

RENIFORM NEMATODE REPRODUCTION ON SOYBEAN CULTIVARS AND BREEDING LINES IN 2016

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Abstract

In 2016, 142 private soybean cultivars and lines from the Arkansas Variety Testing Program and 211 breeding lines and varieties from Public Soybean Breeders: 5 from USDA Jackson TN (Arelli), 35 from Arkansas (Chen), 17 from Missouri (Shannon), 91 from Southern Illinois (Kantartzi), 19 from Clemson (Fallen), and 44 from Georgia (Li) were tested in the greenhouse to determine their suitability as hosts for the reniform nematode (RN), *Rotylenchulus reniformis*. Resistant soybean lines provide an economically effective management tactic to suppress RN population densities for a subsequent cotton crop. All genotypes were inoculated with 2,000 vermiform RN in two separate greenhouse studies grown for 84 days. The RN resistant varieties Anand and Hartwig, the RN susceptible cultivars Braxton and Ellis, and fallow reniform nematode infested soil (to show survival without a host) served as controls. The reproductive index ($RI = Pf/Pi$) was calculated based on the average number of vermiform nematodes extracted from the soil of each treatment. Soybean lines with a greater ($P = 0.05$) RI than the resistant controls were considered suitable hosts for *R. reniformis*. Of the 142 Arkansas Variety test lines, 137 were considered suitable hosts; however private lines Dyno-Gro S49xs76, Delta Grow DG4995 RR, Armor AR5206C, Go Soy 4914GTS, and Go Soy 49G16 had a magnitude of resistance that was similar to the resistant checks. The Reniform nematode did not reproduce more than the resistant checks on Anand (22 of the 211) and on Hartwig (17 of the 211) on breeding lines and varieties submitted by the Public Soybean Breeders. These lines may be of interest for developing reniform resistant cultivars in a soybean breeding programs. The five commercially available soybean lines from the Arkansas variety test may be useful in a cotton - soybean rotation to reduce the numbers of reniform nematodes and allow cotton to be grown economically.

Introduction

The reniform nematode (*Rotylenchulus reniformis*) causes considerable damage and yield loss to cotton in the United States from the middle-Atlantic states south then west thru Texas. Presently no commercial upland cotton varieties have reniform nematode resistance, whereas several sources of reniform nematode resistance exist in soybean. Soybean reniform nematode resistance is most often linked to resistance to the soybean cyst nematode (SCN (*Heterodera glycines*)) obtained from Peking, PI90763, and PI437654. It has been shown that SCN resistance obtained from PI-88788 lacks resistance to reniform nematode (Robbins & Rakes, 1996). This is unfortunate because the majority (about 98%) of soybean varieties with SCN resistance are linked to PI 88788. The reniform nematode non-host crops of corn, sorghum and rice would also be useful in rotation with cotton.

The use of reniform nematode resistant soybean in a rotation with cotton can be a useful management option. Public soybean breeding lines from programs at the University of Arkansas, Clemson University, University of Missouri, University of Southern Illinois, and USDA from Jackson Tennessee that have a low rate of reniform nematode reproduction may prove very useful in breeding soybean for reniform nematode resistance.

Information on the reproduction of the reniform nematode on contemporary soybean cultivars is limited. Robbins, et al. (1994) reported on the reproduction of the reniform nematode on 30 soybean cultivars. In 1996, Robbins & Rakes reported reniform nematode reproduction on 16 soybean cultivars, 45 germplasm lines, and the differentials used in the soybean cyst nematodes race determination tests (Peking, PI90763, PI88788). A history of the reniform nematode in the South was given to the Southern Soybean Disease Workers (Robbins 2013b). During the 1999 to 2016 period yearly tests have determined the host status for over 2,600 soybean lines (Robbins et al., 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007a, 2008, 2009, 2010, 2011, 2012, 2013a, 2014, 2015, 2016). These papers are the basis for reniform nematode reproduction information on contemporary soybean lines. The breeding lines tested for reniform nematode reproduction are given by Robbins et al. (2007b, 2008, 2009, 2010, 2011, 2012, 2013a, 2014, 2015, and 2016).

The objectives of the 2016 studies were to: 1) identify new soybean cultivars that are poor hosts for the reniform nematode that could be useful in rotation with cotton or other reniform nematode susceptible crops in reniform nematode infested fields. 2) to identify useful breeding soybean lines for use in selection of new reniform nematode resistant cultivars and 3) to list useful lines for cotton-soybean rotations from 2012 to 2016.

Materials and Methods

The soybean lines and cultivars tested in 2016 were from both private and public sources. Seeds of all cultivars were germinated in vermiculite and transplanted into 10-cm-diam. clay pots containing 500 cm³ of pasteurized fine sandy loam soil (approximately 86% sand, 8% silt, 6 % clay, <1% O.M.) for the private lines and 8 ounce Styrofoam cups containing 180 cm³. The reniform nematode inoculum was obtained by washing the soil from the roots of the susceptible cultivar Braxton grown in the greenhouse for at least 10 weeks, suspending the nematodes in water, and pouring the nematode suspension through nested 850- and 38-µm-pore sieves. The material on the 38-µm-pore sieve was placed on a tissue in a Baermann funnel. All vermiform stages of *R. reniformis* were collected after 16 hours. A total of 2,000 vermiform reniform nematodes were injected with an autopipe into two, 2.5 cm-deep holes made in the soil in each pot containing one seedling in the cotyledon stage the day of transplanting. Pots were arranged in a randomized complete block design, with five replications per line or cultivar. Soybean cultivars Anand and Hartwig were included as resistant controls, Braxton as a susceptible control and an inoculated pot with no plant (fallow) as an inoculum survivor control. After 84 days the number of vermiform reniform nematodes in the soil of each pot was determined (Jenkins, 1974). A reproductive index (RI), defined as the number of eggs + vermiform nematodes at test termination (Pf)/initial inoculation level (Pi), was calculated for each cultivar. In addition, the ratio of the RI of each cultivar to the RI of Anand (RA) and Hartwig (RH) was calculated. The log ratio data of both [log₁₀ (RA + 1)] and [log₁₀ (RH + 1)] were analyzed as a randomized complete block using analysis of variance. Log ratio transformations were used because of the high degree of variation in nematode counts within a cultivar. All statistical analyses were carried out using SAS version 8 (SAS Institute, Cary, NC).

Results

Of the 144 Arkansas Variety test lines, 139 were considered suitable hosts to reniform; however, Dyno-Gro S49xs76, Delta Grow DG4995 RR, Armor AR5206C, Go Soy 4914GTS, and Go Soy 49G16 had a magnitude of resistance that was similar to the highly resistant controls Anand and Hartwig. These commercially available reniform nematode resistant soybean lines may be useful in a cotton - soybean rotation to reduce the numbers of reniform nematodes and allow the economically growing of cotton (Table 1).

The reniform nematode did not reproduce more than Anand on 22 lines (17 than Hartwig) of the 211 breeding lines and varieties submitted by Public Soybean Breeders. These lines may be of interest for developing reniform resistant cultivars in a soybean breeding programs (Table 2).

Public breeding lines with a useful level of reniform resistance in varieties and breeding lines tested in 2016 are listed in Table 2. Of 2016's 211 public breeding lines, varieties, and lines up to 22 would be useful in reniform resistance breeding programs. In table 3 all soybean varieties with levels of resistance to reniform nematode useful in cotton-soybean rotations of tests since 2013 are listed. Annual Reproductive Indexes of Reniform nematode have been reported by the senior author since 1998. Finding the older varieties may be a challenge as many private varieties last only a very few seasons (years).

Table 1. *Rotylenchulus reniformis* data of Average Soil Count per Pot (500 cm³), Reproduction index (Pf/Pi) and Disease Rating on 144 selected soybean cultivars and lines from the Arkansas Soybean Variety Testing Program 2016 tests.

Test line	Converted RI	Soil Count	RI (Pf/Pi)	Disease Rating
Fallow	0.2471	432	0.22	Survival Check
Anand	0.7923	1676	0.84	Resistant Check
Go Soy 49G16	0.8851	1608	0.80	Resistant
Hartwig	0.9224	1752	0.88	Resistant Check
Go Soy 5214GTS	0.9622	1704	0.85	Resistant
Armor AR5206C	1.1331	2208	1.10	Resistant
Delta Grow DG4995 RR	1.1792	2352	1.18	Resistant
Dyna-Gro S49XS76	2.2243	4668	2.33	Resistant
Asgrow AG 53X6	4.5077	9352	4.68	Moderate Resistant
Progeny P 5016RXS	4.7061	17464	8.73	Moderate Resistant
GS43R216	4.8891	14096	7.05	Moderate Resistant
USG 7536XT	6.0282	14528	7.26	Moderate Susceptible
Progeny P 4588RY	6.3838	33540	16.77	Moderate Susceptible
GS48R216	6.3864	22136	11.07	Moderate Susceptible
NK S42-E5 Brand	6.6659	18852	9.43	Moderate Susceptible
Delta Grow DG4977 LL/STS	6.6665	21420	10.71	Moderate Susceptible
Armor 47-D17	6.9977	25128	12.56	Moderate Susceptible
AvDx-F216	7.7595	20476	10.24	Susceptible
LG C4615RX	8.4202	25024	12.51	Susceptible
Delta Grow DG4790 RR2	8.4259	21048	10.52	Susceptible
Armor 48-D24	8.5049	26472	13.24	Susceptible
Delta Grow DG5580 RR2	8.9822	24976	12.49	Susceptible
Eagle Seed ES4998RR	9.3841	44260	22.13	Susceptible

AvZx-D515	9.4255	30032	15.02	Susceptible
GS45R216	9.7756	20840	10.42	Susceptible
NK S47-C8 Brand	9.8637	25808	12.90	Susceptible
Progeny P 4944RX	9.9507	25016	12.51	Susceptible
Asgrow AG 42X6	10.0095	40492	20.25	Susceptible
Armor 47-R70	10.0192	23828	11.91	Susceptible
S12-4718	10.281	38242	19.12	Susceptible
Progeny P 5768RX	10.6956	37468	18.73	Susceptible
GS47R216	10.878	28356	14.18	Susceptible
REV® 49L49™	11.0433	38332	19.17	Susceptible
Go Soy 4912LL	11.3297	54404	27.20	Susceptible
Eagle Seed ES4870RYX	11.4131	25568	12.78	Susceptible
Go Soy 4913LL	11.9034	25316	12.66	Susceptible
Go Soy 483.C	12.3958	32404	16.20	Susceptible
S12-3782	12.4277	40164	20.08	Susceptible
Delta Grow DG4845 RR2X	12.5615	33236	16.62	Susceptible
REV® 48A76™	12.5809	27580	13.79	Susceptible
Mycogen 5N424R2	12.6553	34368	17.18	Susceptible
Armor ARX4706	12.6843	33296	16.65	Susceptible
NK S49-B1 Brand	12.9002	31172	15.59	Susceptible
Progeny P 4516RXS	13.0216	39992	20.00	Susceptible
REV® 45A46™	13.1983	35176	17.59	Susceptible
Delta Grow DG4680 RR2	13.2062	34936	17.47	Susceptible
Delta Grow DG4781 LL	13.5608	30376	15.19	Susceptible
Delta Grow DG4855 RR2X/STS	13.7022	47336	23.67	Susceptible
Eagle Seed ES4460RYX	13.7631	33220	16.61	Susceptible
AvDx-E816	13.8944	34236	17.12	Susceptible
NK S48-D9 Brand	14.5926	43048	21.52	Susceptible
Mycogen 5N480R2	14.8599	35344	17.67	Susceptible
Armor AR4906	14.9251	39412	19.71	Susceptible
CZ 4898 RY	15.0263	36320	18.16	Susceptible
Asgrow AG 48X7	15.4733	46256	23.13	Susceptible
Progeny P 4613RYS	16.2631	41332	20.67	Susceptible
Delta Grow DG5461 LL	16.3009	43124	21.56	Susceptible
Asgrow AG 49X6	16.41	29200	14.60	Susceptible
LG C4900RX	16.4519	48984	24.49	Susceptible
Eagle Seed ES5930RYX	16.457	50828	25.41	Susceptible
USG 74B83RS	16.7662	35784	17.89	Susceptible
Dyna-Gro S48XT56	16.8053	30900	15.45	Susceptible
Asgrow AG 46X6	16.9753	51864	25.93	Susceptible
UAX 59313GT	17.102	33300	16.65	Susceptible
AvDx-D916	17.1153	56884	28.44	Susceptible
UAX 59013C	17.3088	63746	31.87	Susceptible

Eagle Seed ES4680RYX	17.8213	59632	29.82	Susceptible
Delta Grow DG5170 RR2/STS	18.0573	49936	24.97	Susceptible
MSX 48XDS1	18.295	43552	21.78	Susceptible
Asgrow AG 55X7	18.4105	44452	22.23	Susceptible
NK S52-Y2 Brand	18.9084	51592	25.80	Susceptible
Armor 48-D80	19.0414	40960	20.48	Susceptible
USG 7506XTS	19.2169	59604	29.80	Susceptible
S12-3791	19.2783	33800	16.90	Susceptible
USG 7487XTS	19.6093	66760	33.38	Susceptible
UAX 59012C	19.7258	66000	33.00	Susceptible
Armor 43-D34	19.7777	34400	17.20	Susceptible
Mycogen 5N406R2	19.9483	50136	25.07	Susceptible
Asgrow AG 45X6	20.8199	35920	17.96	Susceptible
UAX 5102	20.8395	52492	26.25	Susceptible
Shillinger e4510	20.8687	61156	30.58	Susceptible
Asgrow AG 47X6	21.058	46000	23.00	Susceptible
Blue River 50SK7	21.7805	66248	33.12	Susceptible
Eagle Seed ES5650RR	22.0545	68372	34.19	Susceptible
Asgrow AG 44X6	22.1668	60772	30.39	Susceptible
MSX 46XDS1	22.1765	64900	32.45	Susceptible
Delta Grow DG5067 LL	22.4586	39600	19.80	Susceptible
Progeny P 4816RX	22.5426	48980	24.49	Susceptible
Armor AR 49-61	22.6121	50116	25.06	Susceptible
Armor 44-D40	22.6612	45900	22.95	Susceptible
CZ 4222 LL	22.712	44280	22.14	Susceptible
Dyna-Gro S49XT07	23.1144	43500	21.75	Susceptible
Mycogen 5N414R2	23.5457	75556	37.78	Susceptible
LG C4845RX	24.4738	58700	29.35	Susceptible
Go Soy 4814GTS	24.5531	44500	22.25	Susceptible
Progeny P 4799RXS	24.5736	48020	24.01	Susceptible
NK S47-K5 Brand	24.6303	81504	40.75	Susceptible
Blue River 47FC7	25.2844	72548	36.27	Susceptible
Armor AR4606	25.7486	47540	23.77	Susceptible
Go Soy 42L16	26.3035	68916	34.46	Susceptible
Eagle Seed ES5420RYX	26.5801	71076	35.54	Susceptible
NK S45-W9 Brand	27.1833	54500	27.25	Susceptible
Eagle Seed ES5015RYX	27.5008	70540	35.27	Susceptible
UAX 59011C	27.548	88388	44.19	Susceptible
USG 7496XTS	28.1712	52680	26.34	Susceptible
S12-2418	28.2873	79128	39.56	Susceptible
Dyna-Gro S45XS66	28.6462	55780	27.89	Susceptible
NK S42-P6 Brand	28.6877	53460	26.73	Susceptible
Dyna-Gro S45LL97	28.8119	74160	37.08	Susceptible

Delta Grow DG4587 LL/STS	28.9341	58120	29.06	Susceptible
USG 756XT	29.3743	68020	34.01	Susceptible
Armor ARX5506	29.674	72480	36.24	Susceptible
Armor 46-D08	29.6816	50900	25.45	Susceptible
MSX 49XD1	29.7663	61760	30.88	Susceptible
UAX 59113GT	30.6595	57800	28.90	Susceptible
Delta Grow DG4545 RR2X/STS	31.1105	55020	27.51	Susceptible
Mycogen 5N433R2	31.1294	62700	31.35	Susceptible
Armor 39-D90	31.3517	91664	45.83	Susceptible
Armor ARX4906	31.3776	96300	48.15	Susceptible
Go Soy 43L16	32.0304	56700	28.35	Susceptible
REV® 48L63™	32.1366	91400	45.70	Susceptible
USG 7497XT	33.4315	69020	34.51	Susceptible
Dyna-Gro SX16844XS	33.9079	62900	31.45	Susceptible
Armor 53-D04	34.1866	58660	29.33	Susceptible
Asgrow AG 4632	34.9293	66680	33.34	Susceptible
CZ 4656 RY	35.0261	65260	32.63	Susceptible
Progeny P 4620RXS	35.4178	62800	31.40	Susceptible
Asgrow AG 46X7	35.601	76160	38.08	Susceptible
USG 7557XT	36.0206	65700	32.85	Susceptible
Shillinger e4892	36.3736	65700	32.85	Susceptible
Dyna-Gro S45XS37	37.0855	72760	36.38	Susceptible
NK S56-M8 Brand	37.8131	67220	33.61	Susceptible
Progeny P 5417RX	38.5454	79600	39.80	Susceptible
Shillinger e4993	39.5728	71100	35.55	Susceptible
Armor 49-D66	40.2734	83800	41.90	Susceptible
Armor 49-D90	40.4218	68560	34.28	Susceptible
Progeny P 4247LL	41.0544	87700	43.85	Susceptible
Asgrow AG 54X6	44.0006	86000	43.00	Susceptible
UAX 51010	45.345	100020	50.01	Susceptible
Armor 55-R68	46.0664	88100	44.05	Susceptible
REV® 48A26™	46.5067	81920	40.96	Susceptible
MSX 49XD3	49.5712	93800	46.90	Susceptible
GS4915R2	50.1182	93100	46.55	Susceptible
USG 7547XT	57.01	119900	59.95	Susceptible
UAX 59111C	59.6877	108900	54.45	Susceptible
Ellis	62.061	133300	66.65	Susceptible Check
Braxton	82.804	167400	83.70	Susceptible Check

Blue = Resistant

Red = Moderate Resistant

Green = Moderate Susceptible

Black = Susceptible

Table 2. *Rotylenchulus reniformis* data of Breeder, Line, Soil Count Average per Pot (500 cm³), Reproduction Index = (Pf/Pi) and Disease Rating on 219 selected soybean breeding lines from cooperating Southern Soybean Breeders 2015 tests.

Test Line	Breeder	Soil Count	RI (Pf/Pi)	Disease Rating
Fallow		324	0.16	Survival Check
S14-7233	Shannon	2860	1.43	Resistant
S13-1805	Shannon	3729	1.86	Resistant
S13-11733	Shannon	3972	1.99	Resistant
Hartwig		4553	2.28	Resistant Check
SC13-5535RR1	Fallen	4839	2.42	Resistant
SC12-5712R2	Fallen	4866	2.43	Resistant
S14-9999	Shannon	5160	2.58	Resistant
S14-3831	Shannon	5280	2.64	Resistant
Anand		5840	2.92	Resistant Check
S14-9017	Shannon	5960	2.98	Resistant
S14-8982	Shannon	6560	3.28	Resistant
SC10-07	Fallen	6618	3.31	Resistant
JTN-5316	Arelli	6760	3.38	Resistant
G13-3461R2	Li	6900	3.45	Resistant
JTN-5516	Arelli	7020	3.51	Resistant
S14-9051	Shannon	7080	3.54	Resistant
SC12-5713R2	Fallen	7233	3.62	Resistant
G13-1121R2	Li	10440	5.22	Moderate Resistant
ExF12	Kantartzi	14100	7.05	Moderate Resistant
ExF1	Kantartzi	15058	7.53	Moderate Resistant
G13-2300R2	Li	15180	7.59	Moderate Resistant
G13-1699R2	Li	15280	7.64	Moderate Resistant
R13-1019	Chen	15580	7.79	Moderate Resistant
ExF39	Kantartzi	17420	8.71	Moderate Resistant
ExF10	Kantartzi	17600	8.80	Moderate Resistant
Forrest (Tartartzi CK)	Kantartzi	19400	9.70	Moderate Resistant
JTN-5216	Arelli	19940	9.97	Moderate Resistant
ExF59 B	Kantartzi	20260	10.13	Moderate Susceptible
ExF88	Kantartzi	23240	11.62	Moderate Susceptible
ExF76	Kantartzi	23620	11.81	Moderate Susceptible
S11-16882	Shannon	28380	14.19	Moderate Susceptible
R12-514	Chen	28574	14.29	Moderate Susceptible
S14-4034	Shannon	30360	15.18	Moderate Susceptible
SC14-5503R2	Fallen	30760	15.38	Moderate Susceptible
ExF17	Kantartzi	31640	15.82	Moderate Susceptible

JTN-5416	Arelli	32756	16.38	Moderate Susceptible
ExF2	Kantartzi	35227	17.61	Moderate Susceptible
ExF7	Kantartzi	38720	19.36	Moderate Susceptible
ExF59 A	Kantartzi	39820	19.91	Moderate Susceptible
S14-9872	Shannon	42220	21.11	Susceptible
S98-1930	Fallen	42680	21.34	Susceptible
SC03-9151	Fallen	44660	22.33	Susceptible
ExF63	Kantartzi	47160	23.58	Susceptible
ExF4	Kantartzi	47840	23.92	Susceptible
JTN-5116	Arelli	51820	25.91	Susceptible
SC13-5538RR1	Fallen	52722	26.36	Susceptible
SC07-108RR	Fallen	55160	27.58	Susceptible
Hartwig	Li	58200	29.10	Susceptible
ExF30	Kantartzi	58960	29.48	Susceptible
ExF9	Kantartzi	59840	29.92	Susceptible
ExFF38	Kantartzi	62680	31.34	Susceptible
S14-3942	Shannon	66313	33.16	Susceptible
ExF77	Kantartzi	75700	37.85	Susceptible
ExF67	Kantartzi	82280	41.14	Susceptible
R13-818	Chen	85460	42.73	Susceptible
S14-9003	Shannon	88120	44.06	Susceptible
ExF24	Kantartzi	89600	44.80	Susceptible
G13-1269R2	Li	89700	44.85	Susceptible
ExF52	Kantartzi	94020	47.01	Susceptible
ExF55	Kantartzi	96280	48.14	Susceptible
ExF98	Kantartzi	105880	52.94	Susceptible
SC07-1490RR	Fallen	106398	53.20	Susceptible
ExF62	Kantartzi	114440	57.22	Susceptible
ExF91	Kantartzi	122700	61.35	Susceptible
ExF31	Kantartzi	131060	65.53	Susceptible
ExF29	Kantartzi	136100	68.05	Susceptible
R13-359	Chen	136600	68.30	Susceptible
ExF57	Kantartzi	138860	69.43	Susceptible
ExF74	Kantartzi	141680	70.84	Susceptible
ExF73	Kantartzi	144700	72.35	Susceptible
R12-4786	Chen	146800	73.40	Susceptible
G11-2663R2	Li	150440	75.22	Susceptible
R13-354	Chen	153440	76.72	Susceptible
S13-15764	Shannon	157720	78.86	Susceptible
ExF8	Kantartzi	159580	79.79	Susceptible

ExF3	Kantartzi	163240	81.62	Susceptible
ExF69	Kantartzi	168020	84.01	Susceptible
SC11-5140	Fallen	176560	88.28	Susceptible
R13-1724	Chen	181320	90.66	Susceptible
S14-15156	Shannon	181760	90.88	Susceptible
ExF90	Kantartzi	185040	92.52	Susceptible
ExF81	Kantartzi	186680	93.34	Susceptible
R10-298	Chen	191440	95.72	Susceptible
G13-3855R2	Li	191920	95.96	Susceptible
Ellis		192560	96.28	Susceptible Check
ExF60	Kantartzi	192980	96.49	Susceptible
R13-907	Chen	193068	96.53	Susceptible
ExF75	Kantartzi	194700	97.35	Susceptible
G13-2947R2	Li	198000	99.00	Susceptible
R13-14007	Chen	199640	99.82	Susceptible
R12-7446RY	Chen	200000	100.00	Susceptible
G13-2454R2	Li	201700	100.85	Susceptible
ExF48	Kantartzi	201888	100.94	Susceptible
R13-4638RY	Chen	204820	102.41	Susceptible
R13-4244	Chen	206080	103.04	Susceptible
S14-2088	Shannon	206320	103.16	Susceptible
SC10-302	Fallen	206800	103.40	Susceptible
ExF71	Kantartzi	207440	103.72	Susceptible
G93-9106	Li	207920	103.96	Susceptible
G12-2103R2	Li	211040	105.52	Susceptible
ExF56	Kantartzi	211940	105.97	Susceptible
R13-335	Chen	212000	106.00	Susceptible
Essex (Tartartzi CK)	Kantartzi	214400	107.20	Susceptible
ExF78	Kantartzi	214800	107.40	Susceptible
G13-2114R2	Li	214880	107.44	Susceptible
ExF49	Kantartzi	215120	107.56	Susceptible
R13-14575RR	Chen	216460	108.23	Susceptible
ExF87	Kantartzi	217120	108.56	Susceptible
ExF40/41	Kantartzi	217300	108.65	Susceptible
ExF19	Kantartzi	220080	110.04	Susceptible
G13-2842R2	Li	220500	110.25	Susceptible
R13-13997	Chen	220800	110.40	Susceptible
R12-2069	Chen	221120	110.56	Susceptible
ExF37	Kantartzi	222160	111.08	Susceptible
ExF83	Kantartzi	222760	111.38	Susceptible
R12-2142	Chen	225040	112.52	Susceptible

ExF94	Kantartzi	225760	112.88	Susceptible
SC10-455RR	Fallen	225840	112.92	Susceptible
R10-1809	Chen	226000	113.00	Susceptible
R13-2423RR	Chen	226400	113.20	Susceptible
G12-2731R2	Li	226640	113.32	Susceptible
G13-1183R2	Li	227920	113.96	Susceptible
R11-6870	Chen	229320	114.66	Susceptible
ExF11	Kantartzi	231680	115.84	Susceptible
R13-13433	Chen	235520	117.76	Susceptible
R13-532	Chen	237760	118.88	Susceptible
SC10-406RR	Fallen	238640	119.32	Susceptible
G13-2759R2	Li	239680	119.84	Susceptible
SC02-011	Fallen	240500	120.25	Susceptible
CNS	Li	241540	120.77	Susceptible
G13-2755R2	Li	243980	121.99	Susceptible
ExF68	Kantartzi	246320	123.16	Susceptible
ExF45	Kantartzi	247040	123.52	Susceptible
ExF36	Kantartzi	247440	123.72	Susceptible
G93-9009	Li	247560	123.78	Susceptible
R11-171	Chen	250500	125.25	Susceptible
ExF46	Kantartzi	251120	125.56	Susceptible
G12-2259R2	Li	252800	126.40	Susceptible
G12PR-63R2	Li	253620	126.81	Susceptible
G13-1769R2	Li	254640	127.32	Susceptible
ExF93	Kantartzi	254720	127.36	Susceptible
Bossier	Li	256560	128.28	Susceptible
G12-2062R2	Li	256760	128.38	Susceptible
ExF84	Kantartzi	257120	128.56	Susceptible
ExF79	Kantartzi	258560	129.28	Susceptible
ExF28	Kantartzi	258680	129.34	Susceptible
R13-9687	Chen	259160	129.58	Susceptible
ExF80	Kantartzi	260000	130.00	Susceptible
R13-4187RY	Chen	260520	130.26	Susceptible
Hagood	Li	260920	130.46	Susceptible
G13-1089R2	Li	261800	130.90	Susceptible
ExF53	Kantartzi	262080	131.04	Susceptible
Cook	Li	263320	131.66	Susceptible
ExF5	Kantartzi	263360	131.68	Susceptible
R11-2517	Chen	263920	131.96	Susceptible
R13-13333	Chen	266000	133.00	Susceptible
ExF27	Kantartzi	266660	133.33	Susceptible

ExF89	Kantartzi	268000	134.00	Susceptible
G13-2369R2	Li	268980	134.49	Susceptible
ExF21	Kantartzi	270880	135.44	Susceptible
ExF43/44	Kantartzi	271200	135.60	Susceptible
SC10-79	Fallen	271920	135.96	Susceptible
Benning	Li	272800	136.40	Susceptible
ExF50	Kantartzi	274480	137.24	Susceptible
R12-226	Chen	274960	137.48	Susceptible
UA 5612	Chen	278000	139.00	Susceptible
R13-1419	Chen	278000	139.00	Susceptible
G12-6543	Li	283920	141.96	Susceptible
ExF58	Kantartzi	284160	142.08	Susceptible
ExF18	Kantartzi	284240	142.12	Susceptible
G12-6515	Li	284640	142.32	Susceptible
G13-2939R2	Li	285920	142.96	Susceptible
ExF51	Kantartzi	288720	144.36	Susceptible
G12-1784R2	Li	292320	146.16	Susceptible
G11PR-56151R2	Li	298640	149.32	Susceptible
R13-9736	Chen	299520	149.76	Susceptible
ExF22	Kantartzi	300000	150.00	Susceptible
S13-11061	Shannon	304320	152.16	Susceptible
ExF23	Kantartzi	306000	153.00	Susceptible
ExF26	Kantartzi	306960	153.48	Susceptible
R12-712	Chen	310660	155.33	Susceptible
ExF34	Kantartzi	310660	155.33	Susceptible
R11-328	Chen	314000	157.00	Susceptible
ExF72	Kantartzi	314240	157.12	Susceptible
G12-3107R2	Li	318000	159.00	Susceptible
ExF6	Kantartzi	319460	159.73	Susceptible
G12-6386	Li	321200	160.60	Susceptible
G12-6518	Li	323360	161.68	Susceptible
Braxton		324640	162.32	Susceptible Check
ExF20	Kantartzi	329200	164.60	Susceptible
ExF65	Kantartzi	330000	165.00	Susceptible
ExF54	Kantartzi	330500	165.25	Susceptible
G11-1614R2	Li	331920	165.96	Susceptible
ExF32+33 mix	Kantartzi	335360	167.68	Susceptible
ExF15/16	Kantartzi	336000	168.00	Susceptible
R12-7448RY	Chen	338400	169.20	Susceptible
ExF25	Kantartzi	339920	169.96	Susceptible
SC07-1518RR	Fallen	341280	170.64	Susceptible

ExF64	Kantartzi	342000	171.00	Susceptible
G11PR-56238R2	Li	345940	172.97	Susceptible
SC09-210RR	Fallen	356660	178.33	Susceptible
ExF66	Kantartzi	366480	183.24	Susceptible
ExF70	Kantartzi	374000	187.00	Susceptible
G13-1488R2	Li	374960	187.48	Susceptible
G12-1475R2	Li	375200	187.60	Susceptible
Haskell	Li	380660	190.33	Susceptible
ExF97	Kantartzi	396000	198.00	Susceptible
SC10-69	Fallen	397200	198.60	Susceptible
GaSoy 17	Li	402000	201.00	Susceptible
ExF35	Kantartzi	426320	213.16	Susceptible
ExF47	Kantartzi	436000	218.00	Susceptible
ExF95	Kantartzi	440000	220.00	Susceptible
ExF61	Kantartzi	454000	227.00	Susceptible
ExF42	Kantartzi	456000	228.00	Susceptible
ExF13	Kantartzi	560400	280.20	Susceptible

Blue = Resistant

Red = Moderate Resistant

Green = Moderate Susceptible

Black = Susceptible

A list of Public Soybean Breeders commercial lines and varieties from the test years 2013 to 2016 are given (Table 3). These varieties would be especially important for a cotton-soybean rotation where reniform is a problem. Other earlier tests are not given because of rapid replacement of these varieties by new varieties and their subsequent unavailability.

Table 3. Private commercial soybean varieties tested in 2012, 2013, 2014, and 2015 that exhibit variety reniform resistance.

2013	2014	2015	2016
Delta Grow 4940	Delta Grow DG4940RR	Delta Grow DG 4995 RR	Armor AR5206C
ARMOR X1410	Armor AX4520	Go Soy 4914GTS	Delta Grow DG4995 RR
MPG-S-5214NRR	Eagle Seed ES5335RY	Delta Grow DG 5128	Dyno-Gro S49xs76
Willcross RY2513N	LG Seeds C5252R2	Go Soy Leland	Go Soy 4914GTS
Leland	Asgrow AG5535 GENRR2Y		Go Soy 49G16
ARMOR X47C	Willcross WX 2524N		
Schillinger 4712R2	Armor AX4450		
Eagle Seed 5650RR	Dyna-Gro S52RY75		
	Delta Grow DG5230GENRR2Y		
	Mycogen X54522NR2		

Summary

Commercial reniform nematode resistant soybean varieties may be useful in cotton-soybean rotations. Of the 142 private soybean lines tested in 2016 five exhibited adequate resistance to be considered useful in a cotton-soybean rotation (Table 1). All Commercial Varieties tested in 2016 can be found in Table 1.

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