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Resistance in Soybean Cultivars from Maturity Groups V–VIII to Soybean Cyst and Root-knot Nematodes[1]

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Abstract: One hundred thirty-nine cultivars of soybean (*Glycine max*) in Maturity Groups V, VI, VII, and VIII were evaluated in a greenhouse for resistance to *Heterodera glycines* races 3 and 14 and *Meloidogyne incognita, M. arenaria,* and *M. javanica.* Of the cultivars tested, 37% had resistance to *H. glycines* race 3 alone, 12% had resistance to both races 3 and 14, and 69% exhibited a moderate or high level of resistance to one or more of the *Meloidogyne* spp. However, 24% were susceptible to each race of *H. glycines* and to all *Meloidogyne* spp. Whereas 40% of the cultivars were moderately resistant to *M. javanica,* only 23% were moderately resistant to *M. incognita* and 24% to *M. arenaria.* Although 28% of the cultivars had a high level of resistance to *M. incognita,* only 6 and 3% had this level of resistance to *M. javanica* and *M. arenaria,* respectively. Seventeen percent of the cultivars possessed a moderate or high level of resistance to all three *Meloidogyne* spp., and 37% had resistance to *H. glycines* race 3 and *M. incognita.* With the exception of resistance to *H. glycines* race 14, resistance in soybean to these nematodes was fairly uniformly distributed across maturity groups.

Key words: Heterodera glycines, Glycine max, Meloidogyne incognita, Meloidogyne arenaria, Meloidogyne javanica, nematode resistance, soybean, susceptibility.

Foremost in the arsenal growers have for limiting yield losses to sedentary endoparasitic nematodes is the use of resistant cultivars. Indeed, this is the most effective, economical, and environmentally sound management strategy for limiting yield losses of soybean (*Glycine max* (L.) Merr.) by the soybean cyst nematode (*Heterodera glycines* Ichinohe) and root-knot nematodes (*Meloidogyne* spp.) in the southern United States. Thus, it is important to identify the soybean cultivars grown in this region that have resistance to these nematodes.

The number of soybean cultivars in Maturity Groups V, VI, VII, and VIII released during the past few years has increased greatly. Many of these cultivars possess genes for resistance to *H. glycines* (primarily race 3 and some to race 3 and races suppressed by resistance genes from PI 88788) and one or more of three *Meloidogyne* spp. that are economically important on soybean in the southern United States: *M. incognita* (Kofoid & White) Chitwood, *M. arenaria* (Neal) Chitwood, and *M. javanica* (Treub) Chitwood. However, limited information is available on the resistance of most of these cultivars to *H. glycines* and *Meloidogyne* spp. under uniform test conditions.

During 1983–89, we evaluated 139 soybean cultivars for resistance to *H. glycines,* races 3 and 14, and to *M. incognita, M. arenaria,* and *M. javanica* in greenhouse tests. This report presents information on nematode resistance of cultivars that were tested in 2 or more years.

Materials and Methods

Thirty-seven publicly and 102 privately developed soybean cultivars in Maturity Groups V (38 cultivars), VI (47 cultivars), VII (41 cultivars), and VIII (13 cultivars) were evaluated for resistance to *H. glycines* races 3 and 14, *M. incognita* (race 3), *M. arenaria* (race 2), and *M. javanica.* Cultivars tested were all the cultivars being considered for recommendation to Georgia soybean growers by the University of Georgia Cooperative Extension Service during 1983–89. Selected cultivars were consid-

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ered as standards and evaluated each year to develop a cyst or gall rating scheme. For *H. glycines,* plants were assigned a rating of "susceptible" (generally ≥ 11 white females or cysts per plant) or "resistant" (generally ≤ 10 white females or cysts) on the basis of number of white females or cysts relative to the standard resistant cultivars. The resistant and susceptible standards were Centennial and Lee for race 3 and Leflore and Centennial for race 14, respectively. For each *Meloidogyne* species, the number of galls on the resistant and susceptible standards (5) was used to develop a gall index of 1 (< 10 galls per plant) to 5 (> 90 galls) (3). Each cultivar was evaluated a minimum of 2 years in a randomized complete block experimental design with four replications. Plants were grown with supplemental light provided by 400-W metal halide lamps (Multivapor, Westinghouse Electric Corp., Bloomfield, NJ) and fertilized weekly with 6 mg N, 3 mg P, and 5 mg K.

To evaluate resistance to *H. glycines,* five seeds of each cultivar were planted in 420-ml styrofoam cups filled with soil naturally infested with either race 3 or race 14 (7). The soil infested with race 3 (cyst index: Peking, 0; Pickett, 1; PI 88788, 0; PI 90763, 0) was a Cecil coarse sandy loam (72% sand, 12% silt, 16% clay; a member of the clayey, kaolinitic, thermic family of Typic Hapludults) collected from the Plant Sciences Farm near Athens, Georgia. The soil infested with race 14 (cyst index: Peking, 37; Pickett, 76; PI 88788, 1; PI 90763, 11) was a Dothan sandy loam (85% sand, 12% silt, 3% clay; a member of the fine-loamy, siliceous, thermic family of Plinthic Paleudults) collected near Waynesboro, Georgia. One week after planting, seedlings were thinned to one per cup and watered as needed. After 30–40 days, when white females and cysts had developed on susceptible standard cultivars, the soil was gently shaken from each root system, white females and cysts were enumerated under a magnifying lamp, and a resistant or susceptible rating was assigned. If the plants tested for a cultivar varied with resistant and susceptible reactions, the cultivar reaction was recorded as mixed.

Cultivars were evaluated for resistance to each *Meloidogyne* species in polystyrene Todd Planter Flats (Model 150-5; Speedling, Sun City, FL) according to procedures previously described (4). Every other row in each flat was filled with methyl bromide-fumigated Pacolet sandy loam soil (a member of the clayey, kaolinitic, thermic family of Typic Hapludults) amended with sand to a texture of 80% sand, 12% silt, and 8% clay. Seven to ten days after planting, each seedling was inoculated with 2,000 eggs of *M. incognita, M. arenaria,* or *M. javanica* collected from tomato (*Lycopersicon esculentum* Mill. cv. Rutgers) with 0.5% NaOCl as described by Hussey and Barker (2). The *M. incognita* population was established by combining three populations selected for their aggressiveness on soybean (3), and populations of *M. arenaria* and *M. javanica* were provided by S. A. Lewis (Clemson University, Clemson, SC) and R. A. Kinloch (University of Florida, Jay, FL), respectively. When galls developed on the susceptible standard cultivars, ca. 20–40 days after inoculation, soil was washed from each root system and a rating of galling severity was assigned.

Data for the 7 years were examined for common cultivars across data sets. There was an obvious commonality among three groups of cultivars which were tested in successive years (Tables 1–3). Within each group of cultivars the data were combined over years. The statistical model assumed replication and year as random effects and cultivar as a fixed effect. Protected least significant differences (LSD) at $P = 0.05$ were calculated for cultivar comparisons.

Results and Discussion

Resistance to *H. glycines* was based on white female and cyst development relative to standard cultivars and is presented as discrete categories (Tables 1–3). Root-knot nematode resistance was based on a gall index which is presented as a continuous variable from 1 to 5. A gall index of ≤ 1.5 indicated a high level of root-knot resis-

TABLE 1. Reaction of soybean cultivars to *Heterodera glycines* (SCN), races 3 and 14, and *Meloidogyne incognita* (Mi), *M. arenaria* (Ma), and *M. javanica* (Mj), tested 1983–85.

Company or brand name	Cultivar	Maturity group	Reaction to SCN†		Gall index‡			No. of tests
			Race 3	Race 14	Mi	Ma	Mj	
			Test cultivars					
AgraTech	GK 67	VI	S	S	1.7	4.1	3.1	3
AgraTech	GK 120	VII	S	S	1.3	2.9	2.0	3
Asgrow	A5474	V	R	R	4.9	3.4	2.4	3
Asgrow	A5980	V	R	M	5.0	3.1	2.4	2
Asgrow	A6242	VI	R	R	4.9	3.4	2.9	2
Asgrow	A6381	VI	S	S	4.7	2.5	2.4	2
Asgrow	A6520	VI	R	R	4.9	2.4	1.7	3
Asgrow	A7372	VII	S	S	1.8	2.8	2.4	3
Deltapine	105	V	S	S	3.4	3.8	3.6	3
Deltapine	345	V	S	S	4.8	2.7	2.4	3
Deltapine	246	VI	S	S	4.5	2.7	2.1	2
Deltapine	506	VI	S	S	4.9	3.0	2.8	3
Deltapine	566	VI	S	S	4.0	3.6	4.0	2
Deltapine	471	VII	S	S	1.3	2.8	2.3	3
Deltapine	497	VII	S	S	4.0	4.6	3.8	3
Hartz	5171	V	R	S	4.7	2.3	1.5	3
Hartz	5252	V	R	S	2.3	2.7	2.8	3
Hartz	5370	V	R	S	1.5	2.4	1.9	3
Hartz	6130	VI	R	R	1.4	2.2	1.8	2
Hartz	7110	VII	R	S	1.6	2.0	1.6	2
Hartz	7126	VII	R	S	4.4	2.7	2.2	2
Hartz	8112	VIII	S	S	4.0	3.0	2.4	2
HyPerformer	Shiloh	V	S	M	3.3	4.0	3.9	2
HyPerformer	Wilstar 550	V	S	S	4.6	2.9	1.8	3
HyPerformer	Sumter	VI	R	S	1.9	3.5	2.7	3
HyPerformer	Spartan	VII	S	S	3.5	4.5	4.2	2
HyPerformer	Wilstar 790	VII	S	S	4.9	3.0	1.8	3
Northrup King	Coker 425	V	S	S	3.7	4.7	3.1	2
Northrup King	Coker 485	V	R	S	1.0	3.6	3.2	2
Northrup King	Coker 156	VI	S	S	3.6	3.1	2.3	2
Northrup King	RA 604	VI	R	S	1.3	2.3	2.0	3
Northrup King	RA 680	VI	R	S	1.0	3.3	2.4	3
Northrup King	S 69-54	VI	R	S	3.4	2.4	3.0	2
Northrup King	S 69-96	VI	S	S	4.7	3.5	3.0	3
Northrup King	Coker 237	VII	S	S	3.8	3.2	2.9	2
Northrup King	Coker 317	VII	R	S	4.7	3.4	2.2	2
Northrup King	RA 702	VII	R	S	1.5	3.3	3.3	2
Northrup King	6727	VII	R	S	1.5	3.4	1.8	2
Northrup King	McNair 700	VII	S	S	4.2	3.7	2.9	3
Northrup King	McNair 770	VII	R	S	3.9	3.9	2.8	3
Northrup King	S 72-60	VII	S	S	4.4	3.4	2.5	3
Northrup King	Coker 368	VIII	R	S	1.5	3.9	3.2	3
Northrup King	Coker 488	VIII	S	S	3.9	4.0	3.3	3
Northrup King	6738	VIII	R	S	1.0	2.0	1.6	2
Pioneer variety	5482	V	S	S	4.3	2.1	1.7	2
Pioneer variety	9561	V	R	S	1.6	2.6	1.5	2
Pioneer variety	9571	V	R	R	1.9	2.5	2.7	2
Public variety	Bedford	V	R	R	1.6	1.8	1.8	3
Public variety	Celest	V	S	S	1.5	1.7	2.5	2
Public variety	Cobb	VIII	S	S	1.3	3.9	2.1	3
Public variety	Dare	V	S	S	3.1	1.8	2.9	2
Public variety	Davis	VI	S	S	4.3	3.5	3.2	3
Public variety	Dowling	VIII	S	S	3.1	4.2	2.9	3
Public variety	Duocrop	VII	S	S	4.9	2.8	2.8	3
Public variety	Essex	V	S	S	3.9	3.4	2.5	3
Public variety	Forrest	V	R	S	1.7	2.7	2.0	2

TABLE 1. Continued

Company or brand name	Cultivar	Maturity group	Reaction to SCN†		Gall index‡			No. of tests
			Race 3	Race 14	Mi	Ma	Mj	
Public variety	Foster	VIII	R	S	1.2	3.9	2.3	3
Public variety	Jeff	VI	R	R	1.4	3.4	2.1	3
Public variety	Johnston	VIII	S	S	3.5	4.2	3.1	3
Public variety	Kershaw	VI	S	S	4.0	3.9	4.0	3
Public variety	Mack	V	R	S	4.3	2.5	2.4	2
Public variety	Ransom	VII	S	S	4.1	3.8	2.6	3
Public variety	Thomas	VII	R	S	1.7	3.4	3.4	2
Public variety	Twiggs	VI	R	S	1.2	2.9	1.6	2
Public variety	Wright	VII	S	S	1.9	2.5	2.1	3
Public variety	Young	VI	S	S	4.3	4.6	3.4	2
Terra-Vig	515	V	R	S	1.0	4.4	3.2	2
Terra-Vig	553	V	S	S	1.9	3.9	3.5	2
Terra-Vig	808	VIII	R	S	4.7	2.0	3.0	2
			Standard cultivars					
Public variety	Braxton	VII	S	S	1.5	1.6	1.2	3
Public variety	Centennial	VI	R	S	1.1	3.4	1.9	3
Public variety	GaSoy 17	VII	S	S	4.1	3.3	3.1	3
Public variety	Gordon	VII	R	S	1.4	2.1	1.6	3
Public variety	Kirby	VIII	R	S	1.4	2.9	1.3	3
Public variety	Leflore	VI	R	R	1.5	3.8	2.3	2
Public variety	Tracy M	VI	S	S	4.3	4.3	3.6	3
LSD ($P = 0.05$) for comparing cultivars in two tests					1.2	1.5	1.4	
LSD ($P = 0.05$) for comparing cultivars in two and three tests.					1.1	1.4	1.2	
LSD ($P = 0.05$) for comparing cultivars in three tests					1.0	1.2	1.1	

† S = susceptible, R = resistant, M = mixed.
‡ Gall index = 0 (zero galls) to 5 (many galls).

tance, an index of ≥ 1.6 to ≤ 2.5 was considered to indicate a moderate level of root-knot resistance, and a cultivar with a gall index of ≥ 2.6 was considered susceptible. None of the cultivars were considered to be highly resistant and equivalent in root-knot resistance to the plant introductions recently identified in the Southern Soybean Germplasm Collection (1,4). In summarizing the data for all cultivars, gall indices for the standard cultivars were averaged over the three groups of tests (Tables 1–3).

Various combinations of resistance to the two races of *H. glycines* and three species of *Meloidogyne* occurred in the cultivars. However, 24% of the cultivars were susceptible to all of the nematodes (Fig. 1). Sixty-nine percent of the cultivars possessed a moderate or high level of resistance to one or more of the *Meloidogyne* species. Whereas 37% were resistant to *H. glycines* race 3 alone, only 12% of the cultivars were resistant to races 3 and 14 (Fig. 1). All cultivars resistant to race 14 were also resistant to race 3 (Table 1–3). Eighty-two percent of the race 14 resistant cultivars were in Maturity Groups V and VI. Development of additional cultivars in Maturity Groups VII and VIII with *H. glycines* race 14 resistance will be warranted as the

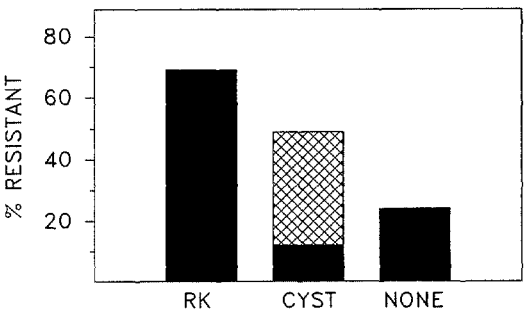

FIG. 1. Percentage of 139 soybean cultivars with a moderate or high level of resistance to either *Meloidogyne incognita, M. arenaria,* and (or) *M. javanica* (RK), resistance to *Heterodera glycines* (cyst) race 3 (▩), or races 3 and 14 (■), or susceptible (NONE) to all of these nematodes.

TABLE 2. Reaction of soybean cultivars to *Heterodera glycines* (SCN), races 3 and 14, and *Meloidogyne incognita* (Mi), *M. arenaria* (Ma), and *M. javanica* (Mj), tested 1985–87.

Company or brand name	Cultivar	Maturity group	Reaction to SCN†		Gall index‡			No. of tests
			Race 3	Race 14	Mi	Ma	Mj	
			Test cultivars					
Asgrow	A6785	VI	S	S	1.9	2.7	1.8	2
Asgrow	A7986	VII	S	S	3.5	2.8	3.4	2
Deltapine	415	V	R	S	2.5	3.0	3.1	2
Deltapine	726	VI	R	S	3.5	4.5	4.2	2
Hartz	5164	V	R	R	1.5	2.3	2.1	2
Hartz	6200	VI	R	S	2.8	3.6	3.3	2
Hartz	6372	VI	R	S	1.1	1.7	1.8	2
Hartz	6385	VI	R	S	1.8	2.6	1.5	2
HyPerformer	Sampson	VI	S	S	4.2	3.6	3.7	2
HyPerformer	Sanalona	VI	S	S	3.4	4.7	4.1	2
HyPerformer	Starr	VII	S	M	1.5	2.9	2.0	2
Northrup King	Coker 686	VI	R	S	1.7	2.7	1.7	2
Northrup King	RA 606	VI	R	M	1.6	3.4	2.9	2
Northrup King	Coker 6847	VII	R	S	1.5	2.0	3.9	2
Pioneer variety	9581	V	R	R	1.1	2.4	2.1	2
Pioneer variety	9591	V	S	S	3.9	3.4	4.5	2
Pioneer variety	9691	VI	R	S	1.8	2.4	3.0	2
Pioneer variety	9791	VII	S	S	3.2	2.7	4.0	2
Public variety	Bryan	VI	R	S	2.0	1.4	1.6	2
Public variety	Colquitt	VII	S	S	2.1	2.3	1.4	2
Public variety	Sharkey	VI	R	S	3.4	3.0	3.4	2
Public variety	TN 5-85	V	R	S	4.5	2.7	3.7	2
Riverside	RVS 503	V	S	S	4.0	1.2	3.3	2
Riverside	RVS 577	V	R	S	1.4	2.0	1.9	2
Riverside	RVS 593	V	R	S	1.8	2.7	3.0	2
Riverside	RVS 613	VI	R	S	3.5	2.3	2.6	2
Riverside	RVS 696	VI	R	S	1.1	3.6	3.8	2
Riverside	RVS 707	VII	R	R	2.3	2.6	1.9	2
Riverside	RVS 757	VII	R	M	2.0	1.6	2.4	2
Terra-Vig	616	VI	M	S	4.7	4.7	4.3	3
Terra-Vig	717	VII	M	S	4.7	4.4	3.3	3
			Standard cultivars					
Public variety	Bossier	VII	S	S	4.4	1.2	2.9	2
Public variety	Braxton	VII	S	S	1.0	2.4	1.7	1
Public variety	CNS	VII	S	S	5.0	4.9	4.5	1
Public variety	Centennial	VI	R	S	1.2	2.5	3.7	2
Public variety	GaSoy 17	VII	S	S	3.8	2.9	3.7	2
Public variety	Gordon	VII	R	S	1.5	1.5	1.5	2
Public variety	Jackson	VII	S	S	1.7	1.4	1.2	1
Public variety	Kirby	VIII	R	S	1.5	1.8	1.9	2
Public variety	Leflore	VI	R	R	1.0	3.3	3.5	1
Public variety	Tracy M	VI	S	S	5.0	3.7	4.3	1
LSD ($P = 0.05$) for comparing cultivars in two tests					1.1	1.4	1.1	
LSD ($P = 0.05$) for comparing cultivars in two and three tests					1.0	1.3	1.0	
LSD ($P = 0.05$) for comparing cultivars in three tests					1.0	1.1	1.0	

† S = susceptible, R = resistant, M = mixed.
‡ Gall index = 0 (zero galls) to 5 (many galls).

frequency of this race increases in the southern United States.

Root-knot resistance varied considerably among the cultivars. Whereas 40% of the cultivars had a moderate level of resistance to *M. javanica*, only 24% and 23% were moderately resistant to *M. arenaria* and *M. incognita*, respectively (Fig. 2). The greatest number (28%) of cultivars with a high level of root-knot resistance were re-

TABLE 3. Reaction of soybean cultivars to *Heterodera glycines* (SCN), races 3 and 14, and *Meloidogyne incognita* (Mi), *M. arenaria* (Ma), and *M. javanica* (Mj), tested 1987–89.

Company or brand name	Cultivar	Maturity group	Reaction to SCN†		Gall index‡			No. of tests
			Race 3	Race 14	Mi	Ma	Mj	
			Test cultivars					
AgraTech	AT575	V	S	S	4.8	4.4	4.0	2
AgraTech	AT700	VII	S	S	1.7	2.9	2.6	2
Deltapine	878	VIII	S	S	4.5	4.2	4.2	4
Statesville	FFR606	VI	R	R	2.0	3.3	2.7	2
Statesville	FFR646	VI	R	R	1.5	4.6	3.5	2
Statesville	FFR695	VI	S	S	2.2	4.0	2.8	2
Statesville	FFR36259	VII	S	S	4.0	4.0	5.0	2
Hartz	H5240	V	R	S	1.5	2.9	2.7	2
Hartz	6686	VI	S	S	2.3	4.5	2.2	2
Hartz	H6570	VI	R	R	1.4	3.5	3.3	2
Hartz	H7190	VII	S	S	3.6	2.5	1.7	3
Hartz	H7585	VII	S	S	4.1	4.3	2.5	2
HyPerformer	HSC 579	V	S	S	4.9	3.0	3.3	3
HyPerformer	Shenandoah	V	S	S	4.7	4.1	2.8	2
HyPerformer	HSC B2J	VI	R	S	1.6	2.3	1.8	3
HyPerformer	HSC Baldwin	VI	R	S	1.5	1.2	2.5	2
HyPerformer	HSC 721	VII	R	R	2.0	3.8	3.3	2
Northrup King	6955	V	R	S	4.6	4.0	2.8	2
Northrup King	6995	V	R	R	1.4	2.1	2.3	2
Northrup King	S 74-40	VII	S	S	1.7	3.5	3.0	2
Northrup King	S 83-30	VIII	R	S	1.5	3.5	2.5	2
Pioneer variety	9641	VI	S	S	3.0	3.9	2.8	2
Pioneer variety	9751	VII	R	S	1.1	3.4	1.7	2
Public variety	Avery	V	R	R	1.9	3.5	4.1	2
Public variety	Hutcheson	V	S	S	4.5	3.4	4.2	3
Public variety	Lamar	VI	S	S	1.3	4.3	1.6	2
Public variety	Perrin	VIII	S	S	1.3	1.2	1.0	2
Riverside	RVS 699	VI	S	S	1.5	3.3	3.0	2
Terra-Vig	708	VII	S	S	3.7	4.0	3.8	2
			Standard cultivars					
Public variety	Bossier	VII	S	S	4.6	3.4	2.1	2
Public variety	Braxton	VII	S	S	1.0	1.5	1.7	2
Public variety	CNS	VII	S	S	4.5	4.1	3.8	2
Public variety	Centennial	VI	R	S	1.7	4.0	3.7	2
Public variety	GaSoy 17	VII	S	S	4.3	4.1	4.0	2
Public variety	Gordon	VII	R	S	1.2	1.7	1.3	2
Public variety	Jackson	VII	S	S	2.0	3.0	1.4	2
Public variety	Kirby	VIII	R	S	1.3	2.3	1.7	2
Public variety	Leflore	VI	R	R	1.7	3.9	2.9	2
Public variety	Tracy M	VI	S	S	4.1	3.9	3.0	2
LSD ($P = 0.05$) for comparing cultivars in two tests					1.2	1.2	1.5	
LSD ($P = 0.05$) for comparing cultivars in two and three tests					1.0	1.1	1.4	
LSD ($P = 0.05$) for comparing cultivars in three tests					1.0	1.0	1.3	

† S = susceptible, R = resistant.
‡ Gall index = 0 (zero galls) to 5 (many galls).

sistant to *M. incognita* (Fig. 2). On the other hand, few of the cultivars had a similar level of resistance to *M. arenaria* (3%) or to *M. javanica* (6%). Overall, 51, 46, and 27% of the cultivars had a moderate or high level of resistance to *M. incognita*, *M. javanica*, and *M. arenaria*, respectively. Previous studies (3) indicated that the response of cultivars to *M. incognita* in a greenhouse provided a reliable indication of soybean reaction of this nematode under field conditions.

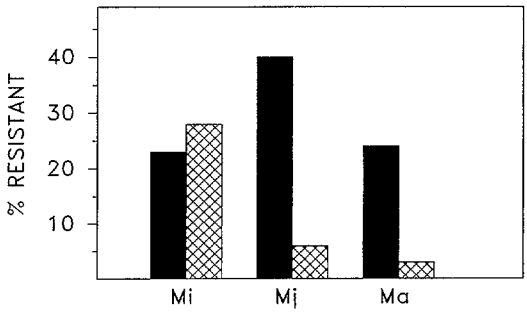

FIG. 2. Percentage of 139 soybean cultivars with a moderate (■) or high (▩) level of resistance to *Meloidogyne incognita* race 3 (Mi), *M. javanica* (Mj), or *M. arenaria* race 2 (Ma).

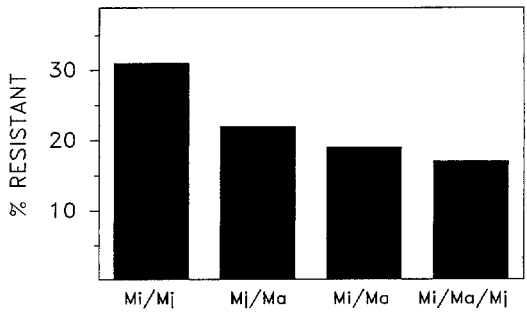

FIG. 3. Percentage of 139 soybean cultivars with a moderate or high level of resistance to two or more *Meloidogyne* species. Mi = *M. incognita*, Ma = *M. arenaria*, Mj = *M. javanica*.

Many of the cultivars were resistant to more than one of the nematode species. Thirty-seven percent of the cultivars were resistant to *H. glycines* race 3 and had a moderate or high level of resistance to *M. incognita*. Of the cultivars tested, 19, 31, and 22% had a moderate or high level of resistance to *M. incognita* and *M. arenaria*, to *M. incognita* and *M. javanica*, and to *M. javanica* and *M. arenaria*, respectively (Fig. 3). However, only 23 cultivars (17%) possessed a moderate or high level of resistance to all three *Meloidogyne* species. Of these, six cultivars were also resistant to *H. glycines* races 3 and 14. Perrin was the only cultivar with a high level of resistance to all three *Meloidogyne* species, but susceptible to both races of *H. glycines* (Table 3).

Comparison of responses of soybean cultivars to *M. incognita* from another study (6) with responses obtained in our studies revealed inconsistencies. Some cultivars rated resistant to *M. incognita* in the former study were susceptible in our tests. For example, Coker 156 was rated 1.6 and Coker 317 was rated 2.3 in the earlier study, whereas these cultivars were rated 3.6 and 4.7, respectively, in our study. These inconsistencies could be due to differences in the aggressiveness of the *M. incognita* populations used. The population used in our study is extremely aggressive on soybean (1,3,8). Nonetheless, ratings across experiments could be compared if data were standardized by establishing rating schemes using standard cultivars (3).

The data presented in this report provides for the first time information on the resistance of cultivars to the four most important nematode parasites of soybean in the southern United States evaluated under uniform test conditions. This independent assessment of resistance will be helpful in selection of cultivars for growing in fields infested with these nematodes and selection of parents for the development of cultivars resistant to multiple nematode species. This study also underscores the need in Maturity Groups VII and VIII for additional soybean cultivars highly resistant to specific nematodes (e.g., *M. arenaria* and *H. glycines* races (7) to which resistance genes from PI 88788 are effective), if these nematodes are going to be managed effectively in the southern United States in the future.

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