MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Information

Agronomy Facts No. 43
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2004 CYST NEMATODE- RESISTANT SOYBEAN VARIETY TEST

Soybean cyst nematode (*Heterodera glycines*) was found in Maryland for the first time in 1980. Since the first discovery, damaging levels of cyst nematodes have been identified in most Eastern Shore counties and in two counties west of the Chesapeake Bay. Typical aboveground soybean plant symptoms are stunting, yellowing, and wilting under moisture stress. These symptoms usually appear on scattered patches of plants in infested fields.

The selection and use of resistant soybean varieties is one of the best production practices available to reduce yield losses due to nematodes. Most resistant varieties are not immune to attack by all cyst nematodes because the plant's resistance is specific for individual cyst nematode races. Infested fields may contain a mixture of cyst nematode races. A resistant variety planted in these fields must carry resistance to the most prevalent race of cyst nematode in the field to produce satisfactory yields. However, continuous production of a variety resistant to the same races could shift the prevalence of races in that field to ones that can infect the resistant variety. Therefore, it is best to rotate nonhost crops such as corn or sorghum with resistant soybean varieties in cyst-infested fields.

A variety test was established in 2004 by the Maryland Agricultural Experiment Station, Department of Natural Resource Sciences and Landscape Architecture, to provide soybean growers with the latest information on agronomic performance of varieties with resistance to cyst nematodes. Entries in the test included public and private brands, varieties, and experimental lines that have resistance to various races of cyst nematodes. The susceptible varieties Chesapeake, Hutcheson, Stressland, and Williams 82 were used as control plots. Several Maryland experimental lines were also evaluated in the tests. These lines were MD 96-5275, MD 96-5502, MD 97-6065, MD 98-5927, MD 99-5144, MD 99-5720, MD 99-0687-3RR, MD 99-1353-2RR, MD 00-5020, and MD 00-5159.

A list of the released entries in the 2004 test, their respective maturity group designation, the races of cyst nematodes to which each has resistance, and the suppliers of the private entries who paid a fee for testing are listed in Table 1. Since cyst-infested fields can also contain other nematode species, a rating for resistance to root-knot nematode (*Meloidogyne incognita*) is also given in Table 1 if the supplier provided this information.

Two tests were planted near Salisbury, MD in Wicomico County. One test was located at the Pemberton Historical Park in a field that is primarily infested with cyst nematode races 1 and 5. The other test was located at the Lower Eastern Shore Research and Education Center, Salisbury Facility in a field that is infested with a mixture of races 1, 3, and 5. Even though the initial number of cysts in the soil in the test sites was relatively low at planting, the nematode population can build quickly to damaging levels.

The entries were divided into their designated maturity groups so that entries within a test would be of similar maturity. Each entry was evaluated in a four-row plot, 11 feet in length, replicated three times. Row spacing was 30 inches and the seeding rate was 8 seeds/foot. Recommended cultural practices were followed in establishing and maintaining the plots (Table 2). Yield data were determined by harvesting an 8-foot section from the center rows of each plot. Plant height was determined at maturity when 95% of the pods on each entry had attained their mature color. The total number of full cysts on four plants from each plot was determined at each site approximately 30-35 days after planting.

All data were statistically analyzed. A least significant difference (LSD) value was calculated for each characteristic. This number is a statistical test calculated at the 20% probability level to aid in comparing the differences among entries. When two entries are compared and the difference between them is greater than the calculated LSD value, the entries are judged to be statistically different. This means that there is an 80% probability that the differences observed in the test are real and not due to chance. A designation of “NS” indicates that there are no statistically significant differences among the entries in the test for that characteristic.

In general, the 2004 growing season was very good across the state. Rainfall was adequate and distributed throughout the season in most areas of the state. Monthly rainfall amounts for May through October are shown in Table 3. At these test locations, however, monthly rainfall was below average for the months of May, June, and September. Irrigation equipment is available at the Salisbury Facility and three one-inch applications of water were added during July as shown in Table 3.

Seed yields are shown in Tables 4-5. The yields of the susceptible varieties Chesapeake, Hutcheson, Stressland, and Williams 82 were usually below the maturity group mean in the tests. Note the number of cysts found on the susceptible varieties. Varieties are usually classified as resistant if they have less than 10% of the number of cysts found on susceptible varieties.

Although all of the entries in the test except the susceptible varieties carry some resistance to cyst nematodes, it is evident that entries differ in their level of resistance. These test results also illustrate the importance of growing varieties that carry resistance to the race of nematodes present in specific infested fields. Cyst nematode races 1 and 3 are the most frequently observed races in Maryland. Soybean growers must determine the race of cyst nematode that is present in their infested fields so that they can select an appropriate soybean variety. Frequently growers do not know the race of cyst nematode in their fields and they plant a variety with resistance to race 3 because these varieties are the most widely available. Growers who have planted cyst nematode-resistant varieties but have observed damage on the variety should check with their county extension office for assistance in determining the race present in their infested fields.

The performance of a variety for several years gives the best measure of its yield potential and agronomic characteristics. The average yields of those varieties grown for two years at each location can be determined from data in Tables 4-5.The information provided here should be used as a guide and growers should select a variety with great care based on personal experience as well as other available information.

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Additional information:

Inclusion of entries in the Cyst Nematode-Resistant Soybean Variety Test does not constitute an endorsement or recommendation of a specific entry by the University of Maryland. Advertising statements by an individual company about the performance of its entries can be made as long as they are accurate statements about the data as published, with no reference to other companies' varieties. Statements similar to the "See the official Cyst Nematode-Resistant Variety Test, Agronomy Facts No. 43" and "Endorsement or recommendation by the University of Maryland is not implied" must accompany any information that is reproduced. Agronomy Facts No. 43 can be downloaded from the University of Maryland Cropping Systems webpage:

http://www.nrsl.umd.edu/extension/crops

Table 1. Maturity group, nematode resistance, and seed supplier of released entries in the 2004 test.

BRAND	ENTRY	Maturity Group	Resistant* to Cyst Races	Resistant* to Root Knot	Supplier
DOEBLERS	4236	IV	R3**	NT	Doebler's PA Hybrids, Inc.
	4435	IV	R3,R14	NT	Jersey Shore, PA 17740
S.STATES	RT3802N	III	R3,R14	NT	Southern States Cooperative
	RT3940N	III	R3,R14	NT	Richmond, VA 23260
	RT4230N	IV	R3,R14	NT	
	RT4502N	IV	R3,R14	NT	
	RT4810N	IV-S	R3,R14	NT	
VIGORO	V37C5RR	III	All Races	NT	Royster-Clark, Inc.
	V49C5RR	IV-S	All Races	NT	Collinsville, IL 62234
PUBLIC	INA	IV	R1-R5	NT	IL Ag Experiment Station
	KS 4602N	IV-S	R3	NT	KS Ag Experiment Station
	KS 5502N	V	R2-4,R14	S	KS Ag Experiment Station
	LS 93-0375	IV	R3,R14	NT	Southern IL University-Carbondale
	MANOKIN	IV-S	R1,R3	MR	MD Ag Experiment Station
	PANA	III	R2-4,MR5,R14	NT	IL Ag Experiment Station
	REND	IV	R3,R4,R14	NT	IL Ag Experiment Station

*R=resistant; MR=moderately resistant; S=susceptible; NT=not tested
**R3- Races not specified

Table 2. Soybean test plot information.

LOWER EASTERN SHORE RESEARCH & EDUCATION CENTER, SALISBURY FACILITY
Wicomico County - Salisbury, MD

Cooperator:	D. Armentrout
Planting Date:	June 2
Row Spacing:	30 inches
Soil Type:	Norfolk loamy sand
Soil Test:	pH 6.7, P Index- Very High, K Index- Very High
Previous Crop:	Soybeans
Fertilizer:	500 lbs/A 0-10-31
Lime:	None
Herbicide:	Preemerge:0.7 lb/A Lorox DF and 0.75 pt/A Dual Magnum II
	Post:20 oz/A Ultra Blazer, 16 oz/A Basagran, 1oz/A 2,4-DB, surfactant
Insecticide:	None
Cultivation:	Once
Irrigation:	Three= July 1(1 inch), July 6 (1 inch), July 16 (1 inch)

PEMBERTON HISTORICAL PARK
Wicomico County - Salisbury, MD

Cooperator:	Wicomico County Dept. of Parks and Recreation
Planting Date:	June 2
Row Spacing:	30 inches
Soil Type:	Norfolk loamy sand
Soil Test:	pH 6.4, P Index-Very High, K Index- Medium
Previous Crop:	Soybeans
Fertilizer:	500 lbs/A 0-10-31
Lime:	None
Herbicide:	Preemerge:0.7 lb/A Lorox DF and 0.75 pt/A Dual Magnum II
	Post:20 oz/A Ultra Blazer, 16 oz/A Basagran, 1oz/A 2,4-DB, surfactant
Insecticide:	None
Cultivation:	Once
Irrigation:	None

Table 3. Monthly 2004 and 30-year average precipitation (inches) during May through October at LES-REC, Salisbury Facility.

	May	June	July	Aug.	Sept.	Oct.	Total
2004	2.71	2.54	5.00*	9.23	3.12	0.73	18.33
Average	3.32	3.62	3.76	5.72	3.59	3.63	23.64

*Irrigation added at LES RES: 3 inches more (1 inch on each date-July 1, 6, and 16)

Table 4. Seed yields (2003 and 2004) and performance of entries of grown at the Salisbury Facility in a cyst nematode-infested soil. (Races 1,3, and 5)

BRAND – ENTRY	Seed Yield, Bu/A 2004	Seed Yield, Bu/A 2003	Height, Inches	Full Cysts/ 4 Plants
MATURITY GROUP III				
S.STATES - RT3940N	20.8	-	18	497
PUBLIC - PANA	20.2	19.3	24	333
VIGORO - V37C5RR	19.7	-	17	190
S.STATES - RT3802N	15.9	17.9	22	427
PUBLIC - WILLIAMS 82 (S)	18.3	16.2	19	627
Mean	**19.0**	**20.8**	**20**	**415**
LSD (0.20)	**NS**	**5.0**	**NS**	**243**
MATURITY GROUP IV				
EXPERIMENTAL - MD 99-5144	36.5	35.4	23	253
PUBLIC - INA	35.8	34.5	26	63
S.STATES - RT4230N	33.3	-	21	410
DOEBLERS - 4435	33.0	-	23	110
DOEBLERS - 4236	31.9	-	22	147
S.STATES - RT4502N	29.2	25.7	24	450
PUBLIC - REND	27.3	31.7	27	127
EXPERIMENTAL - MD 99-5720	24.9	19.3	22	463
PUBLIC - LS 93-0375	24.1	27.4	22	123
PUBLIC - STRESSLAND (S)	18.8	17.6	22	887
Mean	**26.8**	**27.8**	**23**	**284**
LSD (0.20)	**7.2**	**5.7**	**NS**	**244**
MATURITY GROUP IV-S				
EXPERIMENTAL - MD 00-5020	47.8	52.5	26	213
EXPERIMENTAL - MD 96-5275	43.9	42.7	25	117
PUBLIC - MANOKIN	40.0	45.8	26	83
VIGORO - V49C5RR	37.3	-	28	113
S.STATES - RT4810N	25.9	31.3	22	493
EXPERIMENTAL - MD 99-1353-2RR	25.0	35.7	19	393
PUBLIC - KS 4602N	24.5	33.4	24	330
PUBLIC - CHESAPEAKE (S)	23.0	41.0	26	597
Mean	**33.4**	**38.7**	**25**	**293**
LSD (0.20)	**4.4**	**5.8**	**2**	**286**
MATURITY GROUP V				
PUBLIC - KS 5502N	48.3	52.5	27	0
EXPERIMENTAL - MD 98-5927	42.8	47.8	21	33
EXPERIMENTAL - MD 96-5502	39.5	47.2	23	33
EXPERIMENTAL - MD 00-5159	37.9	40.8	26	83
EXPERIMENTAL - MD 99-0687-3RR	31.7	35.9	26	110
EXPERIMENTAL - MD 97-6065	25.2	37.7	20	297
PUBLIC - HUTCHESON (S)	23.4	18.6	22	567
Mean	**35.5**	**37.1**	**23**	**160**
LSD (0.20)	**7.4**	**6.9**	**2**	**128**

*Full Cysts/4 Plants on July 13

Table 5. Seed yields (2003 and 2004) and performance of entries grown at Pemberton Historical Park in a cyst nematode-infested soil. (Races 1 & 5)

BRAND – ENTRY	Seed Yield, Bu/A 2004	2003	Height, Inches	Full Cysts/ 4 Plants
MATURITY GROUP III				
VIGORO - V37C5RR	14.1	-	14	33
PUBLIC - PANA	12.0	28.8	18	83
S.STATES - RT3802N	11.9	30.8	15	147
S.STATES - RT3940N	11.8	-	16	123
PUBLIC - WILLIAMS 82 (S)	11.1	21.4	14	167
Mean	**12.2**	**27.1**	**15**	**111**
LSD (0.20)	**NS**	**6.0**	**NS**	**NS**
MATURITY GROUP IV				
PUBLIC - INA	23.5	45.1	19	27
EXPERIMENTAL - MD 99-5144	20.9	40.1	17	93
PUBLIC - LS 93-0375	20.4	28.9	18	167
PUBLIC - REND	17.4	32.3	19	77
DOEBLERS - 4236	15.5	-	16	247
S.STATES - RT4230N	13.4	-	15	97
EXPERIMENTAL - MD 99-5720	13.4	31.1	15	73
DOEBLERS - 4435	12.3	-	17	110
S.STATES - RT4502N	11.5	31.0	13	193
PUBLIC - STRESSLAND (S)	15.4	31.0	18	260
Mean	**14.9**	**32.9**	**17**	**136**
LSD (0.20)	**3.7**	**6.0**	**3**	**86**
MATURITY GROUP IV-S				
EXPERIMENTAL - MD 96-5275	25.1	44.9	14	110
EXPERIMENTAL - MD 00-5020	25.1	47.1	14	0
PUBLIC - MANOKIN	21.8	41.8	15	123
VIGORO - V49C5RR	19.7	-	17	23
PUBLIC - KS 4602N	17.5	33.5	18	177
S.STATES - RT4810N	16.5	36.9	17	60
EXPERIMENTAL - MD 99-1353-2RR	12.6	32.5	11	47
PUBLIC - CHESAPEAKE (S)	12.2	29.3	16	127
Mean	**18.8**	**36.2**	**15**	**83**
LSD (0.20)	**3.7**	**3.9**	**2**	**75**
MATURITY GROUP V				
EXPERIMENTAL - MD 96-5502	33.0	47.4	20	0
EXPERIMENTAL - MD 98-5927	31.2	47.8	15	33
PUBLIC - KS 5502N	28.7	42.0	18	0
EXPERIMENTAL - MD 00-5159	24.2	39.4	17	173
EXPERIMENTAL - MD 97-6065	21.1	35.0	17	243
EXPERIMENTAL - MD 99-0687-3RR	19.4	41.5	15	133
PUBLIC - HUTCHESON (S)	15.1	32.6	15	147
Mean	**35.5**	**35.9**	**23**	**160**
LSD (0.20)	**7.4**	**6.2**	**2**	**128**

*Full Cysts/ 4 Plants on July 13