

2008-2009 Fusarium wilt trial results

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Introduction

Fusarium wilt, caused by the soilborne fungus *Fusarium oxysporum* f. sp. *vasinfectum* (*Fov*), is an economically important disease in portions of west Texas. Infection of cotton (*Gossypium hirsutum*) by *Fov* is more severe when fields are co-infested with the root-knot nematode (*Meloidogyne incognita*) (2). Virulent populations of *Fov*, capable of inciting disease in the absence of *M. incognita*, have been identified in the United States (5); however, disease development in west Texas appears to reflect the classical Fusarium wilt-root-knot interaction (Woodward, personal observation). Management strategies for this disease complex consist of the use of nematicides, rotation with non-host crops, soil fumigation, and planting resistant cultivars. Nematicides do not directly impact *Fov*, but can negatively impact Fusarium wilt via reducing nematode damage (3). Likewise, crop rotation affects *M. incognita* more so than *Fov*, due to the ability of the fungus to survive saprophytically (8). Fumigation is effective at reducing Fusarium wilt damage (4); however, it has yet to be widely adopted. Varying levels of resistance to *Fov* and *M. incognita* (6,7) has been identified in some cultivars. Information regarding the performance of commercially available cultivars is limited (1). The objective of this work was to identify cotton cultivars currently being marketed in west Texas which are partially resistant to Fusarium wilt.

Materials and Methods

Field trials were conducted in Dawson, Gaines, Terry, and/or Yoakum counties during the 2008 and 2009 growing seasons. These fields were known to be infested with *Fov* and have a history of Fusarium wilt. Trials consisted of 25-32 entries per location with a total of four replications. Trials were planted during the middle of May using a John Deere Maxx Emerge vacuum planter equipped with cones. The 2008 Dawson county trial, was replanted in early June due to poor stand establishment. No nematicides were used in any of the trials, and all management practices were at the discretion of the cooperating producer. Stand counts were determined approximately 28 days after planting and disease incidence was monitored throughout the season. Trials were harvested using a John Deere 484 modified with an internal basket equipped with load cells. Data were analyzed using PROC ANOVA in SAS, and means were separated using Fisher's Protected LSD ($P \leq 0.05$). The cultivars evaluated varied by trial, thus, trials were analyzed independently.

Results and Discussion

The trial location utilized in Dawson County had been used in previous years to conduct similar experiments (1). Fusarium wilt incidence ranged from 0.5 to 3.3% (Table 1), which is substantially lower than previous years (data not shown). Differences in lint yield were observed despite low levels of disease incidence. Yields ranged from 563.2 to 1164.9 lb/A for Phytogen 375WRF and Stoneville 5458B2F, respectively. Yields for Stoneville 4554B2F, Deltapine104B2RF, Deltapine 174RF, and (1090.0, 1110.5, 1156.3 lb/A, respectively) did not differ from Stoneville 5458B2F. Yields for Fibermax 9063B2F (593.2 lb/A) were similar to those of Phytogen 375WRF.

The field site in Gaines County was co-infested with *Verticillium dahliae* in addition to *Fov* and *M. incognita*. Disease incidence at this location ranged from 0 to 22.8% (Table 2), and the % mortality (due to *Fov*) was moderately correlated with yield (data not shown). Yields were lowest for the cultivars Fibermax 840B2F, Phytogen 375WRF, Fibermax 820RF, and Deltapine 167RF, 513, 549, 549, and 550 lb/A, respectively. Yields were greatest for Deltapine 174RF (1733 lb/A), followed by Stoneville 5458B2F, Stoneville 4554B2F, and NexGen 3410RF at 1423, 1136, and 1068 lb/A, respectively.

A severe Fusarium wilt epidemic was observed at the Yoakum County site in 2007. Field trials were established during the 2008 growing season; however, stands were lost due to extreme winds and blowing sand. A successful trial was conducted in 2009. Disease incidence at this location was much higher ranging from 5.7 to 83.2% with a mean of 32.9% (Table 3). Yields were negatively correlated with disease incidence (data not shown) and ranged from 100 to 1314 lb/A. Yields were lowest for Phytogen 375WRF, Phytogen 565WRF, Fibermax 1740B2F, Fibermax 1880B2F, and Fibermax 9063B2F. Yields were greatest for Stoneville 5458B2F, Stoneville 4288B2F, Stoneville 4498B2F and Deltapine 104B2RF. Likewise, returns (\$/acre) were greatest for Stoneville 5458B2F, Stoneville 4288B2F, Stoneville 4498B2F followed by Deltapine 104B2RF.

Stunting, although sporadic, was observed throughout the 2009 Terry County trial; however, few plants exhibited classical Fusarium wilt symptoms (2). Despite no obvious differences in disease incidence yield results from this trial were similar to those observed in other trials. With yields being greatest for Deltapine 174RF, Stoneville 4288B2F, Stoneville 5458B2F, Stoneville 4498B2F and DP104B2RF and lowest for PhytoGen 375WRF and Fibermax 1740B2F.

Fusarium wilt is a destructive disease that affects production fields on the Southern High Plains of west Texas. The interaction with *M. incognita* makes identifying resistant cultivars difficult; however, several strategies that negatively impact the nematode indirectly affect Fusarium wilt. Results from this study are of value when choosing cultivars to plant in fields infested with *Fov*. Furthermore, the rapid development and release of new cotton cultivars necessitates the need for an active screening program.

Acknowledgements

This research was funded in part through a grant from the Cotton Incorporated Texas State Support Committee. The contributions of grower collaborators Douglas Stafford, Jackie Burris, Shannon Patton and Raymond McPherson is greatly appreciated. We thank Mitchell Ratliff, Ira Yates, Brian Holliday, Evan Arnold, Justin Carthel, and Victor Mendoza for their technical assistance. We also thank all of the seed companies that provided seed.

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Table 1. Final Fusarium wilt ratings and lint yields for cotton cultivars evaluated in Gaines County, TX 2008

Cultivar^a	Fusarium wilt (% mortality)^b	Lint yield (lb/A)^c
DP 174RF	0.0	1,733 a ^d
ST 5458B2F	0.0	1,423 b
ST 4554B2F	0.0	1,136 bc
NG 3410RF	0.3	1,068 cd
AT Apex B2RF	1.0	1,041 cde
DP 164B2RF	0.7	930 cdef
AM 1532B2RF	1.3	924 cdef
DP 161B2RF	3.6	915 cdef
FM 9160B2F	0.0	914 cdef
AT Orbit RF	0.0	881 cdefg
DP 104B2RF	5.1	868 cdefg
AT Patriot RF	0.0	854 defg
AFD 5065B2RF	2.3	848 defgh
DP 143B2RF	1.9	833 defgh
FM 9063B2F	1.9	817 defghi
FM 9180B2F	3.3	809 defghi
AM 1622B2RF	6.5	807 defghi
PG 485WRF	3.1	788 defghij
DP 147RF	1.3	773 defghij
FM 1880B2F	0.3	764 efghij
NG 4370B2RF	9.8	762 efghij
CG 4020B2RF	2.1	737 fghij
AT Titan B2RF	5.0	717 fghij
AT Epic RF	18.7	685 fghij
AM 1550B2RF	17.9	683 fghij
CG 3035RF	9.1	614 ghij
DP 167RF	0.5	550 hij
FM 820F	1.6	549 hij
PG 375WRF	3.4	549 ij
FM840B2F	22.8	513 j

^a Cultivar abbreviations include: DP = Deltapine, ST = Stoneville, NG = NexGen, PM = Paymaster, AT = All-Tex, AFD = Associated Farmers Delinting, AM = Americot, CG = Cropland Genetics, and PG = Phytogen. ^b Fusarium wilt was restricted to two replications of the trial, therefore, means separation was not carried out. ^c Lint yield reflect the appropriate lint % from a 1000 g sub-sample. ^d Data are the means from four replications. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P \leq 0.05$).

Table 2. Final Fusarium wilt ratings and lint yields for cotton cultivars evaluated in Dawson County, TX 2008

Cultivar^a	Fusarium wilt (%)	Lint yield (lb/A)^b
DP 104B2RF	1.5 cdefg ^c	1,111 ab ^c
ST 5458B2F	0.9 fg	1,165 a
ST 4554B2F	1.1 defg	1,090 abc
DP 174RF	2.2 cdefg	1,156 a
ST 5327B2F	2.1 cdefg	1,015 abcd
NG 3348B2RF	0.9 efg	927 bcde
PM 2141B2RF	0.5 g	905 cdef
AT Epic RF	4.2 a	846 defg
AFD 5064F	1.5 cdefg	844 defgh
CG 3220B2RF	1.7 cdefg	872 defg
NG 3410RF	0.5 g	894 def
AM 1532B2RF	1.2 defg	875 defg
ST 4498B2RF	0.7 g	861 defg
DP 161B2RF	1.5 cdefg	742 efgjijk
CG 3035RF	4.1 ab	795 efghi
DP 141B2RF	1.6 cdefg	771 efg hij
PG 315RF	3.0 abcd	784 efg hij
AM 1550B2RF	2.7 abcdef	733 fghijk
FM 1880BRF	1.2 defg	727 fghijk
FM 9058F	2.8 abcde	720 fghijk
FM 9180B2F	0.9 fg	740 efg hijk
AFD 5065B2F	1.0 defg	694 ghijk
PG 375WRF	3.3 abc	563 k
FM 9063B2F	0.7 g	593 jk
ST 5283F	3.4 abc	651 hijk

^a Cultivar abbreviations include: DP = Deltapine, ST = Stoneville, NG = NexGen, PM = Paymaster, AT = All-Tex, AFD = Associated Farmers Delinting, AM = Americot, CG = Cropland Genetics, and PG = Phytogen. ^b Lint yield reflect the appropriate lint % from a 1000 g sub-sample.

^c Data are the means from four replications. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P \leq 0.05$).

Table 3. Final Fusarium wilt ratings and lint yields for cotton cultivars evaluated in Yoakum County, TX 2009

Cultivar^a	Fusarium wilt (%)		Lint yield (lb/A)^b		\$/Acre^c	
ST 5458B2F	13.8	ijklm ^d	1,314	a ^d	638	a ^d
ST 4288B2F	11.8	klm	1,149	ab	599	ab
ST 4498B2F	10.9	klm	949	bc	415	abc
DP 104B2RF	17.4	hijklm	841	bcd	337	bcd
PG 525WRF	14.6	ijklm	750	cde	305	cd
AM 1532B2RF	21.6	ghijklm	702	cdef	297	cd
ST 4554B2RF	5.7	m	678	cdefg	275	cde
DP 174RF	6.2	lm	621	cdefgh	271	cde
AM 1622B2RF	19.6	hijklm	613	cdefgh	264	cde
NG 3348B2RF	34.8	efghi	608	cdefgh	318	cd
AT Patriot RF	29.2	fghijk	530	defghi	151	cdef
DP 0935B2RF	39.9	cdefgh	528	defghi	260	cde
DP 141B2RF	29.0	fghijk	523	defghi	225	cdef
NG 4370B2RF	36.9	cdefgh	510	defghi	231	cdef
DP 164B2RF	33.7	efghij	506	defghi	224	cdef
DP 147B2RF	33.3	efghij	484	defghi	261	cde
NG 3410B2RF	32.1	fghijk	475	efghi	165	cdef
AT Apex B2RF	31.1	fghijk	433	efghij	155	cdef
ST 5288B2F	41.8	cdefg	409	efghij	101	def
DP 161B2RF	27.7	fghijkl	403	efghij	188	cdef
FM 9170B2F	34.6	efghi	385	fghij	110	def
DP 143B2RF	27.3	fghijklm	362	fghij	75	def
FM 9058B2F	48.8	bcdef	334	ghij	264	cde
AT Arid B2RF	35.0	efghi	321	ghij	185	cdef
DP 0949B2RF	57.3	bcd	313	hij	141	def
AT Titan B2RF	23.0	ghijklm	299	hij	93	def
DP 0924B2RF	38.7	cdefgh	274	hij	70	def
FM 9063B2F	58.9	bc	268	hij	142	def
FM 1880B2F	54.8	bcde	222	ij	241	cdef
FM 1740 B2F	65.3	ab	207	ij	74	def
PG 565WRF	36.6	defgh	193	ij	12	ef
PG 375WRF	83.2	a	100	j	-14	f

^a Cultivar abbreviations include: DP = Deltapine, ST = Stoneville, NG = NexGen, PM = Paymaster, AT = All-Tex, AFD = Associated Farmers Delinting, AM = Americot, CG = Cropland Genetics, and PG = Phytogen. ^b Lint yield reflect the appropriate lint % from a 1000 g sub-sample. ^c Values are based on the gin turnout (% lint), fiber quality results obtained from HVI analysis, and seed and technology fees. ^d Data are the means from four replications. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P \leq 0.05$).

Table 4. Lint yields for cotton cultivars evaluated in Terry County, TX 2009^a

Cultivar^b	Lint yield (lb/A)^c	
DP 174RF	629	a ^d
ST 4288B2F	628	a
ST 5458B2F	606	a
ST 4498 B2F	595	ab
DP 104 B2RF	591	ab
AM 1532 B2RF	574	abc
AT Patriot RF	554	abdc
FM 9180 B2F	553	abdc
PG 315RF	541	abdc
AM 2220 B2RF	522	abdc
DP 0920 B2RF	517	abdce
FM 9160 B2F	514	abdcef
FM 9058 B2F	500	abdcefg
ST 5288 B2F	493	abdcefg
NG 3410 B2RF	493	abdcefg
AT Epic RF	485	abdcefg
ST 4554 B2F	483	abdcefg
DP 141 B2RF	481	abdcefg
AM 1550B2RF	479	abdcefg
FM 9170 B2F	469	abdcefg
DP 164 B2RF	464	abdcefg
NG 3348 B2RF	435	bcdefgh
DP 0912 B2RF	421	cdefgh
PG 565WRF	407	cdefgh
DP 0935 B2RF	402	defgh
AT Orbit RF	400	defgh
AR Arid	391	defgh
DP 143B2RF	352	efgh
FM 1740B2F	352	efgh
BAYER EXP	349	fgh
NG 4370 B2RF	334	gh
PG 375WRF	294	h

^a Disease incidence was low at this location and did not warrant ratings. ^b Cultivar abbreviations include: DP = Deltapine, ST = Stoneville, NG = NexGen, PM = Paymaster, AT = All-Tex, AFD = Associated Farmers Delinting, AM = Americot, CG = Cropland Genetics, and PG = Phytogen. ^c Lint yield reflect the appropriate lint % from a 1000 g sub-sample. ^d Data are the means from four replications. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P \leq 0.05$).