.60
DP 104B2RF	661	1,502	26	2.6	3.1	0.485	3.30
DP 1050B2RF[f]	654	1,382	43	2.8	2.5	0.523	3.35
DP EXP	645	1,361	31	2.9	2.7	0.525	3.55
DP EXP	640	1,354	32	2.9	2.9	0.523	3.25
ST 4554B2F	639	1,387	25	2.7	2.8	0.511	3.15
NG 2549B2RF	626	1,555	22	2.6	2.8	0.447	3.10
DP EXP	624	1,481	28	2.9	2.8	0.468	3.05
DP EXP	622	1,334	45	2.9	2.9	0.518	3.15
NG 1572RF	570	1,340	36	2.7	2.8	0.468	3.15
Bayer EXP	548	1,258	31	2.8	2.3	0.491	2.85
DP 0924B2RF	532	1,318	24	2.7	2.8	0.456	2.95
DP 0935B2RF	524	1,400	16	2.8	3.0	0.424	2.80
CG 3220B2RF	509	1,190	27	2.9	2.6	0.485	2.95
NG 3331B2RF	504	1,214	37	2.9	2.4	0.472	3.20
NG 3538RF	500	1,145	31	2.3	1.8	0.487	3.25
CG 3035RF	484	1,131	38	3.0	2.6	0.480	2.95
DP EXP	482	1,244	44	2.9	2.8	0.443	2.90
NG 1556RF	436	1,029	33	2.6	2.8	0.479	3.35
LSD (0.05)	62	124	9	0.1	0.4	0.082	0.66

[a]NG = NexGen, FM = Fibermax, ST = Stoneville, DP = Deltapine, PG = Phytogen, CG = Cropland Genetics.
[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.
[c]% Wilt = incidence of wilt on 24 August.
[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 26 Sept.
[e]Mic = micronaire.
[f]This is a mid to full season variety and should not have been tested at this short season site.

Table 4. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Slaton, TX (Lubbock county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants /ft row	Loan Value ($/lb)	Mic[e]
NG 8021RF	878	1,778	25	1.1	2.8	0.526	3.15
NG 3348B2RF	761	1,636	21	1.4	3.4	0.507	3.15
FM 9170B2F	746	1,680	26	1.1	3.2	0.485	2.85
FM 9160B2F	716	1,671	20	1.1	3.2	0.470	2.90
NG 2549B2RF	707	1,590	23	1.5	3.2	0.488	3.15
DP EXP	682	1,506	27	1.7	3.0	0.459	2.60
FM 9180B2F	670	1,494	24	1.3	3.5	0.495	3.00
AT MarathonB2F	662	1,406	21	1.8	3.3	0.519	3.05
NG 8015B2RF	639	1,441	28	1.2	3.0	0.491	2.90
DP 104B2RF	631	1,638	25	1.9	3.3	0.426	2.80
AT Patriot RF	625	1,414	27	1.6	3.2	0.482	2.75
NG 3410RF	617	1,557	28	1.7	3.5	0.433	2.65
NG 3273B2RF	605	1,407	22	1.8	3.1	0.479	2.90
ST 5288B2F	599	1,463	22	1.4	3.4	0.457	3.15
NG 1551RF	587	1,246	38	1.6	3.1	0.517	3.35
DP 0924B2RF	563	1,383	23	2.0	3.4	0.457	2.70
DP 1028B2RF	558	1,270	36	2.0	3.4	0.494	2.90
DP EXP	557	1,388	28	2.4	3.3	0.451	2.95
ST 4288B2F	547	1,337	32	1.7	3.4	0.461	2.60
NG 3538RF	547	1,238	30	1.4	2.9	0.488	2.90
AT Apex B2RF	546	1,310	32	1.9	3.4	0.469	2.70
DP 0920B2RF	544	1,362	24	1.9	3.5	0.450	2.75
ST 4554B2F	523	1,387	24	1.8	3.3	0.428	2.70
DP 1034B2RF	522	1,301	46	2.2	3.2	0.455	2.75
DP 0912B2RF	521	1,312	33	2.0	3.1	0.450	2.70
PG 375WRF	519	1,247	26	2.5	3.4	0.470	2.75
PG 315RF	506	1,282	28	2.4	3.2	0.440	2.50
DP 1044B2RF	480	1,364	22	1.4	3.5	0.402	2.55
DP 0935B2RF	460	1,210	29	2.1	3.4	0.437	2.35
NG 3331B2RF	455	1,181	34	2.2	3.1	0.443	2.73
DP 1032B2RF	448	1,126	40	2.2	2.9	0.459	2.60
AM 1550B2RF	412	1,124	35	2.7	3.4	0.427	2.55
LSD (0.05)	67	149	10	0.2	0.4	0.080	NS

[a]NG = NexGen, FM = Fibermax, DP = Deltapine, AT = All-Tex, ST = Stoneville, PG = Phytogen, AM = Americot.
[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.
[c]% Wilt = incidence of wilt on 25 August.
[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 25 Sept.
[e]Mic = micronaire.

Table 5. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Brownfield, TX (Terry county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants /ft row	Loan Value ($/lb)	Mic[e]
DP 1032B2RF	891	1,788	27	2.2	2.1	0.537	3.30
FM 9170B2F	882	1,764	14	1.3	2.9	0.540	3.20
FM 1740B2F	874	1,729	13	1.5	3.0	0.564	3.85
FM 1880B2F	870	1,667	8	1.6	2.6	0.553	3.80
NG 3348B2RF	870	1,696	7	1.4	2.9	0.553	3.80
FM 9180B2F	868	1,655	13	1.4	2.7	0.567	3.95
NG 8021RF	865	1,638	15	1.7	2.1	0.563	3.65
ST 4554B2F	865	1,737	11	2.0	2.9	0.538	3.40
FM 9160B2F	860	1,674	11	1.1	3.0	0.556	3.55
DP 174RF	844	1,690	16	2.1	3.1	0.534	3.25
FM 820F	830	1,668	12	1.7	3.0	0.534	3.30
DP 1044B2RF	826	1,609	14	1.9	3.0	0.556	3.50
AT ApexB2RF	825	1,653	16	2.3	3.1	0.540	3.40
DP 164B2RF	777	1,534	12	1.8	2.9	0.551	3.35
ST 5288B2F	776	1,687	16	1.8	2.9	0.501	3.35
AM 1532B2RF	775	1,627	19	2.2	2.9	0.519	3.00
FM 840B2F	767	1,564	21	2.1	2.8	0.535	3.45
ST 5458B2F	763	1,589	18	2.4	3.2	0.524	3.30
DP 0924B2RF	754	1,616	19	2.4	2.7	0.510	3.25
PG 485WRF	754	1,513	19	2.0	3.0	0.543	3.80
DP EXP	750	1,533	29	2.4	2.6	0.534	3.27
DP 1034B2RF	737	1,543	24	2.4	2.4	0.523	3.10
DP 161B2RF	725	1,484	21	2.1	2.4	0.534	3.30
DP 0935B2RF	717	1,675	12	2.3	2.6	0.469	2.70
PG 425RF	708	1,502	19	2.2	3.1	0.510	3.30
AT TitanB2RF	702	1,392	17	2.1	2.6	0.553	3.60
AT Patriot RF	702	1,433	16	2.0	2.8	0.530	3.35
PG 565WRF	690	1,530	19	2.3	2.5	0.496	2.85
AT Epic RF	681	1,519	23	2.6	2.4	0.487	2.75
AT Orbit RF	657	1,281	10	2.0	2.4	0.558	3.55
NG 723RF	651	1,366	27	2.2	1.3	0.518	3.05
DP 141B2RF	581	1,365	23	1.7	2.7	0.475	2.55
LSD (0.05)	67	130	8	0.2	0.4	0.080	0.91

[a]DP = Deltapine, FM = Fibermax, NG = NexGen, ST = Stoneville, AT = All-Tex, AM = Americot , PG = Phytogen,.

[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.

[c]% Wilt = incidence of wilt on 31 August.

[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 28 Sept.

[e]Mic = micronaire.

Table 6. Affect of Verticillium wilt on cultivar value/acre, yield, loan value, and micronaire in a field near Seminole, TX (Gaines county).

Cultivar[a]	Value $/a[b]	Lbs of Lint/a	%[c] Wilt	Def[d]	Plants /ft row	Loan Value ($/lb)	Mic[e]
DP EXP	1,131	2,180	66	2.0	2.6	0.550	3.75
DP 1034B2RF	1,057	2,045	56	1.9	2.3	0.551	3.75
DP 1028B2RF	1,054	2,024	56	1.7	2.3	0.555	3.65
DP 1032B2RF	1,039	1,994	52	1.7	1.6	0.556	3.95
FM 9180B2F	1,000	2,028	49	1.3	2.6	0.527	3.30
FM 9160B2F	997	2,073	51	1.2	2.4	0.515	3.25
DP EXP	988	1,915	46	1.7	1.8	0.552	3.65
DP EXP	943	1,878	59	1.8	1.9	0.539	3.70
DP 0935B2RF	927	1,970	45	1.9	2.6	0.506	3.35
ST 4554B2F	901	1,931	60	1.9	2.3	0.503	3.55
AM 1532B2RF	891	1,734	53	1.7	2.1	0.553	3.75
AT Orbit RF	890	1,706	27	1.8	2.4	0.555	3.80
FM 1740B2F	887	1,848	50	1.7	2.6	0.518	3.20
Bayer EXP	880	1,708	36	1.7	2.1	0.556	3.40
ST 4498B2F	870	1,962	35	1.9	2.7	0.479	3.30
DP 174RF	869	1,987	69	1.6	2.1	0.467	3.45
DP 0949B2RF	862	1,752	44	1.8	2.0	0.531	3.45
FM 820F	834	1,673	47	1.9	2.6	0.534	3.25
ST 5288B2F	833	1,894	44	1.6	2.6	0.477	3.60
FM 1880B2F	829	1,754	27	1.8	2.6	0.512	3.50
AT Epic RF	828	1,632	57	2.0	1.9	0.542	3.40
PG 565WRF	816	1,860	53	1.5	1.9	0.475	3.15
DP 1044B2RF	798	1,764	45	1.7	2.4	0.492	3.20
DP 164B2RF	777	1,728	45	1.4	2.0	0.489	3.15
PG 425RF	770	1,757	52	1.6	2.4	0.472	3.80
NG 3348B2RF	768	1,802	35	1.7	2.3	0.464	3.45
PG 485WRF	751	1,680	53	1.5	2.4	0.488	3.35
FM 840B2F	729	1,609	45	2.1	2.4	0.496	3.05
AT Titan B2RF	722	1,543	56	1.5	1.9	0.512	3.30
DP 161B2RF	712	1,711	56	1.6	2.1	0.456	3.20
DP 141B2RF	690	1,688	40	1.2	2.2	0.449	3.05
ST 5458B2F	672	1,628	45	1.9	2.2	0.456	3.30
LSD (0.05)	118	251	24	0.2	0.5	0.060	NS

[a]DP = Deltapine, FM = Fibermax, ST = Stoneville, AM = Americot , AT = All-Tex, PG = Phytogen, NG = NexGen.
[b]Value ($/a) = (lint yield x loan value) – cost of seed and technology fee/acre. Seed and technology fees were obtained from the web site http://www.plainscotton.org.
[c]% Wilt = incidence of wilt on 30 July.
[d]Def = defoliation rating which was on a 0 – 3 scale with 0 = no defoliation, 1 = 1 leaf to 32% of plants defoliated, 2 = 33 to 66% of plants defoliated and 3 = greater than 66% of plants defoliated. Rating was taken on 29 Sept.
[e]Mic = micronaire.

Table 7. Ranking of cultivars across test sites in terms of relative (Rel.) value[a], relative yield, relative wilt, and relative defoliation (Def).

Cultivar[b]	# of sites	Rel. value	Rank value	Rel. yield	Rank yield	Rel. Def,	Rank Def.	Rel. Wilt	Rank wilt
NG 712B2RF	2	0.972	1	0.952	2	0.735	13	0.399	5
NG 8021RF	3	0.915	2	0.927	8	0.646	5	0.607	29
FM 9170B2F	2	0.896	3	0.950	3	0.537	1	0.538	17
ST 4288B2F	4	0.893	4	0.912	9	0.767	20	0.523	14
FM 9160B2F	6	0.886	5	0.942	5	0.562	2	0.462	7
NG 3348B2RF	6	0.878	6	0.928	6	0.691	7	0.365	3
AFD 5065B2F	1	0.877	7	0.868	15	0.792	27	0.513	12
NG 3410RF	3	0.877	8	0.947	4	0.764	18	0.499	9
NG 2549B2RF	4	0.876	9	0.963	1	0.742	14	0.467	8
FM 9180B2F	6	0.865	10	0.895	13	0.649	6	0.561	20
FM 1740B2F	4	0.858	11	0.901	11	0.755	17	0.543	19
DP0912B2RF	4	0.840	12	0.902	10	0.829	40	0.610	31
DP 104B2RF	4	0.831	13	0.928	7	0.854	44	0.562	21
PG 367WRF	2	0.818	14	0.896	12	0.825	38	0.439	6
DP 0920B2RF	4	0.809	15	0.874	14	0.749	16	0.384	4
NG 1551RF	4	0.806	16	0.786	38	0.765	19	0.659	39
NG 8015B2RF	2	0.797	17	0.852	18	0.634	3	0.599	28
DP EXP	3	0.793	18	0.834	23	0.768	22	0.582	24
DP 1028B2RF	4	0.778	19	0.812	29	0.894	52	0.806	57
DP EXP	2	0.772	20	0.804	32	0.890	50	0.752	51
DP 1032B2RF	3	0.772	21	0.817	26	0.898	53	0.835	60
ST 4498B2F	2	0.766	22	0.840	22	0.882	48	0.507	10
DP 174RF	2	0.761	23	0.866	16	0.792	26	0.760	55
FM 1880B2F	2	0.759	24	0.806	31	0.734	12	0.322	1
ST 4554B2F	6	0.757	25	0.841	21	0.819	34	0.574	22
DP 1034B2RF	3	0.754	26	0.819	25	0.930	63	0.870	63
AT Apex B2RF	2	0.751	27	0.815	27	0.868	45	0.634	36
AT Patriot RF	3	0.750	28	0.788	37	0.744	15	0.537	16
DP EXP	3	0.747	29	0.843	20	0.887	49	0.621	35
FM 820F	2	0.734	30	0.782	40	0.794	28	0.578	23
AM 1532B2RF	2	0.732	31	0.790	35	0.840	42	0.703	48
DP EXP	3	0.732	32	0.849	19	0.911	57	0.829	59
ST 5288B2F	3	0.731	33	0.853	17	0.705	9	0.541	18
DP 0924B2RF	5	0.720	34	0.811	30	0.841	43	0.593	27
PG 375WRF	3	0.717	35	0.824	24	0.926	62	0.651	38
DP EXP	3	0.716	36	0.774	42	0.908	54	0.836	61
AM 1504B2RF	2	0.713	37	0.790	36	0.822	36	0.612	32
DP 0949B2RF	1	0.713	38	0.760	45	0.869	46	0.585	25
AT MarathonB2RF	3	0.712	39	0.758	46	0.779	23	0.593	26
AT SummittB2RF	2	0.701	40	0.783	39	0.819	35	0.609	30
DP 1044B2RF	3	0.694	41	0.800	33	0.728	11	0.526	15
DP 164B2RF	2	0.684	42	0.763	43	0.695	8	0.521	13
DP EXP	4	0.681	43	0.715	55	0.826	39	0.713	49
AT Orbit RF	2	0.666	44	0.687	62	0.817	33	0.347	2
NG 723RF	3	0.665	45	0.707	56	0.781	24	0.857	62
DP EXP	3	0.665	46	0.746	50	0.934	64	0.967	67
DP 0935B2RF	4	0.664	47	0.815	28	0.894	51	0.511	11
AT Epic RF	2	0.659	48	0.734	53	0.985	66	0.810	58
PG 485WRF	2	0.659	49	0.746	49	0.767	21	0.701	46
PG 315RF	2	0.658	50	0.776	41	0.914	58	0.613	33

Cultivar[b]	# of Sites	Rel Value	Rank value	Rel. yield	Rank yield	Rel. Def,	Rank Def.	Rel. Wilt	Rank wilt
FM 840B2F	2	0.657	51	0.744	52	0.922	61	0.675	41
PG 565WRF	2	0.652	52	0.792	34	0.798	29	0.694	45
PG 425RF	2	0.641	53	0.761	44	0.813	32	0.701	47
DP 1050B2RF[c]	3	0.635	54	0.702	59	0.873	47	0.913	64
ST 5458B2F	2	0.629	55	0.756	47	0.916	59	0.618	34
NG 3273B2F	3	0.628	56	0.693	61	0.804	31	0.693	44
Bayer EXP	4	0.627	57	0.697	60	0.833	41	0.643	37
DP 161B2RF	2	0.625	58	0.745	51	0.798	30	0.757	54
NG 1572RF	3	0.619	59	0.754	48	0.917	60	0.931	65
CG 3035RF	2	0.617	60	0.707	57	0.947	65	0.935	66
AT Titan B2RF	2	0.617	61	0.681	65	0.784	25	0.681	42
NG 3331B2RF	3	0.611	62	0.717	54	0.911	56	0.761	56
NG 3538RF	3	0.599	63	0.661	66	0.716	10	0.730	50
CG 3220B2RF	2	0.588	64	0.686	63	0.910	55	0.682	43
NG 1556RF	2	0.576	65	0.616	67	0.824	37	0.753	52
AM 1550B2RF	1	0.565	66	0.681	64	1.000	67	0.753	53
DP 141B2RF	2	0.535	67	0.707	58	0.639	4	0.671	40

[a]Relative (rel.) value is the value of the crop/acre (lint yield x loan value – seed and technology fees) for each plot, divided by the highest average value for a cultivar in that test. The relative value in this table is an average of all the plots across however many sites it was tested. Relative yield, defoliation and wilt are similar, in that the value for each plot was divided by the highest average value for a cultivar in that test. For value and yield, the closer to 1, the better the cultivar performed. For defoliation and wilt, the smaller the relative value, the more resistant to Verticillium the cultivar was.

[b]NG = NexGen, FM = Fibermax, ST = Stoneville, DP = Deltapine, PG = Phytogen, AT = All-Tex, AM = Americot, CG = Cropland Genetics.

[c]This variety was only tested at short-season sites and is listed as a mid to full season variety, so relative value and yield are likely to be inaccurate for a longer season site.