Agronomy Facts No. 43
Revised January 2002

2001 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 2001 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 experimental lines were also evaluated in the tests. These lines and their origin are MD 95-5358, MD 96-5275, MD 96-5502, MD 97-6065, MD 97-6156, MD 98-5095, MD 98-5165, MD 98-5295, MD 98-5314, MD 98-5579, MD 98-5584, MD 98-5927, MD 98-5987, MD 98-6079 from Maryland; and V 95-0016, V 95-0391, V 98-0309, V 99-2596 from Virginia.

A list of the released entries in the 2001 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 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 gave 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. At planting, the soil in the test area at the Pemberton Historical Park and the Salisbury Facility averaged less than 10 full cysts/250 cc of soil. 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 four 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.

The 2001 growing season was generally favorable for soybean growth across the state. Rainfall at the Salisbury Facility exceeded the long-term averages in May through August, but rainfall decreased significantly during September and October (Table 3). The tests at the Salisbury Facility also received irrigation on July 24 (1 inch) and September 6 (0.7 inch).

Seed yields are shown in Tables 4-7. 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 some of the susceptible varieties have fewer cysts than other entries in the test, this probably reflects the variation in distribution of cysts in the soil.

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 4-7.

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.

Prepared by: W. J. Kenworthy and L. A. Wood

Acknowledgements:

The financial support of the Maryland Soybean Board, which helped to provide equipment and funds for conducting this research, is greatly appreciated. The contributions of L.A. Wood, J.M. Treacy, D. Duressa, F.L. Wells, S. Sardanelli, R. Harrell, V. Calder, D. Willey, J. Lynch, and F.R. Mulford of the University of Maryland, and J.E. Terrell, Jr., Department of Recreation and Parks, Wicomico County, are recognized as being essential in the successful completion of this test and are gratefully acknowledged.

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 new 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 grown in the 2001 test.

BRAND	ENTRY	Maturity Group	Resistant* to Cyst Races	Resistant* to Root Knot	Supplier
CLARKS	CL47NRR	IV-S	R3,R14	NT	Clark Seeds, Inc.
	CL441NRR	IV	R3,R14	NT	Kenton, DE 19955
AGRIPRO	4004RR/N	IV	R3**	NT	Garst Seed Co.
	4512RR/N	IV	R3**	NT	Slater, IA 50244
S. STATES	RT3799N	III	R3,R14	NT	Southern States Coop.
	4483N-STS	IV	R3,R14	NT	Richmond, VA 23260
	RT446N	IV	R3	NT	
	RT5001N	V	R3,R14	NT	
PUBLIC	ACCOMAC	V	R1,R3	R	VA Ag Experiment Station
	ANAND	V	R3,R5,R14	S	MO Ag Experiment Station
	DELSOY 5710	V	R1-R5,R14+	R	MO Ag Experiment Station
	FOWLER	V	R2,R3,R5,R14	S	USDA & TN Ag Experiment Station
	INA	IV	R1-R5	NT	IL Ag Experiment Station
	IA 3014	III	R3	NT	IA Ag Experiment Station
	JACK	III	R3	NT	IL 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
	WICOMICO	V	R1,R3	S	MD Ag Experiment Station

*R=resistant; MR=moderately resistant; S=susceptible; +=resistant to other races; NT=not tested
**Not reported but assumed to be R3

Table 2. Soybean test plot information.

Lower Eastern Shore Research & Education Center, Salisbury Facility
Wicomico County, Salisbury

Cooperator:	F.L. Wells
Planting Date:	June 4
Row Spacing:	30 inches
Soil Type:	Norfolk loamy sand
Soil Test:	pH 6.1, P Index- Excess, K Index- Optimum
Previous Crop:	Soybeans
Fertilizer:	200 lbs/A 0-10-46
Lime:	None
Herbicide:	0.7 lb Lorox-DF and 0.75 pt/A Dual II Magnum
Insecticide:	2 oz/A Baythroid
Cultivation:	Once
Irrigation:	1 inch- July 24; 0.7 inch- September 6

Pemberton Historical Park
Wicomico County, Salisbury

Cooperator:	J.E. Terrell, Jr.
Planting Date:	June 4
Row Spacing:	30 inches
Soil Type:	Norfolk loamy sand
Soil Test:	pH 5.7, P Index- Excess, K Index- Medium
Previous Crop:	Soybeans
Fertilizer:	200 lbs/A 0-10-46
Lime:	None
Herbicide:	0.7 lb Lorox-DF and 0.75 pt/A Dual II Magnum
Insecticide:	None
Cultivation:	Once
Irrigation:	None

Table 3. Monthly 2001 and 30-year average precipitation (inches) during May through October at LES-REC, Salisbury Facility.

	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Season**
2001	4.65	4.19	5.03	5.85	2.35	1.33	23.40
Average	3.32	3.62	3.76	5.72	3.59	3.63	23.64

Irrigation in addition to rainfall at Salisbury Facility: 1 inch July 24 and 0.7 inch Sept. 6

Table 4. Seed yields (2000 and 2001) and performance of entries of Maturity Groups III and IV grown at the Salisbury Facility in a cyst nematode-infested soil. (Races 1, 3, & 5).

BRAND - ENTRY	Seed Yield, Bu/A 2001	Seed Yield, Bu/A 2000	Height, Inches	Full Cysts/ 4 Plants*
MATURITY GROUP III				
S.STATES - RT3799N	13.1	18.6	16	154
PUBLIC - IA 3014	10.2	-	15	298
PUBLIC - PANA	10.2	16.5	17	347
PUBLIC - JACK	7.9	17.3	16	122
PUBLIC - WILLIAMS 82 (S)	5.6	9.3	13	725
Mean	**9.4**	**15.8**	**15**	**329**
LSD (0.20)	**2.9**	**3.3**	**2**	**178**
MATURITY GROUP IV				
PUBLIC - INA	32.3	34.7	28	17
PUBLIC - REND	27.5	31.0	23	63
EXPERIMENTAL - MD 98-6079	26.3	-	23	32
EXPERIMENTAL - MD 98-5314	23.1	-	24	449
PUBLIC - LS 93-0375	22.6	23.4	21	277
AGRIPRO - 4512RR/N	22.0	-	20	115
EXPERIMENTAL - MD 97-6156	21.8	26.5	22	40
EXPERIMENTAL - MD 98-5165	20.7	-	23	203
S.STATES - RT446N	19.7	-	22	97
EXPERIMENTAL - MD 95-5358	18.4	23.9	20	161
CLARKS - CL441NRR	18.3	-	18	267
EXPERIMENTAL - MD 98-5295	17.7	-	20	599
S.STATES - 4483N-STS	14.9	26.9	20	203
AGRIPRO - 4004RR/N	14.3	-	20	313
PUBLIC - STRESSLAND (S)	10.5	19.4	20	342
Mean	**20.7**	**25.0**	**22**	**212**
LSD (0.20)	**4.5**	**4.2**	**3**	**168**

*Full Cysts/4 Plants on July 10

Table 5. Seed yields (2000 and 2001) and performance of entries of Maturity Groups IV-S and V grown at the Salisbury Facility in a cyst nematode-infested soil. (Races 1, 3, & 5).

BRAND - ENTRY	Seed Yield, Bu/A 2001	Seed Yield, Bu/A 2000	Height, Inches	Full Cysts/ 4 Plants*
MATURITY GROUP IV-S				
EXPERIMENTAL - MD 96-5275	20.1	32.1	20	38
PUBLIC - MANOKIN	17.9	36.5	19	37
EXPERIMENTAL - MD 98-5584	12.1	-	18	262
EXPERIMENTAL - MD 98-5579	11.3	-	17	226
CLARKS - CL47NRR	7.6	22.9	15	162
PUBLIC - CHESAPEAKE (S)	8.5	20.8	16	163
Mean	**12.9**	**26.1**	**17**	**148**
LSD (0.20)	**3.2**	**2.9**	**2**	**91**
MATURITY GROUP V				
EXPERIMENTAL - MD 96-5502	33.0	38.0	25	5
EXPERIMENTAL - V 95-0016	32.6	-	29	52
EXPERIMENTAL - V 95-0391	32.0	30.6	30	46
PUBLIC - FOWLER	31.2	32.3	31	9
EXPERIMENTAL - MD 98-5927	30.7	-	24	2
PUBLIC - DELSOY 5710	28.4	36.6	32	2
PUBLIC - WICOMICO	27.6	31.6	27	43
PUBLIC - ANAND	27.3	32.2	25	84
EXPERIMENTAL - V 98-0309	26.5	-	24	188
PUBLIC - ACCOMAC	26.3	30.5	31	21
EXPERIMENTAL - MD 98-5987	26.0	-	19	81
EXPERIMENTAL - MD 97-6065	25.5	32.2	21	79
EXPERIMENTAL - MD 98-5095	24.5	-	28	105
EXPERIMENTAL - V 99-2596	22.3	-	24	155
S.STATES - RT5001N	21.5	-	28	71
PUBLIC - HUTCHESON (S)	19.2	25.7	23	156
Mean	**27.2**	**28.5**	**26**	**69**
LSD (0.20)	**5.6**	**4.6**	**3**	**45**

*Full Cysts/4 Plants on July 10

Table 6. Seed yields (2000 and 2001) and performance of entries of Maturity Groups III and IV grown at Pemberton Historical Park in a cyst nematode-infested soil. (Races 1 & 5)

BRAND - ENTRY	Seed Yield, Bu/A 2001	Seed Yield, Bu/A 2000	Height, Inches	Full Cysts/ 4 Plants*
MATURITY GROUP III				
PUBLIC - JACK	10.1	-	14	143
S.STATES - RT3799N	9.7	26.2	15	109
PUBLIC - PANA	9.2	23.2	16	384
PUBLIC - IA 3014	7.9	-	13	427
PUBLIC - WILLIAMS 82 (S)	6.7	22.6	14	847
Mean	**8.7**	**18.1**	**14**	**382**
LSD (0.20)	**NS**	**2.8**	**NS**	**289**
MATURITY GROUP IV				
PUBLIC - INA	20.8	30.6	20	18
EXPERIMENTAL - MD 98-6079	15.5	-	17	127
EXPERIMENTAL - MD 95-5358	15.4	24.2	17	200
EXPERIMENTAL - MD 98-5314	14.6	-	17	691
EXPERIMENTAL - MD 97-6156	12.7	23.4	14	307
PUBLIC - REND	12.4	15.5	17	220
S.STATES - 4483N-STS	11.0	27.1	16	270
S.STATES - RT446N	10.3	-	15	618
EXPERIMENTAL - MD 98-5165	10.1	-	17	579
CLARKS - CL441NRR	9.7	-	12	331
EXPERIMENTAL - MD 98-5295	9.7	-	16	318
AGRIPRO - 4512RR/N	9.6	-	15	423
PUBLIC - LS 93-0375	7.0	21.8	14	503
AGRIPRO - 4004RR/N	6.6	-	12	424
PUBLIC - STRESSLAND (S)	12.1	26.3	17	450
Mean	**11.8**	**23.8**	**15**	**365**
LSD (0.20)	**3.7**	**4.6**	**2**	**253**

*Full Cysts/4 Plants on July 10

Table 7. Seed yields (2000 and 2001) and performance of entries of Maturity Groups IV-S and V grown at Pemberton Historical Park in a cyst nematode-infested soil. (Races 1 & 5)

BRAND - ENTRY	Seed Yield, Bu/A 2001	Seed Yield, Bu/A 2000	Height, Inches	Full Cysts/ 4 Plants*
MATURITY GROUP IV-S				
EXPERIMENTAL - MD 96-5275	16.3	32.1	18	15
PUBLIC - MANOKIN	15.6	36.5	16	37
EXPERIMENTAL - MD 98-5584	8.8	-	15	95
CLARKS - CL47NRR	8.0	22.9	14	71
EXPERIMENTAL - MD 98-5579	7.5	-	13	67
PUBLIC - CHESAPEAKE (S)	6.6	20.8	15	108
Mean	**10.5**	**29.9**	**15**	**65**
LSD (0.20)	**3.2**	**6.3**	**2**	**47**
MATURITY GROUP V				
EXPERIMENTAL - V 95-0016	29.7	-	23	37
EXPERIMENTAL - MD 96-5502	27.8	43.2	18	1
PUBLIC - WICOMICO	27.1	31.8	21	120
PUBLIC - ACCOMAC	26.9	36.8	25	51
EXPERIMENTAL - MD 98-5927	26.6	-	20	1
PUBLIC - ANAND	25.9	34.8	20	40
PUBLIC - DELSOY 5710	25.4	39.9	26	0
PUBLIC - FOWLER	23.0	39.8	24	23
EXPERIMENTAL - V 95-0391	20.3	28.5	21	190
EXPERIMENTAL - V 98-0309	17.2	-	16	331
EXPERIMENTAL - MD 98-5095	17.0	-	16	186
EXPERIMENTAL - MD 97-6065	16.1	28.7	14	245
EXPERIMENTAL - V 99-2596	15.3	-	17	283
S.STATES - RT5001N	14.6	-	18	279
EXPERIMENTAL - MD 98-5987	13.8	-	12	163
PUBLIC - HUTCHESON (S)	16.5	33.5	19	642
Mean	**21.4**	**30.5**	**19**	**162**
LSD (0.20)	**5.4**	**5.3**	**2**	**146**

*Full Cysts/4 Plants on July 10