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Evaluation of Soybean Cultivars for Production in *Meloidogyne incognita*-infested Soil[1]

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Abstract: Significant ($P < 0.05$) differences among galling and yields of 41 soybean cultivars and breeding lines were found when they were produced at a site infested with *Meloidogyne incognita* during 3 years of investigation. Over a period of 6 years of testing, 13 cultivars were identified as having a suitably low susceptibility to warrant their production in *M. incognita* infested soil.

Key words: *Glycine max*, *Meloidogyne incognita*, plant breeding, root-knot nematode, soybean.

Soybean, *Glycine max* (L.) Merr., cultivars and breeding lines have been evaluated annually for agronomic traits and susceptibility to pathogens at various sites throughout the soybean production area of Florida (6). At a site infested with *Meloidogyne incognita* (Kofoid & White) Chitwood, evaluations for root-knot galling and yield responses were performed from 1984 through 1986 on 41 entries from public and private sources. Sixteen cultivars were evaluated each year for continuity.

Soybean producers normally plant cultivars from 2 or 3 maturity groups to allow for an extended harvesting period, thereby decreasing the opportunity for decay of a crop due to delays in harvesting.

The purpose of these studies was to provide information differentiating the preferable cultivars belonging to maturity groups V through VIII (the range of soybean cultivar adaptation for the southeastern United States) for the management of *M. incognita*, the most ubiquitous root-knot nematode pathogen of soybean in the region (3). Data from similar studies for 1981–83 have been published (5).

Materials and Methods

Experiments were conducted at a site naturally infested with *M. incognita* at the University of Florida Agricultural Research and Education Center, Jay. The soil was a loamy sand ultisol-typic paleudult (70% sand, 15% silt, 15% clay, < 2% organic matter; pH 5.8–6.0) fertilized each year with $0N : 30P_2O_5 : 15K_2O$ at 300 kg/ha. Trifluralin at 0.25 liter/ha and vernolate at 1.0 liter/ha were preplant incorporated for weed management. Experiments were arranged in a randomized complete block design with four replicates per entry. Each plot consisted of three rows, 8.2 m long and 9.9 m apart. Alleys, 1 m wide, separated the blocks. Nematode population density per 10 cm^3 soil was assayed immediately before planting to determine the uniformity of infestation. Seven soil cores, 2.5 cm d and 20 cm deep, were taken along the center of each plot. The cores were mixed and the nematodes extracted from a 100-cm^3 sample by centrifugal flotation (2). In addition to *M. incognita*, *Helicotylenchus dihystera* (Cobb) Sher, *Pratylenchus scribneri* Steiner, and *Paratrichodorus christiei* Allen were present in the plots, but in numbers considered too low to influence soybean production. Preplant soil infestation levels of second-stage infective juveniles of *M. incognita* were 4, 21, and 5 per 10 cm^3 soil in successive years. Approximately 30 seeds per meter were planted on 14 June 1984, 26 June 1985, and 22 May 1986.

The cultivars and breeding lines are listed by source and maturity group. Public: 'Bedford' (Group V); 'Centennial', 'Jeff', 'Leflore', and GA 79-402 (Group VI); 'Braxton', 'Gordon', and 'Wright' (Group VII); 'Cobb', 'Foster', 'Hutton', 'Kirby', and F77-7446 (Group VIII). Asgrow Seed Co., Marion, Arkansas: 'A7372' (Group VII). Coker's Pedigreed Seed Co., Hartsville, South Carolina: 'Coker 485' (Group V); 'Coker 686' (Group VI); 'Coker 627',

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TABLE 1. Galling and yield of soybean cultivars and breeding lines grown in *Meloidogyne incognita*-infested soil.

Entry	1984		1985		1986		3-year average	
	Galling	Yield (kg/ha)	Galling	Yield (kg/ha)	Galling	Yield (kg/ha)	Galling	Yield (kg/ha)
Maturity Group V								
Bedford	0.2 de	2,311 a	1.6 c–e	839 a–d	1.9 e–k	1,955 b–f	1.2	1,701
Coker 485			0.3 gh	1,312 ab	1.3 h–k	2,178 a–d		
DP 675					4.0 a	1,132 hi		
Hartz 5370	0.7 b–e	2,494 a	1.8 b–e	1,036 a–c	2.1 d–j	1,955 b–f	1.5	1,828
Maturity Group VI								
Centennial	0.1 e	2,358 a	0.3 gh	1,311 ab	1.2 i–k	2,573 ab	0.5	2,080
Coker 686	0.6 c–e	2,467 a	2.2 bc	1,016 a–c	3.1 a–e	1,766 d–f	1.9	1,749
DP 506					4.0 a	103 l		
DP 566	0.7 b–e	2,247 a			3.5 a–c	703 i–k		
GA 79-402					1.4 g–k	1,818 c–f		
Hartz 6130			1.6 c–e	1,036 a–c	2.3 c–l	2,195 a–d		
Hartz 6383R					1.6 f–k	2,470 ab		
Hartz X6385					2.0 d–j	2,332 a–d		
Jeff	0.2 de	2,367 a	0.3 gh	882 a–d	2.1 d–j	2,195 a–d	0.9	1,814
Leflore					2.8 b–f	2,453 a–c		
RA 606					3.8 ab	1,406 f–h		
RA 680	0.2 de	2,660 a	0.3 gh	1,221 a–c	0.9 jk	2,607 a	0.5	2,162
S69-96	1.3 b	2,565 a	3.6 a	371 de	3.4 a–c	532 j–l	2.8	1,156
Maturity Group VII								
A7372	0.5 de	2,035 a	2.0 b–d	777 b–d				
Braxton	0.3 de	2,523 a	1.4 c–f	1,424 ab	1.5 f–k	1,732 d–g	1.1	1,893
Coker 627	0.0 e	2,555 a	0.6 f–h	1,384 ab	2.0 d–j	2,041 a–e	0.2	1,993
Coker 6727			1.1 d–g	1,197 a–c	2.1 d–j	2,367 a–d		
Coker 82-606					1.7 f–k	2,470 ab		
DP 417					1.8 e–k	2,281 a–d		
DP 497					3.2 a–d	1,029 h–j		
Gordon	0.1 e	2,524 a	0.6 f–h	1,170 a–c	0.8 k	2,538 ab	0.5	2,077
Hartz 7110					1.4 g–k	2,230 a–d		
Hartz 7126	3.5 a	2,127 a	3.9 a	160 e	3.7 ab	1,115 hi	3.7	1,134
Terra-Vig 708	0.8 b–d	2,530 a	3.7 a	907 a–d				
Wright	1.2 bc	2,564 a	1.9 b–d	936 a–d	2.8 b–f	2,092 a–e	2.0	1,864
Maturity Group VIII								
Cobb	0.3 de	2,250 a	1.8 b–e	1,250 a–c	2.6 b–g	1,527 e–h	1.6	1,675
Coker 368	0.0 e	2,469 a	0.9 e–h	1,320 ab	2.6 b–g	2,075 a–e	1.2	1,954
Coker 488	0.1 e	2,401 a	2.6 b	605 c–e	2.6 b–g	1,167 g–i	1.8	1,391
Coker 6738			1.4 c–f	1,234 a–c	1.4 g–k	2,109 a–e		
F77-7446	1.2 b	2,087 a						
Foster			0.6 f–h	1,017 a–c				
Hartz 8112					4.0 a	309 kl		
Hutton	0.0 e	1,887 a						
Kirby	0.0 e	2,296 a	0.1 h	1,490 a	1.2 i–k	2,195 a–d	0.4	1,993
RA 801	0.1 e	2,528 a	1.6 c–e	851 a–d				
Terra-Vig 808	3.8 a	1,981 a						

Data are averages of four observations. Averages followed by the same letter within a column are not significantly ($P < 0.05$) different according to Duncan's multiple-range test.

Galling rated on a scale of 0 = no galling, 0.2 = < 5%, 1 = 5–25%, 2 = 26–50%, 3 = 51–75%, and 4 = > 75% root surface galled.

'Coker 6727', and Coker 82-606 (Group VII); 'Coker 368', 'Coker 488', and 'Coker 6738' (Group VIII). Delta and Pine Land Co., Wilson, North Carolina: 'DP 675' (Group V); 'DP 506' and 'DP 566' (Group VI); 'DP 417' and 'DP 497' (Group VII). Jacob Hartz Seed Co., Stuttgart, Arkansas: 'Hartz 5370' (Group V); 'Hartz 6130',

Hartz 6383R, and Hartz X6385 (Group VI); 'Hartz 7110' and 'Hartz 7126' (Group VII); 'Hartz 8112' (Group VIII). Northrup King Co., Dallas, Texas: 'S69-96' (Group VI). Rohm and Haas Seeds, Inc., Philadelphia, Pennsylvania: 'RA 606' and 'RA 680' (Group VI); RA X223 (Group VII); 'RA 801' (Group VIII). Terral-Norris Seed Co., Inc., Lake Providence, Louisiana: 'Terra-Vig 708' (Group VII); 'Terra-Vig 808' (Group VIII).

Plots were cultivated and hand weeded when necessary. Root-knot galling in each plot was scored on 19 September 1984, 10 September 1985, and 25 August 1986 when plants had at least 12 or 13 nodes on their main stems (1). Two groups of four plants were rated according to the following scale: 0 = no galling; 0.2 = < 5%, 1 = 5–25%, 2 = 26–50%, 3 = 51–75%, and 4 = > 75% of the root surface galled. The middle row of each plot was harvested at crop maturity on 6 November 1984, 25 November 1985, and 10 November 1986. Yields were adjusted to 13% moisture content. Galling and yield data were subjected to analysis of variance procedures and means separated ($P < 0.05$) by Duncan's multiple-range test.

Results and Discussion

The amount of root-knot galling suffered by individual cultivars planted each year tended to increase over the 3-year period of investigation (Table 1). Differences ($P < 0.05$) in galling among cultivars were greater in 1984 and 1986 than in 1985. Weather conditions during the 1984 and 1986 season were optimal for soybean production in Florida. In 1985, however, excessive rainfall from tropical depressions and inadequate solar radiation during flowering and podset were not suitable for adequate yields throughout the production area. Yield differences ($P < 0.05$) among cultivars were found in 1985 and 1986 but not in the first year of experimentation at the site. There was a significant ($P < 0.01$) relationship between the average yield (Y) of the 16 cultivars that were planted each year and their amount of galling (X): $Y = 2{,}211 - 308X$, $r = -0.9$.

In the tests reported here and from previous tests of similar design (5), Kirby has been consistently among the least galled and among the highest yielding entries in 6 years of testing. Using data from this cultivar as criteria for comparison, other cultivars, which for at least 3 of the 6 years of testing (1981–86) have had galling not significantly greater than Kirby and yields not significantly less, may be recommended for production in sites infested with *M. incognita*. These are group V—Bedford; group VI—Centennial, Jeff, and RA 680; group VII—Bragg, Braxton, Coker 627, and Gordon; group VIII—Cobb, Coker 368, Foster, Hutton, and Kirby.

With these 13 cultivars from four maturity groups currently available for production in *M. incognita*-infested sites, management of *M. incognita* in southeastern soybean production is achievable, especially with timely rotation (4) with less susceptible hosts for this nematode where infestations are severe.

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