COTTON DISEASES REPORT 2021

FUSARIUM WILT, ROOT KNOT NEMATODE AND RENIFORM NEMATODE

Dr. Terry Wheeler and Dr. Cecilia Monclova-Santana

PLANT PATHOLOGY AND MICROBIOLOGY DEPT., TEXAS A&M RESEARCH AND EXTENSION CENTER
1102 E. Drew St. Lubbock, TX 79403

Fusarium Wilt in Cotton Trial Results for 2021

Cecilia Monclova[1], Jessica Dotray[1], Jonathan Shockey[1], and Terry Wheeler[2]
[1]Texas A&M AgriLife Extension Service, [2]Texas A&M AgriLife Research, Lubbock

Background: Fusarium wilt is a fungal disease that causes wilting and stand loss in cotton. Fusarium wilt is present in fields with nematode pressure (either root knot and/or reniform). In 2021, one field was used to evaluate cotton variety trials for reaction to Fusarium wilt.

Hall County: Planted on May 10 and harvested on November 08. Soil texture is loamy sand (sand 88%; silt 6%; clay 11%) and soil properties are included on Table 1. Yield ranged from 1,603 to 2,392 lbs of lint/acre (Table 2). The top five yielding varieties carry root knot nematode resistant (RKN) genes, except for NG 5150B3XF (which is unlikely to be resistant) and was the second best yielding cultivar. The top yielding variety was PHY 411 W3FE, followed by NG 5150 B3XF, PHY 480 W3FE, PHY 332 W3FE, and ST 4946GLB2. All top yielding varieties were significantly higher in yield compared to the susceptible check (DP 1646 B2XF). Though, NG 5150 B3XF yielded very well, the nematode populations were significantly higher than the other top yielding varieties that carry RKN resistance genes. Overall, susceptible varieties reported a higher number of root-knot nematode juveniles and eggs compared to the varieties that have partial and high resistance to root knot nematode.

Table 1: Soil properties at Turkey, TX.

pH	Cond	NO_3N	P	K	Ca	Mg	S	Na	Sand	Silt	Clay	textural	Organic	Organic
	umhos/cm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	class	Carbon %	Matter %
7.8	185	16	104	298	1336	309	6	18	83	6	11	Loamy Sand	0.53	0.91

Recommendation: Select a variety that carries at least partial resistance root knot nematode.

Challenges: In 2021, it was reported that root knot resistant varieties reported 5-10% losses. In high pressure, and conducive environment it still uncertain how much the resistance holds. We believe the use of resistant varieties still provided protection compared to a susceptible variety.

Acknowledgements: Thanks to Plains Cotton Growers for sponsoring this project.

Quick Diagnosis: Pull a plant check for galls or small spheres on roots (figure 1), slice the stem open and look for browning or darkening (dark brown or black color) of the center vascular cylinder (figure 2).

Sample submission for diagnosis: Select a plant where symptoms are starting. Keep soil out of direct light and heat.

Plant Pathology Lab
Texas A&M AgriLife Research Center
1102 E. Drew St.
Lubbock, TX 79414

Table 2: Fusarium wilt variety trial in Hall County in 2021. Data presented from the top yielding varieties.

Variety[1]	Lint Yield (lbs/a)	Yield x Loan ($/A)	Loan Value ($/lb)	Avg. Turnout	Plant/ ft row		% Change in stand	RK[3] / 500 cm[3] soil	RK[3] eggs/ 500 cm soil	RKR[4]
					05/24	11/08				
PHY 411 W3FE	2,392	1,346.05	0.563	0.30	4.15	3.37	-18.83	56	45	HR
NG 5150 B3XF	2,337	1,337.42	0.572	0.32	3.45	2.92	-15.45	225	1,020	U
PHY 480 W3FE	2,305	1,244.81	0.540	0.29	4.19	3.37	-19.48	38	15	HR
PHY 332 W3FE	2,244	1,295.51	0.577	0.29	4.27	3.71	-13.33	38	45	R
ST 4946GLB2	2,227	1,269.04	0.570	0.28	3.51	3.08	-11.53	150	810	PR
DP 1747NR B2XF	2,168	1,229.84	0.567	0.30	3.16	2.53	-19.88	75	330	R
FM 2498GLT	2,162	1,236.51	0.572	0.31	4.19	3.61	-13.80	731	4,545	S
PHY 350 W3FE	2,157	1,166.65	0.541	0.28	3.82	3.37	-11.50	38	255	PR
ST 5091 B3XF	2,149	1,232.96	0.574	0.33	3.95	3.24	-18.05	525	1,095	S
PHY 400 W3FE	2,138	1,229.97	0.575	0.28	3.82	3.14	-17.58	75	405	PR
DP 2143NR B3XF	2,128	1,229.88	0.578	0.30	4.06	3.2	-21.15	56	90	R
FM 1730GLTP	2,108	1,109.00	0.526	0.33	3.43	2.59	-24.20	94	195	PR
ST 5600B2XF	2,071	1,175.94	0.568	0.31	4.12	2.95	-28.30	113	165	R
DP 1646 B2XF	2,066	1,188.92	0.576	0.30	3.99	3.22	-19.18	225	375	S
PHY 545 W3FE	2,030	1,157.46	0.570	0.29	4.07	2.93	-28.33	19	60	R
DP 2044 B3XF	2,003	1,060.16	0.529	0.29	3.74	3.06	-17.75	544	3,120	S
NG 4098 B3XF	1,945	1,098.04	0.565	0.29	3.23	2.75	-14.83	281	675	S
DP 2141NR B3XF	1,938	1,117.49	0.577	0.29	4.52	3.44	-23.93	0	15	R
DP 1840 B3XF	1,915	1,099.61	0.574	0.27	3.79	3.15	-16.68	206	630	S
ST 5707B2XF	1,910	1,104.69	0.578	0.28	3.76	3.23	-14.00	469	1,755	S
NG 4936 B3XF	1,899	1,091.18	0.575	0.33	3.03	2.19	-26.05	394	945	S
PHY 443 W3FE	1,731	974.11	0.563	0.22	4.15	3.57	-13.98	0	225	PR
ARMOR 9831 B3XF	1,657	949.21	0.573	0.30	3.93	2.68	-31.60	244	825	S
DP 1522 B2XF	1,603	913.94	0.570	0.27	1.75	1.74	0.25	469	4,305	S
prob>F	0.0001	0.0001	0.515	<0.0001	<0.0001	<0.0001	0.0006	0.0076	<0.0001	
MSD (0.05)	316	178.78	4.56	0.01	0.60	0.59	11.57	397.72	1,835	

[1] PHY is Phytogen, ST is Stoneville, FM is Fibermax, DP is Deltapine. [2] MSD is the minimum significance difference. [3] RK is root-knot nematode. [4]RKR is root-knot nematode resistance response, HR-highly resistant, PR- partially resistance, R- resistance, U- unknown response, S- susceptible.

Table 3: Fiber traits for the Hall County Fusarium wilt trial in 2021. Results are presented in alphabetical order.

Variety[1]	Micro naire	Length	Strength	Unifor-mity	Elon-gation	Rd	+b	Leaf	CGRD
Armor 9831 B3XF	4.28	1.13	30.5	81.1	7.1	84.3	7.2	1.0	21-1
DP 1522B2XF	3.66	1.14	31.2	81.6	7.7	82.2	7.3	3.0	21-1, 31-1
DP 1646B2XF	4.27	1.23	29.7	81.5	7.2	84.5	7.1	1.0	11-2, 21-1
DP 1747NR B2XF	4.21	1.12	30.9	81.4	6.6	82.4	7.8	2.0	21-1
DP 1840B3XF	3.77	1.20	32.0	80.7	6.5	83.7	7.6	2.0	11-1, 21-11
DP 2044B3XF	3.64	1.23	32.5	79.7	6.0	81.0	7.6	4.0	21-2, 31-1
DP 2141NR B3XF	4.24	1.17	32.4	83.1	6.5	82.0	7.6	2.5	21-1, -2
DP 2143NR B3XF	4.57	1.16	33.1	82.4	6.1	83.0	7.6	2.0	21-1
FM 1730GLTP	3.72	1.24	33.0	83.7	5.7	82.4	6.3	5.0	21-2, 41-1
FM 2498GLT	4.66	1.16	29.8	82.6	6.0	83.3	7.1	2.5	21-2
NG 4098B3XF	3.78	1.22	33.7	81.5	6.2	81.3	7.7	3.5	21-2, 31-1
NG 4936B3XF	4.41	1.17	28.8	82.7	6.9	84.7	6.5	1.0	11-2, 21-2
NG 5150B3XF	4.29	1.18	29.6	81.2	6.4	83.7	7.0	2.0	11-2, 21-2
PHY 332 W3FE	4.12	1.14	31.0	81.2	6.5	83.0	7.6	1.5	21-1
PHY 350 W3FE	3.73	1.12	30.2	80.7	6.5	83.6	7.2	2.5	21-1, -2
PHY 400 W3FE	3.83	1.16	31.7	80.7	6.1	83.0	7.3	2.5	21-1, -2
PHY 411 W3FE	4.13	1.11	31.8	82.2	6.5	84.6	6.6	2.5	21-1
PHY 443 W3FE	3.99	1.15	32.9	82.6	6.6	81.9	7.6	3.5	21-1, 31-1
PHY 480 W3FE	3.58	1.16	30.9	82.2	7.3	83.1	7.8	2.5	11-2, 21-1
PHY 545 W3FE	3.71	1.13	31.8	82.0	6.7	82.7	7.4	2.5	21-1
ST 4946GLB2	4.08	1.15	30.9	82.9	6.8	81.7	7.6	3.0	21-1, 31-1
ST 5091B3XF	4.35	1.16	29.0	81.2	5.9	83.7	7.2	2.0	21-1
ST 5600B2XF	4.39	1.15	31.2	81.8	7.1	81.8	8.2	3.0	21-1
ST 5707B2XF	4.17	1.20	33.3	82.9	6.5	81.1	8.3	2.5	21-1
prob>F	0.0018	<0.0001	<0.0001	0.005	<0.0001	0.003	<0.0001	0.045	
MSD (0.05)	0.49	0.03	1.16	1.62	0.31	1.84	0.40	1.94	

[1] PHY is Phytogen, ST is Stoneville, FM is Fibermax, DP is Deltapine.[2] MSD is the minimum significance difference.

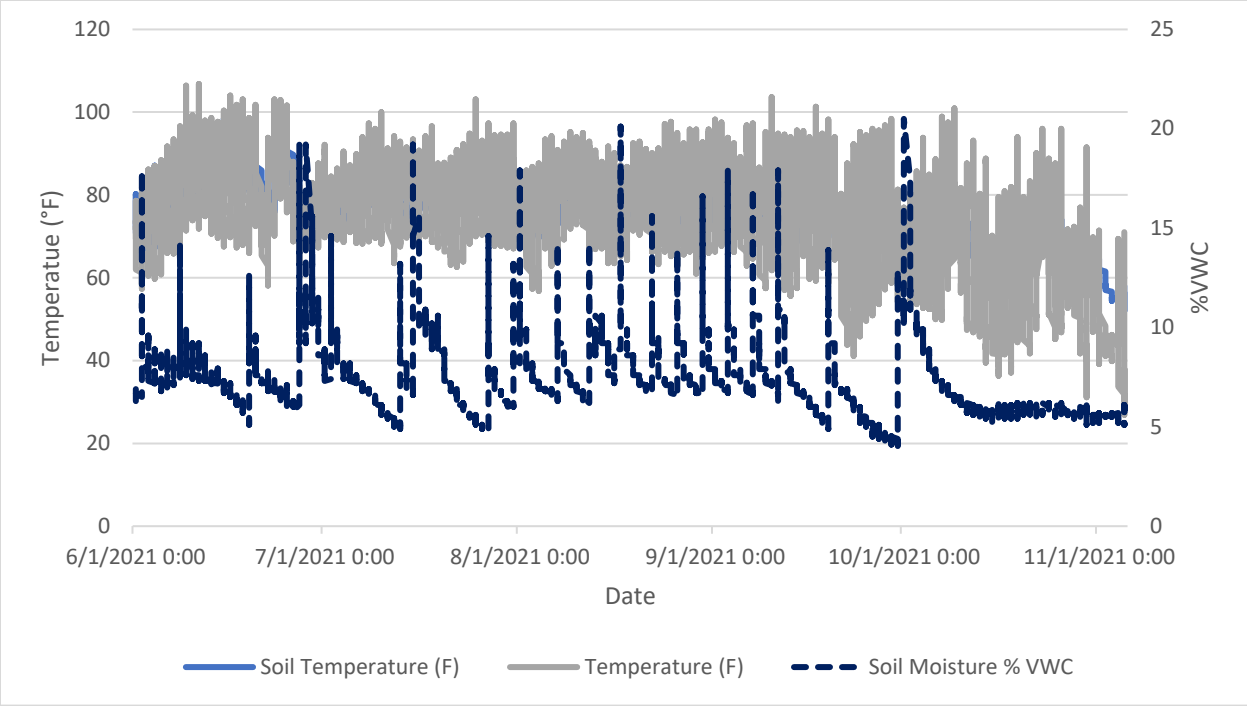

Figure 1: Soil temperature (°F), soil moisture (%VWC) and temperature (°F) from June 01 to November 05, 2021

Figure 2: Symptoms in the field, short rows of wilted plants that form circles.

Figure 3: Cotton roots with galls caused by Root knot nematode adult females (blue arrow), stem necrosis caused by Fusarium wilt (red arrow).

Variety trials in Root-knot Nematode and Reniform Nematode Locations

By Terry Wheeler[1] and Cecilia Monclova-Santana[2]

[1]Texas A&M AgriLife Research, Lubbock, [2]Texas A&M AgriLife Extension Service, Lubbock

Acuff: This root-knot nematode site was planted on 24 May. The plots were 2-rows wide (40-inch centers) and 35 feet long. There were 32 cultivars in the trial, each replicated four times. The field was irrigated with a center pivot system. There was good root-knot nematode pressure in the test area on 16 August when the soil samples were taken. Average root-knot nematode per 500 cm^3 soil ranged from a low of 105 (DP 2141NR B3XF) to a high of 44,765 (DP 1822 XF). The most nematode resistant entries were DP 2141NR B3XF, PHY 332 W3FE, PHY 411W3FE, and PX3E33W3FE (Phytogen experimental line) (Table 1). The entries with the highest lint yield and value/acre (calculated by lint yield x loan value) were: PHY 400 W3FE, NG 3195 B3XF, and PHY 411W3FE. PHY 400 W3FE has partial resistance to root-knot nematode and PHY 411W3FE has full resistance to the nematode. The loan values for most cultivars were well above the base loan value ($0.52). Micronaire was good overall at this site (Table 2). Length was exceptional for DP 2044 B3XF, FM 1730GLTP and NG 4098 B3XF (1.22 inches). Strength was also exceptional for NG 4098 B3XF (35.25 grams/tex) compared to all other entries.

Lubbock: This reniform nematode site was planted on 8 June. The plots were 2-rows wide (40-inch centers) and 35 feet long. There were 16 cultivars in the trial, 7 with resistance to reniform nematode and 9 that were susceptible to reniform nematode. 2021 was the first year that commercial varieties were available with resistance to reniform nematode (DP 2141NR B3XF, DP 2143NR B3XF, PHY 332 W3FE, and PHY 443 W3FE). The field was row watered (every other furrow) on 19 June and 10 August. Water stress did occur late in the growing season (September, October), but because of the late planting date and slow maturation, it was deemed to risky to irrigate in September. Plots were sampled for reniform nematode on 24 August. Plots were harvested on 19 November. The lowest reniform nematode counts were found with DP 2143NR B3XF and PHY 443 W3FE (Table 3). The highest yield and value/acre was found with PHY 332 W3FE (1,120 lbs of lint/acre, Table 3). This variety yielded much higher than any other variety in the trial. The seven reniform nematode resistant varieties all had higher yields than all the susceptible varieties. Loan values were good to excellent for all entries (Table 3).

The biggest change in varieties with nematode resistance in 2021 was the addition of four reniform+root-knot nematode resistant varieties: DP 2141NR B3XF, DP 2143NR B3XF, PHY 332 W3FE, and PHY 443 W3FE. Under late planted condition (June 8th), PHY 332W3FE performed the best in terms of yield. All four varieties showed good resistance against both root-knot and reniform nematodes. From a yield perspective, DP 2141NR B3XF performed better than DP 2143NR B3XF.

Table 1. Root-knot nematode (RK) variety trial near Acuff.

Variety	Plants /ft row	Root-knot nematode / 500 cm^3 soil	Log10 RK	Lint yield lbs/a	Value /acre ($)	Loan ($)	Turn Out %	RK rating
PHY 400 W3FE	3.14	3,545	3.45	**1,509**	**862.86**	0.5720	31.5	PR
NG 3195 B3XF	2.15	10,145	3.51	**1,458**	**840.39**	0.5763	33.1	S
PHY 411W3FE	3.36	300	**1.39**	**1,469**	**831.16**	0.5658	33.2	R
FM 1730GLTP	2.82	4,445	3.62	1,330	772.21	0.5805	29.6	PR
PHY 332 W3FE	3.34	115	**1.14**	1,308	755.11	0.5773	27.8	R
FM 2202GL	2.81	26,750	4.42	1,299	749.02	0.5765	32.6	S
ST 4993B3XF	2.57	22,105	4.27	1,316	746.05	0.5668	32.2	S
PHY 350 W3FE	3.04	2,500	3.09	1,287	745.32	0.5790	28.7	PR
AR 9371 B3XF	3.07	20,570	4.16	1,288	735.69	0.5713	33.9	S
FM 1621GL	2.81	7,215	3.20	1,316	733.41	0.5573	30.1	PR
DP 2141NR B3XF	2.61	105	**1.13**	1,263	724.96	0.5740	31.0	R
DP 2012 B3XF	3.05	4,260	3.51	1,240	713.37	0.5753	31.0	S
PHY 205 W3FE	3.64	370	2.36	1,278	711.85	0.5570	28.2	R
DP 1820 B3XF	2.04	26,775	4.31	1,227	707.59	0.5768	33.5	S
ST 5091B3XF	3.00	8,095	3.86	1,278	705.06	0.5518	33.4	S
ST 5600B2XF	3.22	1,155	2.99	1,252	704.00	0.5623	35.5	R
PX3E33W3FE	3.33	110	**1.62**	1,223	700.31	0.5725	27.8	R
DP 2044 B3XF	2.56	18,560	4.17	1,204	694.47	0.5768	32.5	S
ST 4946GLB2	3.29	8,965	3.92	1,254	680.81	0.5428	25.4	PR
AR21XW2XF	2.27	13,490	3.48	1,172	677.13	0.5780	29.5	S
DP 2143NR B3XF	2.87	510	2.56	1,169	674.95	0.5775	29.5	R
NG 4098 B3XF	2.97	5,815	3.75	1,168	671.02	0.5745	28.9	S
PHY 394 W3FE	2.93	750	2.21	1,224	666.36	0.5443	27.7	R
PHY 250 W3FE	2.54	2,440	2.62	1,157	662.01	0.5723	29.1	PR
ST 4990 B3XF	2.93	5,850	3.68	1,111	636.32	0.5730	29.9	S
NG 4050 XF	2.86	14,695	3.95	1,110	633.95	0.5710	31.1	S
NG 3956 B3XF	2.61	8,315	3.80	1,088	620.78	0.5707	28.5	S
DP 1822 XF	2.53	44,765	4.58	1,044	605.14	0.5795	28.4	S
NG 3930 B3XF	2.61	7,760	3.80	977	564.71	0.5783	27.0	S
AR21XR2B3XF	2.72	12,885	4.00	1,042	554.48	0.5320	29.7	S
NG 3500 XF	1.74	23,020	4.34	960	532.04	0.5545	29.7	S
DP 2022 B3XF	2.53	33,360	4.40	983	529.51	0.5388	29.1	S
Prob>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0860	0.019	
MSD (0.05)	0.34	16,216	0.97	151	84.41	0.0455	6.24	

RK=root-knot and RK rating for a variety was S=susceptible, R=resistant, PR=partially resistant.

Table 2. Fiber properties for a root-knot nematode variety test near Acuff.

Variety	Mic.	Length	Unif.	Strength	Elon.	Rd	+b	Leaf	Color Grade
AR21XR2B3XF	3.60	1.11	81.90	31.45	5.6	84.2	6.9	2.0	11-2,21-1
AR21XW2XF	3.93	1.19	83.85	31.90	8.0	82.3	7.0	3.5	21-2,31-1
AR 9371 B3XF	4.23	1.14	82.40	28.35	6.5	83.8	7.6	1.0	11-1,21-1
DP 1820 B3XF	4.43	1.17	81.35	31.70	5.8	83.3	7.4	1.5	21-1
DP 1822 XF	3.89	1.18	81.50	31.45	5.8	83.3	7.5	1.5	21-1
DP 2012 B3XF	3.94	1.16	82.65	30.80	5.7	82.6	7.2	1.5	11-1,31-2
DP 2022 B3XF	3.63	1.12	81.70	29.30	5.6	82.7	6.6	3.5	31-1
DP 2044 B3XF	3.60	1.22	80.70	33.35	5.9	80.4	7.5	3.5	21-1,31-2
DP 2141NR B3XF	4.50	1.14	82.30	31.80	6.3	81.4	8.0	2.0	21-1,31-1
DP 2143NR B3XF	4.53	1.16	82.40	32.15	6.2	82.8	7.8	1.5	21-1
FM 1621GL	4.19	1.14	82.00	31.30	5.7	79.7	7.1	4.5	31-1,41-1
FM 1730GLTP	4.02	1.22	82.80	33.60	5.7	83.9	7.3	2.5	11-2,21-1
FM 2202GL	4.03	1.14	83.20	33.40	6.5	81.8	7.5	3.0	21-2
NG 3195 B3XF	4.32	1.17	82.80	30.35	6.0	83.5	7.6	1.0	21-1
NG 3500 XF	4.53	1.09	82.05	31.75	7.0	80.9	8.2	1.5	11-2,31-1
NG 3930 B3XF	3.97	1.19	82.80	30.40	6.3	83.3	8.0	1.5	11-1,11-2
NG 3956 B3XF	3.98	1.13	82.63	30.17	7.0	80.9	7.9	3.7	21-1,31-1
NG 4050 XF	3.88	1.17	80.00	30.10	6.5	82.0	7.1	4.0	31-1
NG 4098 B3XF	3.71	1.22	81.10	35.25	6.1	80.3	7.4	3.5	31-1
PHY 205 W3FE	3.97	1.09	82.93	31.63	6.0	83.4	7.3	2.7	11-2,21-1
PHY 250 W3FE	4.08	1.13	82.10	30.05	5.5	84.3	7.0	2.5	21-1
PHY 332 W3FE	3.84	1.15	81.80	31.15	6.4	81.9	7.8	3.0	21-1
PHY 350 W3FE	3.87	1.17	83.25	32.25	6.7	82.8	7.2	3.0	21-2
PHY 394 W3FE	3.38	1.17	79.35	29.90	6.2	82.7	7.1	3.0	21-1,21-2
PHY 400 W3FE	3.76	1.14	81.90	31.85	6.2	82.2	7.4	3.5	21-1,31-1
PHY 411 W3FE	4.23	1.11	82.60	31.80	6.5	83.4	7.2	3.0	21-1
PX3E33W3FE	4.01	1.12	81.10	31.60	6.6	82.6	8.3	1.0	11-2
ST 4946GLB2	3.78	1.10	82.23	31.10	6.9	81.2	7.8	3.7	21-1,31-1
ST 4990B3XF	4.11	1.14	82.35	29.95	6.8	84.1	7.4	1.5	11-2,21-1
ST 4993B3XF	4.94	1.16	84.65	33.05	6.5	83.3	7.9	2.0	11-1,21-1
ST 5091B3XF	3.93	1.09	79.65	27.10	6.0	84.0	7.3	2.0	11-2,21-1
ST 5600B2XF	4.62	1.11	82.45	30.00	7.0	82.6	8.0	1.5	21-1
Prob>F	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0080	0.0020	
MSD (0.05)	0.59	0.03	1.57	1.38	0.37	2.0	0.95	2.03	

Table 3. Reniform nematode variety trial in Lubbock.

Variety	Stand	Reniform /100 cm^3 soil	LOG10 (Ren)	Lint yield (lbs/a)	Value ($)/ Acre	Loan Value $/lb	Turn Out %	Reniform Rating[1]
PHY 332 W3FE	3.15	340	2.44	**1,120**	**648.07**	0.5785	27.37	R
PHY 205 W3FE	3.02	540	2.68	1,051	582.39	0.5540	29.18	R
PHY 411 W3FE	3.06	320	2.35	976	544.61	0.5580	27.42	R
PHY 443 W3FE	3.13	190	**2.22**	917	527.72	0.5758	27.87	R
DP 2141NR B3XF	2.85	240	2.29	905	522.32	0.5773	30.50	R
PX3E33W3FE	3.16	210	2.27	902	515.93	0.5723	27.41	R
DP 2143NR B3XF	2.56	100	**1.59**	708	403.14	0.5698	25.67	R
FM 1621GL	2.60	700	2.81	636	348.90	0.5488	29.14	S
FM 2202GL	2.36	780	2.87	580	328.42	0.5660	33.03	S
FM 2498GLT	3.27	1,390	3.00	565	312.73	0.5535	30.46	S
DP 1845 B3XF	2.53	470	2.66	477	273.94	0.5743	27.52	S
FM 2398GLTP	2.90	480	2.33	448	256.25	0.5723	28.96	S
NG 3956 B3XF	3.18	600	2.67	440	247.86	0.5630	27.15	S
NG 3195 B3XF	2.89	590	2.72	435	248.37	0.5713	29.46	S
DP 1820 B3XF	2.81	640	2.75	361	208.73	0.5790	29.68	S
DP 2044 B3XF	3.22	350	2.47	259	149.12	0.5763	26.47	S
Prob>F	0.0001	0.018	0.004	0.0001	0.0001	0.053	0.060	
MSD (0.05)	0.37	728	0.66	113	63.82	2.38	4.56	

[1]R = resistant and S = susceptible.

Table 4. Fiber properties for a reniform nematode variety test in Lubbock

Variety	Mic.	Length	Unif.	Strength	Elon.	Rd	+b	Leaf	Color Grade
DP 1820B3XF	4.45	1.18	82.85	33.65	6.3	83.4	7.7	2.5	21-1
DP 1845 B3XF	3.73	1.21	81.25	32.50	8.0	82.2	7.0	4.0	31-1
DP 2044 B3XF	3.78	1.17	80.80	33.10	6.3	81.1	8.0	3.0	21-1
DP 2141NR B3XF	4.48	1.15	81.75	32.25	7.0	82.9	8.2	1.5	11-1
DP 2143NR B3XF	4.42	1.12	82.35	32.25	6.9	81.1	7.8	2.0	21-1,31-1
FM 1621GL	4.21	1.09	81.10	30.05	6.0	81.0	7.4	4.5	31-1
FM 2202GL	4.03	1.11	82.20	32.25	7.0	81.9	8.1	2.5	21-1
FM 2398GLTP	4.64	1.14	82.90	30.20	6.4	83.6	7.8	1.5	11-2,21-1
FM 2498GLT	4.84	1.12	83.15	30.00	6.2	84.1	7.6	1.5	11-2,21-1
NG 3195 B3XF	3.88	1.12	82.20	30.35	6.7	84.2	7.6	2.0	11-1,11-2
NG 3956 B3XF	4.30	1.11	82.50	30.50	7.2	82.7	8.2	2.0	11-1,21-1
PHY 205 W3FE	4.50	1.09	82.70	30.95	6.4	82.0	7.6	2.0	21-1,31-1
PHY 332 W3FE	4.08	1.16	82.30	32.30	7.3	83.0	8.3	2.5	11-1
PHY 443 W3FE	4.19	1.14	83.05	32.60	6.9	83.4	8.1	1.5	11-2
PHY 411 W3FE	4.39	1.08	82.50	32.05	7.1	83.3	7.5	2.5	21-1
PX3E33W3FE	4.13	1.12	81.95	31.60	7.2	81.9	8.3	1.5	11-1,21-1
Prob>F	0.001	0.001	0.02	0.003	0.0001	0.003	0.0001	0.0001	
MSD (0.05)	0.39	0.04	1.40	1.77	0.3	1.6	0.3	0.9	