UPLAND COTTON VARIETAL RESPONSE TO CHARCOAL ROT

T. A. Turini and E. T. Natwick
University of California Coop. Ext.
Holtville, CA
C. G. Cook
Syngenta
Victoria, TX

Abstract

Ten cotton, Gossypi*um hirsutum* L., cultivars or breeding-lines were evaluated for relative susceptibility to charcoal rot, which is caused by *Macrophomina phaseolina* (Tassi) Goidanich. The cultivars were Texas 121, AP 4103, AP 6101, and Stoneville 474 and experimental seed-lines were NK 2165C, NK 21208SS, NK 2387C, NKX C429-93-2ct, NKX 2907, and NKX 2207. By 21 July, cotton plants were wilting and dying. *Macrophomina phaseolina* was identified by the presence of the sclerotia on the roots of affected plants. On 3 September, the disease incidence was evaluated within in 13-foot section of each of two rows within each plot. Charcoal rot disease incidence was highest in NKX C429-93-2ct. Disease incidence was lowest in AP 6101and Stoneville 474, which did not differ from AP 4013, NKX 2207, NK 2387C.

Introduction

Charcoal rot, which is caused by *Macrophomina phaseolina* (Tassi) Goidanich, is not currently a major economic concern in commercial cotton but can cause substantial economic loss under conditions of drought stress and high temperatures. *M. phaseolina*, a soil-borne fungus, invades roots or lower stems, colonizes internal tissues quickly, and the plant wilts and dies (Watkins 1981). The small, black sclerotia that are embedded in affected tissue are diagnostic for this disease (Watkins 1981).

Fumigants, solarization and deep plowing have had little success in controlling charcoal rot and crop rotation is not practical due to the wide host range of *M. phaseolina* (Bruton and Wann 1988). However, charcoal rot appears to affect some cotton varieties less severely than others (Watkins 1981).

The purpose of this cultivar/breeding line field trial was to evaluate resistance to cotton leaf crumple. However, *M. phaseolina* weakened and killed cotton in this field and there were differences in charcoal rot incidence among cotton entries. This is a report of the differences observed.

Materials and Methods

On 28 March 2000, seeds of ten cotton genotypes were sown and irrigated at the University of California Desert Research and Extension Center, Holtville, CA. The varieties compared were as follows: Texas 121 (Stoneville Pedigree Seed Co.), Stoneville 474 (South Texas Planting Seed Co.), AP 4103 (AgriPro Seed) and AP 6101 (AgriPro Seed); and experimental seed-lines from Northrop King were NK 2165C, NK 21208SS, NK 2387C, NKX C429-93-2ct, NKX 2907, and NKX 2207. The experimental design was a randomized complete block with four replications. Each plot was 26 ft long and 13 ft wide.

Cotton plants were water stressed during July and August, while daily high air temperatures were between 102 and 115 ^{o}F (CIMIS). By 3 September, some plants that had suffered leaf death had produced new growth; other plants were obviously dead.

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The disease was identified by the presence of the sclerotia on the roots of affected plants. To verify that there was a constant association between the fungus and the symptoms, on 26 September, 4-6 plants each apparently healthy, prematurely defoliated and dead were uprooted from each plot in one replication and the roots were examined for sclerotia.

On 3 September, counts were taken of defoliated plants with young growth, dead and total plants present in 4-meter section of each of two rows within each plot. Seed cotton was hand picked from 4-meter sections of row on 5 October. Seed cotton weights were recorded, samples were ginned and lint weights were recorded. Disease incidence, and yield were analyzed with ANOVA. The least significant difference of disease incidence data was calculated. Student-Newman-Keul's Multiple Range Test was used to separate means of yield data.

Results and Discussion

Sclerotia of *M. phaseolina* were present on the roots of all dead plants sampled, on 24.5 % of defoliated plants with re-growth and on 1.3 % of the plants with no above-ground symptoms when examined 26 September.

The pathogen killed fewer AP 6101 (0.0 %), Stoneville 474 (0.0 %), AP 4103 (1.2 %), NKX 2207 (0.6 %) than the other entries, although the percentage of NK 2387C (4.6 %) and NK 2165C (6.7 %) killed were not different from the least affected entries, $P \leq 0.05$ (Table 1). Fewer plants of the AP 6101 (0.0 %) and Stoneville 474 (0.0 %) varieties were defoliated than of the other genotypes included in the study, but did not differ from AP 4103 (1.2 %), NKX 2207 (0.6 %), NK 2387C (7.6 %), NK 2165C (5.1 %) and Texas 121 (5.1 %).

Seed cotton yield of AP 6101 (2849.5 lbs/acre) and AP 4103 (2821.2 lbs/acre) were greater than all other genotypes except NK 2387C (2371.2 lbs/acre), $P \leq 0.05$ (Table 2). Similarly, lint weights of AP 6101 (1069.5 lbs/acre) and AP 4103 (1051.1 lbs/acre) were lower than all other entries except NK2387C (957.7 lbs/acre), Stoneville 474 (797.1 lbs/acre) and NK 2108SS (784.7 lbs/acre).

There was not a significant correlation between disease incidence and yield, $r= 0.4629$: $p > 0.10$ (Figure 1). In this experiment, other factors that could have had a greater influence on yield than charcoal rot include differences in susceptibility of the entries to whitefly or other genotypic traits.

Charcoal rot is a minor problem on cotton; however, *M. phaseolina* is a common soil-borne fungus that can cause damage when cotton plants are stressed. Under conditions of high temperatures and drought stress, AP 6101, Stoneville 474 and AP 4103 may avoid heavy damage due to charcoal rot that could weaken and kill plants of other cultivars and experimental breeding-lines.

References

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Table 1. Charcoal rot incidence.

	Percent Plants[z]		
Variety	**Dead**	**Defoliated**	**Diseased**
AP 6101	0.0	0.0	0.0
Stoneville 474	0.0	0.0	0.0
AP 4103	0.0	1.2	1.2
NKX 2207	0.6	0.6	1.3
NK 2387C	4.6	7.6	12.1
NK 2165C	6.7	6.4	13.1
Texas 121	8.5	5.1	13.6
NKX 2907	9.2	8.1	17.4
NK 2108SS	10.6	8.7	19.3
NKX C429-93-2ct	17.2	31.4	48.6
LSD (P = 0.05)	7.8	7.8	12.8

[z]On 3 September, disease incidence was evaluated in 13 feet in each of two rows within each plot.

Table 2. Pounds per acre seed cotton and lint.

Variety	Seed cotton[y]	Lint[y]
AP 6101	2849.5 a	1069.5 a
AP 4103	2821.2 a	1051.1 a
NK 2387C	2371.2 ab	957.7 ab
Stoneville 474	2025.3 b	797.1 abc
NK 2108SS	1995.3 b	784.7 abc
NK 2165C	1881.9 b	705.7 bc
Texas 121	1899.5 b	701.3 bc
NKX C429-93-2CT	1812.0 b	689.5 bc
NKX 2207	1736.9 b	636.7 bc
NKX 2907	1703.7 b	602.0 c

[y]On 5 October 2000, cotton was harvested a 13-foot sections, seed cotton weights were recorded, and cotton was ginned and lint weights were recorded.

[z]Means within the same column that are followed by the same letter do not differ significantly as determined by Student-Newman-Keul's Multiple Range Test, P = 0.05.

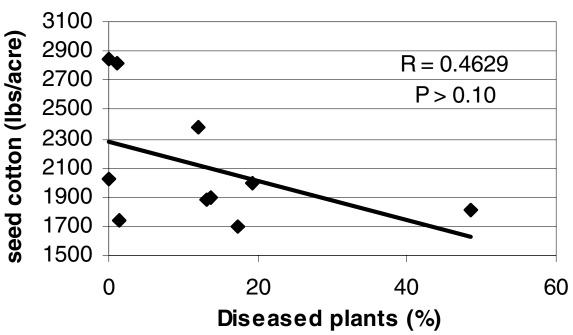

Figure 1. Effect of charcoal rot on seed cotton yield at Desert Research and Extension Center in Holtville, CA in 2000.