

# Fusarium Wilt Resistance of Two Cotton Cultivars from Paraguay

A. J. KAPPELMAN, JR., Research Plant Pathologist, AR, SEA, USDA, and Adjunct Associate Professor, Department of Agronomy and Soils, Auburn University, Auburn, AL 36849

## ABSTRACT

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The Fusarium wilt resistance of two cotton cultivars commonly grown in Paraguay (Reba B-50 and Reba P-279) was evaluated relative to three U.S. cotton cultivars with varying levels of resistance. Reba B-50 was highly resistant, whereas Reba P-279 was susceptible to the disease.

Fusarium wilt (*Fusarium oxysporum* Schlect. f. sp. *vasinfectum* (Atk.) Snyder & Hans.) of cotton (*Gossypium hirsutum* L.), described in the United States by Atkinson in 1892 (2), also occurs in many other cotton-growing areas of the world (4). Although symptoms of this disease were observed in Paraguay in 1945, extensive wilting was not found until 1977 (C. Centurión, *personal communication*), when symptoms were observed on the widely grown cultivar Reba P-279. Since then, wilt symptoms have been observed on other cultivars in certain areas of Paraguay.

This study compares the resistance of two cotton cultivars from Paraguay with that of three U.S. cultivars with varying levels of resistance when plants are 1) grown under greenhouse conditions and artificially inoculated with a spore suspension of *F. oxysporum* f. sp. *vasinfectum* and 2) grown in soil highly infested with both the fungus and root-knot nematodes (*Meloidogyne* spp.).

## MATERIALS AND METHODS

The Fusarium wilt resistance of cotton cultivars Reba P-279, Reba B-50, Rowden, Coker 315, and Stoneville 603 was evaluated in three tests. The last three cultivars named were included because of their known reaction to Fusarium wilt (susceptible, intermediate, and resistant, respectively). Each test was designed as a

randomized complete block. Twelve replications of these entries were evaluated in the first greenhouse test, nine in the second greenhouse test, and four in the field test at Tallassee, Alabama.

Seeds used in greenhouse tests were submerged in water at 80 C for 90 sec to eliminate the effect of seed coat hardness on germination, treated with a fungicide combination containing three parts of thiram and 10 parts of chloroneb, and incubated at 30 C for 24–28 hr. Germinated seeds were planted in rows 15.2 cm apart on greenhouse benches containing steam-sterilized Wickham sandy loam, the same soil type as in the field test.

Planted seeds were covered with fine soil, watered, and covered with brown paper that was kept wet until it was removed after 3 days. Ten days after planting, all rows were thinned to 10 plants spaced 8 mm apart in the row. Plots were hand-cultivated 16 days after

planting, and the soil was firmed around the plants, raising the soil level around the plants by about 2 cm.

The inoculum used in each greenhouse test was a mixture of equal parts (v/v) of six isolates of *F. oxysporum* f. sp. *vasinfectum* race 1. This inoculum was grown in 250-ml flasks containing 165 ml of Czapek solution. After seeding with isolates of the Fusarium wilt fungus, flasks were mounted in a water bath shaker maintained at 27 C. After 10 days, each culture was mixed in a blender, and a hemocytometer was used to count the number of spores. Sterile, distilled water was added to adjust spore suspensions to a concentration of  $2 \times 10^6$  microconidia per milliliter.

A needle-puncture technique similar to that described by Bugbee and Presley (3) was used to inoculate plants in the greenhouse tests 3 wk after emergence. Each plant was inoculated twice, once on each side of the stem 1.7 cm above the soil line. Wilted plants were counted and removed weekly. Plants that remained healthy 4 wk after inoculation were counted, and percentages of wilted plants were determined.

The field test was conducted in soil highly infested with both the wilt fungus and root-knot nematodes. Plots were seeded with 200 seeds per 9 m of row.

**Table 1.** Mean Fusarium wilt expression in five cotton cultivars evaluated for resistance under greenhouse and field conditions

Cultivar	Percentage of wilted plants <sup>a,b</sup>			
	GH-1	GH-2	FT-T	Average
Rowden	89 c	78 b	71 b	79
Reba P-279	46 b	51 a	34 a	44
Coker 315	42 b	51 a	24 a	39
Stoneville 603	45 b	41 a	20 a	35
Reba B-50	8 a	34 a	20 a	21

<sup>a</sup>GH-1 = first greenhouse test, GH-2 = second greenhouse test, and FT-T = field test conducted at Tallassee, Alabama.

<sup>b</sup>Means within a column followed by a common letter are not significantly different ( $P = 0.01$ ) according to Duncan's multiple range test.

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Seeds were planted 3–4 cm deep in rows 1.1 m apart on 2 May 1979 and thinned to 9–12 plants per meter of row on 25 May 1979. Live plants were counted 40 days after planting, and wilted plants were counted and removed 56, 64, 71, 104, and 118 days after planting. The number of plants that remained alive in each plot after 146 days was also recorded. Percentage of wilted plants in each plot and mean number of wilted plants were then calculated.

Data from all tests were statistically analyzed, and Duncan's test was used to compare means. Correlation of entry performance across tests was also calculated.

## RESULTS AND DISCUSSION

In the first greenhouse test, significantly less wilting occurred in Reba B-50 than in any other entry (Table 1). Significantly more wilting occurred in the susceptible check, Rowden, than in Stoneville 603, Coker 315, or Reba P-279. In the other two tests, significantly more wilting occurred in Rowden than in the other entries, but differences among Reba B-50, Stoneville 603, Coker 315, and Reba

P-279 were not statistically significant.

Although the field test was conducted in soil highly infested with both the wilt fungus and root-knot nematodes while in the two greenhouse tests, the cultivars were artificially inoculated with a spore suspension of *F. oxysporum* f. sp. *vasinfectum*, cultivar reaction across all tests was significantly correlated.

The relative wilting of the cultivars Stoneville 603, Coker 315, and Rowden used in these tests for comparative purposes was similar to that observed in other field tests (5). The wilt resistance shown by Reba B-50 in the first greenhouse test was greater than expected, whereas the lack of differentiation between Reba B-50 and Reba P-279 in the other two tests was contrary to field observations in Paraguay (C. Centurión, *personal communication*). Differences in environmental conditions, wilt isolates and races, inoculum levels, nematodes, fertility, and cultural practices could account for differences in wilt expression of the two entries from Paraguay in different tests.

The isolate of the wilt fungus from Paraguay was recently identified as race 6

of *F. oxysporum* f. sp. *vasinfectum* (1). The reaction of Rowden to race 1 and race 6 is identical. However, race 6 and race 1 cause different reactions in two other differential hosts. Thus, more experimentation involving the two cultivars from Paraguay and appropriate checks, as well as both race 1 and race 6 of the fungus, is needed. Such work may explain differences noted between wilt reaction of Reba B-50 and Reba P-279 in the experiments reported here and under field conditions in Paraguay.

## LITERATURE CITED

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