

**PERFORMANCE OF PHYTOGEN 3196,
A ROOT KNOT RESISTANT COTTON VARIETY**

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Abstract

The cotton variety Phytogen 3196 was tested in the field and in the laboratory for root knot nematode (*Meloidogyne incognita*) resistance. The variety was planted in a field in Ashley County, AR that was highly infested by the root knot nematode. Treatments of Telone II (1,3-dichloropropene), of 1.5 and 3 gallons per acre as well as an unfumigated check were applied in strips and replicated 3 times. Phytogen 3196 was also planted in a field with a low root knot population density and compared with the root-knot susceptible variety Phytogen 355. Laboratory trials were also conducted to compare nematode galling and reproduction of Phytogen 3196 with several other cotton varieties. Phytogen 3196 exhibited moderate levels of resistance in both the field and in the laboratory. The addition of Telone II did not increase the yield of Phytogen 3196, but the yield of Phytogen 3196 in the field were lower than for the nematode susceptible Phytogen 355.

Introduction

Ashley County is located in southeast Arkansas with the cotton producing area of the county located in the eastern one-third. From 40,000-55,000 acres of cotton are grown annually in the Mississippi River alluvial part of the county. The presence of root knot nematodes in the county has been documented and has been recognized for many years as a growing problem in cotton production. Field surveys conducted in 2000 showed that 56% of the cotton fields in the county were infested with root knot and 47% were above the established treatment threshold (Table 1). Grower estimates of yield losses in various years have ranged from 0-500 pounds of lint per acre. Rotations with crops such as root knot resistant soybeans and grain sorghum have met with only very limited success due to market prices and low income from the rotation crop.

Telone II has been used effectively by some growers for several years for root knot nematode control. While fumigation with Telone II has been very successful in controlling nematodes within the growing season, field treatment on an annual basis is a major production expense and the time and labor associated with its application is relatively high. A nematode resistant, high yielding, cotton variety would be of great benefit. The advanced line Phytogen 3196 has been reported as having at least a moderate level of root-knot resistance. Studies were established on two farms near Portland, AR to determine 1) if a combination of resistance with lower rates of application of Telone II could lower the fumigation costs to producers and 2) to evaluate the yield potential of the line. Additional laboratory studies were also conducted to compare the level of nematode resistance in Phytogen 3196 to that in several other commercially available varieties.

Materials and Methods

A field study was established on the Bond Farm (May 8, 2002) in a field with a high root-knot nematode population density and a history of severe root-knot damage in previous years. The plots were field length strips 4 rows wide by approximately 2,600 ft. long, and treatments were replicated 4 times. Treatments included Phytogen 3196 with no Telone II, and with 1.5 or 3.0 gallons/acre of Telone II. Although not randomized and replicated as a part of the test, a planting of the root-knot susceptible commercial cultivar Phytogen 355 with 3 gallon/acre of Telone II was monitored for comparison. No Temik was applied to any of the plots, but the insecticide Gaucho was applied as a seed treatment in all plots. Nematode samples were taken from the center 2 rows of each strip to a depth of 10 inches at cotton emergence, at first bloom, and at cotton maturity. Nematode samples were taken of the Phytogen 355 at maturity only. Yields were measured by harvesting (November 11, 2002) the entire plot and weighing the seed cotton on a boll buggy equipped with scales. Lint turnout was obtained from a laboratory gin without the use of lint cleaner.

A second study was established (May 14, 2002) in a field with a low incidence of root knot on the Cochran Farm to compare the yield of Phytogen 3196 and Phytogen 355. Plots (strips) were approximately 650 ft long, and each variety was replicated 3 times. These varieties were embedded into a standard cotton variety test that was being conducted in the field. A total of

16 other commercial cotton cultivars were included in the test. Temik 15 G was applied at planting in all plots at 5 lb per acre. No nematode samples were taken during the season, and yields (November 18, 2002) were measured in the same manner as indicated above.

In addition to the field studies, lab studies were conducted to compare the galling severity and nematode reproduction of Phytogen 3196 with that of Stoneville 5599BR, Paymaster 1560BG, Stoneville 4892 BR, Stoneville LA887 and Paymaster 1560. Three separate experiments (February, April, and September) were conducted during 2002 with 5-10 replications of each cultivar. In each repetition, individual seedlings growing in pasteurized sandy loam soil were inoculated with 5,000 *M. incognita* eggs and allowed to grow for 45 days. At the termination of the study, root galling severity and nematode reproduction were evaluated for all plants of each cultivar.

Results

Bond Field

Root knot nematode numbers at cotton emergence (May 10, 2002) were low in all plots, although the population in the unfumigated check was numerically slightly higher than where Telone II had been applied (Table 1). By first bloom (July 8, 2002), root-knot numbers were higher following application of 1.5 gal/acre than where 3 gal/acre of Telone II was applied. At cotton maturity (November 11, 2002), nematode numbers were high in all treatments although they were slightly lower following the 3 gal/acre rate. Although the final population density of nematodes in the susceptible cultivar Phytogen 355 could not be compared statistically, a comparison of the nematode population densities indicated that nematodes increased to a substantially higher population density than in the Phytogen 3196 even where Telone II was not applied. The lint yield of Phytogen 3196 did not differ among treatments, and application of Telone II did not improve lint yield (Table 2). Again, although statistical comparison is not possible, yield of Phytogen 3196 was numerically lower in all treatments than with the susceptible Phytogen 355 with 3 gal/acre of Telone II, indicating that while Phytogen 3196 is at least moderately resistant to the root-knot nematode, its yield performance, at least under the conditions of this experiment was limited.

Cochran Field

Phytogen 3196 yielded an average of 1,018 lb. lint per acre. The Phytogen 355 yielded an average of 1233# lint per acre, a yield difference of 212# lint per acre. The Phytogen 355 yields ranked second in the cotton variety test in which the plots were embedded. Phytogen 3196 ranked 11th out of the 18 cultivars while Phytogen 355 ranked 3rd in terms of yield performance (Table 3).

In the laboratory tests, root galling severity of Phytogen 3196 was equivalent to the known resistant cultivars Stoneville LA887 and Paymaster 1560 in 2 of the 3 tests, and nematode reproduction was equivalent to these cultivars in all three trials (Table 4). Root galling severity and nematode reproduction was lower on Phytogen 3196 than for Paymaster 1560BG, Stoneville 4892BR, and Stoneville 5599BR in two of the three trials.

Summary, Conclusions and Discussion

Phytogen 3196 exhibited a moderate level of resistance to the root-knot nematode in both field and laboratory studies. In the laboratory, the level of resistance was equivalent to that seen for the cultivars Paymaster 1560 and Stoneville LA887, both of which are considered moderately resistant cultivars. In laboratory tests, Phytogen 3196 was significantly more resistant than the cultivar Stoneville 5599BR that has also been reported to have a moderate level of root-knot resistance, although no field performance comparisons were made in this study. The level of resistance of Phytogen 3196 was apparent in the field where rates of Telone II of 1.5 or 3 gal per acre failed to improve yield even under high nematode pressure. The yield potential of this variety, however, under our conditions was somewhat limited.

Table 1. Root knot nematode population densities in Phytogen 3196 after application of Telone II.

Telone II rate/acre	Nematodes/pint of soil ¹			Days to maturity
	At cotton emergence	At first bloom	At harvest	
0	455 a ²	4.148 a	3.523 a	89
1.5	57 a	1,023 a	2,273 a	93
3.0	57 a	227 b	1,477 a	89

¹Samples collected to a depth of 10 inches

²Means within columns followed by the same letter do not differ at P=0.05 by Duncan's Multiple Range Test

Table 2. Lint yield of Phytogen 3196 after treatment with Telone II.

Cotton Variety	Telone II (gal/acre)	Lint yield (lb./acre)
Phytogen 3196	3.0	1,351 a
Phytogen 3196	1.5	1,329 a
Phytogen 3196	0	1,342 a
Phytogen 355	3.0	1,426

Table 3: Cochran Plots Lint Yield Per Acre

Variety	Temik rate (lb./A.)	Lint Yield/Acre	Rank in Overall Variety Test (18 Varieties)
Phytogen 3196	5	881 b	11
Phytogen 355	5	1,046 a	3

Table 4: Laboratory Test

Culti-var/Line	Gall Severity Rating			Log 10 Eggs/Root System		
	2/11/02 (n=6)	4/10/02 (n=5)	9/17/02 (n=10)	2/11/02 (n=6)	4/10/02 (n=5)	9/17/02 (n=10)
PM						
1560BG	5.0 a	5.0 a	4.9 a	5.02 a	4.99 a	4.74 a
STV						
4892BR	4.2 b	4.2 ab	4.4 ab	4.36 abc	4.89 a	4.83 a
STV						
5599BR	4.3 ab	4.2 ab	3.9 b	4.83 ab	4.72 a	4.53 abc
PSC3196	3.0 c	3.2 bc	2.6 d	3.44 cd	3.72 b	4.15cd
STV						
LA887	2.2 d	2.6 cd	2.8 cd	3.87 cd	3.62 b	3.83 d
PM1560	2.0 d	2.0 d	3.0 cd	3.05 d	3.39 b	4.34 bc