

# Brief Articles

## DEVELOPMENT OF A SET OF UPLAND COTTON LINES FOR COMPARISONS OF FUSARIUM WILT-ROOT-KNOT NEMATODE DATA FROM SEVERAL TESTS<sup>1</sup>

A. J. Kappelman, Jr. and W. P. Sappenfield<sup>2</sup>

### ABSTRACT

Ten cotton (*Gossypium hirsutum* L.) cultivars were evaluated under five environments to determine their reaction to Fusarium wilt (*Fusarium oxysporum* f. *vasinfectum* (Atk.) Snyder & Hans.) and root-knot nematodes (*Meloidogyne* spp.). These tests were conducted in an effort to determine a set of entries with known differential susceptibility to the Fusarium wilt-root-knot nematode complex. 'Auburn 56' and 'Auburn M' were highly resistant, while 'Rowden' and 'Stardel' were highly susceptible under all environments. The other six cultivars differed over environments but usually were intermediate in resistance.

Although a complete set of differentials was not determined, two distinctively different groupings were observed. Using a cultivar from both the resistant group and the susceptible group as check materials in Fusarium wilt screening tests will enable investigators to compare results from different areas on a relative basis.

*Additional index words:* *Gossypium hirsutum* L., *Fusarium oxysporum* f. *vasinfectum*, Cotton wilt differentials, Fusarium wilt-root-knot nematode complex.

**F**USARIUM wilt of cotton (*Gossypium hirsutum* L.), resulting from infection by *Fusarium oxysporum* f. *vasinfectum* (Atk.) Snyder & Hans., occurs to some

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<sup>2</sup> Research Pathologist, Southern Region, Agricultural Research Service, USDA, in cooperation with the Department of Agronomy and Soils, (Alabama) Auburn University Agricultural Experiment Station, Auburn, Ala., and Professor, Department of Agronomy, University of Missouri, Delta Center, Portageville, Mo., respectively.

degree in most states where cotton is grown (1). The incidence of wilt and the degree of damage that follows infection of a given cultivar may vary greatly, however, between states. Some of this variation may be due to the presence or absence of and degree of damage caused by root-knot nematodes. Although lines and cultivars of cotton have been evaluated over a period of years at Tallassee, Ala., comparison of these results (2, 3, 4, 5, 6) with those obtained from tests in other states or locations is difficult without a set of standards with which to make relative evaluations.

This study was initiated to evaluate 10 lines or cultivars of cotton at two locations in order to establish wilt-resistance standards by which comparisons between test results from different locations could be made.

### MATERIALS AND METHODS

Five entries were selected by each author to represent a range in Fusarium wilt susceptibility from near 0 to 100% at each location, based on previous experience. Seeds of these 10 selections were increased at Iguala, Mexico during the winter of 1968-69. Seeds of each entry were acid delinted and divided between cooperators. One seed lot of each entry was maintained at each location in similar cooled, dehumidified rooms to reduce variation between seed lots.

The 10 lines or cultivars of cotton were planted at Tallassee, Ala. in 1969, 1970, and 1971, and also at Clarkton, Mo. in 1969 and 1970. At Clarkton, stand was uniformly thinned to three plants per 30- to 36-cm (12- to 14-in) hill, whereas at Tallassee, 100 seeds were planted per 9.14-m (30-ft) plot, using a belt planter in 1969 and 1970 and a cone planter in 1971. Plots at both locations were fertilized and treated with pesticides according to area recommendations. Counts of wilted plants were made throughout the season, with final stand counts usually made during the 1st week of September each year. Tests at both locations were conducted on land that was known to be highly infested with Fusarium. Moreover, the test site at Tallassee has been maintained under a rotation to increase the infestation of root-knot nematodes and Fusarium wilt to a level greater than that normally encountered in a producer's field.

The test design at both locations each year was a randomized complete block. Four replications were evaluated at Tallassee and five at Clarkton. Percent wilting by entries was calculated for both locations each year. Since data were percentages, and wilting of the entries varied from 0 to 100%, the Arcsin trans-

**Table 1. Mean wilting percentage of 10 cottons evaluated under five environments in the Alabama-Missouri Uniform Wilt Screening Test.**

Cultivar or designation	Environments*					Means over environments		
	1	2	3	4	5	1, 3 & 5	2 & 4	All
	%					%		
Auburn 56	16 a†	2 a	52 a	1 a	34 a	34 a	2 a	21 a
Auburn M	9 a	4 a	58 a	3 a	33 a	33 a	4 a	21 a
G. 65-all	38 a	16 abc	82 a	13 b	40 a	53 b	14 b	38 b
DPL 16	29 a	8 ab	85 b	14 b	78 b	64 b	11 b	42 b
Coker 201	37 a	11 ab	87 b	10 b	69 b	64 b	10 b	42 b
ADT	70 b	30 c	96 c	14 b	58 b	74 c	22 c	54 c
Stoneville 213	83 bc	20 bc	97 c	22 c	66 b	82 c	21 c	57 c
M-8	96 cd	61 d	100 c	45 d	92 c	96 d	53 d	78 d
Stardel	99 d	57 d	100 c	49 d	91 c	96 d	53 d	79 d
Rowden	96 d	64 d	100 c	48 d	100 c	98 d	56 d	82 d

\* Environment 1 = Tallahassee, Ala., 1969; 2 = Clarkton, Mo., 1969; 3 = Tallahassee 1970; 4 = Clarkton 1970; and 5 = Tallahassee 1971. † Means within a column followed by the same letter cannot be considered significantly different at the 0.05 level of probability, according to Duncan's New Multiple Range Test.

formation was made before analysis. After the final test, all data were combined and analyzed, using Tallahassee 1969 = Environment 1, Clarkton 1969 = Environment 2, . . . , Tallahassee 1971 = Environment 5. Means of the 10 cultivars were then compared, using Duncan's New Multiple Range Test.

## RESULTS AND DISCUSSION

During 1969 the highest wilting occurred on 'Stardel' (Table 1) when grown at Tallahassee (Environment 1). While greater wilting ( $P = 0.05$ ) occurred at Tallahassee than at Clarkton, variation was greater at the first location; therefore, varietal rankings were relatively the same.

Although the entries were selected on the basis of previous performances to represent wilting percentages of 0, 25, 50, 75, and 100%, statistical differentiation between all entries was not obtained. However, three significantly different groups could always be distinguished at each location.

In 1970, Environments 3 and 4, the percent wilting of all entries was again significantly greater at Tallahassee than at Clarkton (Table 1). Also during this year, while three significantly different groups were distinguished at Tallahassee, four were evident at Clarkton. Results from the 1971 test, Environment 5, gave three significantly different groupings.

When results were combined and analyzed over environments, significant differences at the 0.01 level of probability were found within both environments and cultivars. While environment  $\times$  cultivar interaction was also significant, the magnitude of this interaction was relatively small compared to differences among cultivars. Thus, the relative ranking of the cultivars was approximately the same over environments and three significantly different groupings were determined. Two resistant cultivars, 'Auburn 56' and 'Auburn M', were always classified within the most resistant grouping. 'Rowden' and 'Stardel' were always classified within the most susceptible grouping over all environments. Cultivars within the intermediately resistant grouping varied over both years and locations. Several of these entries were classified consistently

within this grouping under some environments; however, under other conditions these same cultivars were not significantly different from those in either resistant or susceptible groups. When percent wilting of cultivars was averaged over all environments, four distinct groups were obtained.

When data from a given location were analyzed, at Tallahassee, for example (Environments 1, 3, and 5), while cultivar effects were highly significant, so were years and years  $\times$  cultivars. Therefore, under these conditions of high wilt incidence, no generalization can be made, except that the extremes (either highly resistant or highly susceptible selections) performed relatively the same over years. When data from Clarkton (Environments 2 and 4) were analyzed over years, cultivars were found to be significantly different at the 0.01 of probability. Mean squares for neither years nor years  $\times$  cultivars were significant however. Wilt at this latter location was considerably lower than that at Tallahassee.

Since greater distinction between resistance groupings could be made at Clarkton during 1970, and significant interactions did not occur for years or years  $\times$  cultivars, possibly a lighter incidence of wilt might be favored by some investigators. Many breeders, however, are interested only in highly resistant selections or cultivars. The greater range between entry means that occurred at Tallahassee might be advantageous for selection between entries without regard to significance level.

While the incidence of wilt at Tallahassee was much greater, and the interaction of cultivars  $\times$  years was significant, highly resistant or susceptible cultivars or selections were so classified each year. Since a similar differential was made also at Clarkton, the best evaluation of genetically based resistance was probably made at Tallahassee. Since extremes were relatively the same over environments, comparisons between results from different locations could be made by including one of the resistant and one of the susceptible cultivars as checks in each test and evaluating cultivars included in different tests relative to these checks.

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