RENIFORM NEMATODE REPRODUCTION ON SOYBEAN CULTIVARS AND BREEDING LINES IN 2014

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Abstract

In 2014, 184 soybean varieties from the Arkansas Variety Testing Program and 179 breeding lines and varieties from Public Soybean Breeders: 5 from USDA Jackson, TN (Arelli), 12 from Clemson (Fallen), 69 from Arkansas (Chen), 14 from the Missouri (Shannon), and 79 from Southern Illinois (Kantartzi) 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 greenhouse studies, the tested lines were grown for 91 days. The RN resistant varieties Anand, Forrest, and Hartwig, the RN susceptible cultivar Braxton, and fallow reniform nematode infested soil 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 Arkansas Variety test lines, 158 were considered suitable hosts; however Armor AX4450, Armor AX4460, Armor AX4520, Asgrow AG5535 GENRR2Y, Croplan R2C4873S, Croplan R2C5103, Delta Grow DG4940RR, Delta Grow DG5230GENRR2Y, Dyna-Gro S52RY75, Eagle Seed ES5335RY, HALO X440, LG Seeds C5252R2, MPG 5214NRR, Mycogen X54522NR2, Progeny P 4848 RYS, Progeny P 4928 LL, REV® 46R64™, S09-6262, S11-20124, S11-20356, and Willcross WX 2524N had a magnitude of resistance that was similar to the resistant controls. Lines S09-6262, S11-20124, and S11-20356 are public breeder lines from Missouri. The Reniform nematode did not reproduce more than: Hartwig on 31 of the 179 and 23 of the Anand 179 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 eighteen 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 and soybean in the United States from the middle-Atlantic states south and west to 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 often linked to resistance obtained from Peking and PI437654 to the soybean cyst nematode (*Heterodera glycines*) and excludes resistance PI-88788. 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, University of Missouri, Clemson University, University of Southern Illinois, and USDA from Jackson Tennessee that have a low rate of reniform nematode reproduction may prove very useful in breeding 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, 2 cultivars (Hartwig, Cordell) with resistance from PI's 437654 and 90763, respectively, and the differentials used in the soybean cyst nematodes race determination tests. A history of the reniform nematode in the South was given to the Southern Soybean Disease Workers (Robbins, 2013b). During the 1999 to 2013 period yearly tests have determined the host status for over 2,100 soybean lines (Robbins, et al., 1999, 2000, 2001, 2002,

2003, 2004, 2005, 2006, 2007a, 2008, 2009, 2010, 2011, 2012, 2013a, 2014). These papers form 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). The objectives of the 2014 study were to: 1) identify new soybean cultivars that are poor hosts for the reniform nematode that would be useful in rotation with cotton or other reniform nematode susceptible crops in reniform nematode infested fields. 2) to identify useful breeding lines for use in selection of new reniform nematode resistant cultivars and 3) to list useful lines for cotton-soybean rotations from 2011 to 2014.

Methods and Materials

The soybean lines and cultivars tested in 2014 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.). 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, Forrest 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 91 days for both the private and public varieties and lines, 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, Forrest and Hartwig was calculated. The log ratio data [log10 (RF + 1)] or [log10 (RA + 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 Arkansas Variety test lines, 158 were considered suitable hosts; however, Armor AX4450, Armor AX4520, Asgrow AG5535 GENRR2Y, Delta Grow DG4940RR, Delta Grow DG5230GENRR2Y, Dyna-Gro S52RY75, Eagle Seed ES5335RY, LG Seeds C5252R2, MPG 5214NRR, Mycogen X54522NR2, and Willcross WX 2524N had a magnitude of resistance that was similar to the higher resistant controls Anand and Hartwig. Lines S09-6262, S11-20124, and S11-20356 are public breeder lines from Missouri; whereas Armor AX4460, Croplan R2C4873S, Croplan R2C5103, HALO X440, Progeny P 4848 RYS, Progeny P 4928 LL, and REV® 46R64™ were not different than Forrest and were not believe to have as useful of level of resistance. The commercially available reniform nematode resistant 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 (Table 1).

Table 1. *Rotylenchulus reniformis* data of Converted Log Ratio, Average count, and Reproduction index (Pf/Pi) on 184 selected soybean cultivars and lines from the Arkansas Soybean Variety Testing Program 2014 tests.

Variety/ Line	Converted Log Ratio	Count Average	RI Pf/Pi
DG4940RR+	***0.569***	***480***	0.24
Fallow	***0.611***	***492***	0.25
S11-20356	***0.681***	***600***	0.30
Anand	***1.000***	***765***	0.38
S11-20124	***1.007***	***828***	0.41
MPG 5214NRR	***1.408***	***1260***	0.59

Armor AX4520	***1.421***	***1188***	0.63
Hartwig	***1.687***	***1856***	0.93
Eagle Seed ES5335RY	***2.021***	***1920***	0.96
LG Seeds C5252R2	***2.352***	***2184***	1.09
AG5535 GENRR2Y*	***2.601***	***2400***	1.20
Willcross WX 2524N	***2.688***	***2724***	1.36
Armor AX4450	***3.367***	***3276***	1.64
Dyna-Gro S52RY75	***3.584***	***3360***	1.68
DG5230GENRR2Y+	***4.099***	***4352***	1.88
Forrest	***4.203***	***3924***	1.96
Mycogen X54522NR2	***4.301***	***3766***	2.18
REV® 46R64™	***6.387***	***7456***	3.73
Armor AX4460	***7.657***	***8168***	4.08
Croplan R2C4873S	***8.252***	***8784***	4.11
HALO X440	***8.336***	***9360***	4.39
Progeny P 4928 LL	***8.868***	***8222***	4.68
S09-6262	***8.963***	***11192***	4.93
Croplan R2C5103	***9.542***	***11232***	5.21
Progeny P 4848 RYS	***9.884***	***12360***	5.23
REV® 56A54™	9.999	19846	5.30
AvDx-D514	10.957	13268	5.45
Dyna-Gro S43RY95	11.003	10462	5.60
Armor AX4500	11.088	10896	5.62
REV 55L95	11.322	11754	5.69
REV® 55R53™	11.530	11580	5.79
REV® 48R22™	11.678	9866	5.88
Croplan LC4713S	11.727	11370	5.92
AvDx-D714	12.062	16240	5.98
Pioneer 95L01	12.069	12840	6.06
BX 4959 RY	12.116	10416	6.13
LG Seeds C4919R2	12.119	11844	6.18
Progeny P 4747 RY	12.585	14172	6.25
HBK LL4953	12.808	13734	6.30
Willcross WX2454N	13.175	15688	6.42
USG 74F53R	13.205	12126	6.63
Armor AX4470	13.209	10594	6.72
Progeny P 4788 RY	13.338	11960	6.74
Mycogen 5N452R2	13.582	20880	6.74
HALO 4:97	13.762	21580	6.80
Progeny P 5213 RY	13.848	15530	6.87
Progeny P 4560 LL	13.966	13860	6.88
Mycogen 5N479R2	14.160	13472	6.93
AG4135 GENRR2Y/SR*	14.324	14880	7.02

Go Soy 4914	14.400	12250	7.09
DG4867LL+	14.591	12596	7.28
Progeny P 4819 LL	14.724	16192	7.36
USG 75J23R	14.807	13476	7.44
Progeny P 4620 LLS	14.853	13756	7.57
Progeny P 4211 RY	14.903	15722	7.77
DG4930GENRR2Y+	15.020	17974	7.82
REV® 47R53™	15.022	18652	7.84
AvDx-D613	15.075	12500	7.86
DG4981LL/STS+	15.106	13432	7.87
REV® 52R74™	15.330	14560	8.10
HALO X445	15.381	17112	8.12
LG Seeds C4696R2	15.456	17096	8.16
Armor 47-R13	15.634	13600	8.21
AvDx-D814	16.306	20708	8.22
AG5335 GENRR2Y/SR*	16.420	16448	8.25
R05-4256	16.471	18902	8.27
USG 75G24L	16.492	21586	8.47
Armor 51-R50	16.689	16545	8.55
Seedway SG 4513	17.036	15140	8.56
Armor AX4550	17.058	22992	8.57
Dyna-Gro S49LS65	17.064	17142	8.73
REV® 49A55™	17.165	16494	8.83
REV® 51R53™	17.412	17764	8.83
Eagle ES4998Y	17.455	17922	8.88
Eagle Seed ES4960RY	17.531	16320	8.89
MorSoy Extra 44X82	17.602	14710	8.96
MPG 4714	17.890	18200	8.99
DG4990LL+	17.982	17972	8.99
REV® 47R34™	18.095	14032	9.09
REV® 49R94™	18.113	24304	9.10
DG5475GENRR2Y+	18.289	27880	9.30
MorSoy Extra 47X12	18.607	17784	9.33
REV® 53R23™	18.636	15634	9.45
REV® 49A75™	18.854	18608	9.50
REV® 49A14™	18.908	21452	9.53
Eagle Seed ES4720RY	18.959	20856	9.77
NK S40-N2	18.991	27758	9.85
AG4835 GENRR2Y/SR*	19.095	16944	9.90
Progeny P 5220 LLS	19.133	20886	9.92
Mycogen 5N540R2	19.273	20044	10.02
MPG 5314NRR	19.584	18990	10.04
HBK LL4653	19.807	28972	10.17

Eagle Seed ES5507RY	19.857	26300	10.17
USG 74B94RS	19.858	22576	10.23
Willcross RY2494NS	19.901	15732	10.34
Croplan LC5253S	20.039	18178	10.35
Armor 53-R16	20.052	17458	10.40
NK S55-C3 Brand	20.407	35662	10.43
Willcross WX2495N	20.725	16416	10.44
Hoegemeyer 4904 NR2S	20.780	33284	10.44
BX 5150 LL	20.911	20672	10.53
Armor 43-R43	21.212	19534	10.57
DG4967LL+	21.219	20342	10.73
MorSoy Extra 48X02	21.336	25322	10.79
BX 4748 LL	21.355	23252	10.79
USG 74G74LS	21.753	17656	10.92
DG4825GENRR2Y/STS+	21.760	19066	10.93
Armor AX4430	22.116	19700	11.07
REV® 54R84™	22.151	17666	11.20
REV® 56R63™	22.155	24292	11.29
REV® 44A15™	22.577	20082	11.50
Armor 46-R65	23.172	20338	11.53
AvDx-V213	23.173	43200	11.58
Armor AX4490	23.262	23694	11.63
DG4985GENRR2Y+	23.347	22136	11.66
MPG 483C	23.359	25910	11.69
Pioneer P53T73SR	23.602	29344	11.72
NK S51-C5 Brand	23.690	20466	11.77
Progeny P 4510 RYS	23.695	30552	11.85
Progeny P 5555 RY	23.852	23066	11.87
HALO X449	23.910	31898	11.90
MorSoy Extra 54X41	24.009	26812	12.15
DG4685GENRR2Y+	24.230	21834	12.15
HALO X448	24.310	27666	12.43
Dyna-Gro S46RY85	24.410	27460	12.45
DG4765GENRR2Y/STS+	24.453	31844	12.66
Eagle Seed ES4840RY	24.545	24852	12.90
AvDx-D914	24.790	21134	12.96
Progeny P 4613 RYS	25.127	19800	13.15
Dyna-Gro S49RY25	25.247	20800	13.41
Armor AX4390	25.455	23160	13.65
Progeny P 4440 RY	25.477	23316	13.68
Armor AX4410	25.616	23748	13.73
HALO X451	25.735	23432	13.75
HALO 4:76	25.969	23536	13.83

Willcross WX 2534N	26.208	29380	13.88
DG5267LL+	26.218	31896	13.94
Armor X447C	26.320	21066	14.42
DG4755GENRR2Y+	27.348	23796	14.49
REV® 48R44™	27.353	21866	14.52
HALO X452	27.572	27352	14.55
DG4925GENRR2Y+	27.816	22400	14.67
Croplan R2C4493	28.629	25800	14.69
Pioneer P52T50R	28.669	29100	14.95
USG 74F24RS	29.033	23380	15.10
Pioneer P56T03R2	29.256	32256	15.23
Mycogen 5N550R2	29.612	33904	15.28
REV® 52A94™	30.119	30466	15.40
Armor AX4440	30.674	32900	15.62
BX 5242 LL	30.719	30206	15.71
Progeny P 5960 LL	30.913	33244	15.75
NK S47-K5 Brand	30.949	29040	15.92
MorSoy Extra 49X54	31.167	27300	15.95
Armor AX4480	31.181	50316	15.95
Eagle Seed ES5225RY	31.194	24900	16.13
Seedway SG 4713	32.201	40572	16.45
Pioneer P45T11R	32.288	33852	16.55
LG Seeds C5122R2	33.208	28840	16.62
DG5565GENRR2Y+	33.405	37772	16.64
Pioneer P48T67L	33.990	31500	16.93
ELLIS	34.038	66124	16.95
Armor 50-R44	34.477	31420	17.40
REV® 57R21™	34.927	33100	17.72
MorSoy Extra 51X31	34.987	30800	17.83
DG5575GENRR2Y+	35.368	46530	17.85
DG5481LL+	35.594	36480	18.15
Go Soy 4713	35.636	27500	18.24
DG4767LL/STS+	36.477	31240	18.42
Pioneer P47T89R	37.533	37860	18.72
Braxton	37.647	36300	18.89
Mycogen X54490NR2	38.248	34800	18.93
MorSoy Extra 48X34	38.277	51200	20.27
DG5367LL+	38.380	55166	20.29
Progeny P 4850 RYS	38.745	29900	20.77
Progeny P 5610 RY	38.860	71364	21.48
Progeny P 4930 LL	39.577	35440	21.60
MorSoy Extra 46X04	39.683	44160	21.65
Armor 48-R66	40.152	35700	22.08

Progeny P 5160 LL	40.882	52564	23.27
Progeny P 4900 RY	40.921	41534	24.05
REV® 49L29™	42.595	37440	24.60
DG5480GENRR2Y+	43.208	36840	25.16
Hoegemeyer 4822 NRR	43.751	40534	25.49
Progeny P 5460 LL	46.216	43300	25.60
Armor AX4471	48.391	42960	26.28
Progeny P 5333 RY	51.376	50980	27.58
MorSoy Extra 53X82	52.302	49200	29.28
Hoegemeyer 5280 NRS	54.678	48100	33.06
DG4775GENRR2Y+	68.734	58560	35.68

* = Asgrow and + = Delta Grow

Red, Bold, Italics = Reniform Reproduction not different than Anand (Resistant). LSD .05 2.243 (Anand).

Blue, Bold, Italics = Reniform Reproduction not different than Hartwig (Resistant). LSD .05 4.024 (Hartwig).

Green, Bold, Italics = Reniform Reproduction not different than Forrest (Resistant). LSD .05 5.311 (Forrest).

The reniform nematode did not reproduce more on 31 lines of Hartwig and 23 lines of Anand on the179 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).

Table 2. *Rotylenchulus reniformis* data of Breeder, Line, Log + 1 mean, Reniform count mean, and Reproduction index = (Pf/Pi) on 179 selected soybean breeding lines cooperating Southern Soybean Breeders 2014 tests.

Breeder	Line	Converted Log Ratio	Reniform Count Mean	Reproductive Index Pf/Pi
Fallow	***Fallow inoculated***	***0.40***	***470***	***0.24***
Resistant	***Hartwig***	***1.00***	***1105***	***0.55***
Shannon	***S12-5562***	***1.08***	***1454***	***0.73***
Shannon	***S12-7977***	***1.12***	***1415***	***0.71***
Arelli	***JTN-5110***	***1.12***	***1522***	***0.76***
Kantartzi	***Hartwig(Kantartzi)***	***1.15***	***1506***	***0.75***
Kantartzi	***Peking bg1***	***1.15***	***1612***	***0.81***
Fallen	***TN12-6502R2***	***1.24***	***1606***	***0.80***
Fallen	***TN12-5712R2***	***1.30***	***1881***	***0.94***
Shannon	***S11-15857***	***1.31***	***1701***	***0.85***
Shannon	***S12-5912***	***1.37***	***1855***	***0.93***
Kantartzi	***FH21***	***1.39***	***2001***	***1.00***
Fallen	***TN12-5713R2***	***1.57***	***2048***	***1.02***
Shannon	***S12-5942***	***1.62***	***2132***	***1.07***
Fallen	***TN09-44,121R2***	***1.65***	***2048***	***1.02***
Fallen	***SC98-1930***	***1.67***	***1940***	***0.97***

Kantartzi	***FHRIL35***	***1.69***	***2107***	***1.05***
Fallen	***TN09-44,420R2***	***1.69***	***5821***	***2.91***
Shannon	***S12-4465***	***1.92***	***2166***	***1.08***
Shannon	***S11-16653***	***1.97***	***2694***	***1.35***
Resistant	***Anand***	***2.00***	***2534***	***1.27***
Kantartzi	***Peking bg2***	***2.05***	***3093***	***1.55***
Kantartzi	***FH5***	***2.21***	***3263***	***1.63***
Kantartzi	***FH19***	***2.32***	***2857***	***1.43***
Kantartzi	***FH37***	***2.43***	***3177***	***1.59***
Arelli	***DC 2864 AM***	***2.57***	***4255***	***2.13***
Kantartzi	FH8	2.74	4219	2.11
Kantartzi	FH25	2.75	14964	7.48
Shannon	S11-16882	3.08	5011	2.51
Kantartzi	FRIL72	3.80	7640	3.82
Shannon	S12-8325	3.94	5050	2.53
Kantartzi	FH60	4.01	4941	2.47
Arelli	JTN-4114	4.54	7905	3.95
Kantartzi	FHRIL74	4.75	5703	2.85
Chen	R11-262	5.02	21779	10.89
Chen	R08-3119	5.12	12490	6.25
Shannon	S12-3807	5.92	7847	3.92
Kantartzi	FH1	6.23	13635	6.82
Kantartzi	FH14	6.35	14200	7.10
Fallen	TN12-5706R2	6.38	8350	4.18
Fallen	TN12-6508R2	6.42	10750	5.38
Kantartzi	FH28	7.29	14879	7.44
Kantartzi	FHRIL48	7.82	19281	9.64
Chen	R11-1578	8.19	17169	8.58
Chen	R08-2797	8.25	16205	8.10
Chen	R09-1237	8.35	16645	8.32
Kantartzi	FH12	8.39	11317	5.66
Chen	R07-2001	8.75	21474	10.74
Kantartzi	FH22	8.93	15983	7.99
Kantartzi	FHRIL40	9.06	20408	10.20
Chen	R05-3239	9.19	31661	15.83
Kantartzi	FH18	9.30	18137	9.07
Kantartzi	FH16	9.47	19809	9.90
Kantartzi	FH17	9.48	28836	14.42
Kantartzi	FH65	9.55	15793	7.90
Kantartzi	FHRIL74	9.63	20745	10.37
Chen	R10-4892	9.69	22746	11.37
Kantartzi	FHRIL44	9.83	21978	10.99
Chen	R10-2436	9.87	19204	9.60

Chen	R08-4002	9.91	39464	19.73
Kantartzi	FHRIL50	10.04	18021	9.01
Shannon	S12-3835	10.19	15387	7.69
Arelli	JTN-4214	10.19	18235	9.12
Chen	R10-130RY	10.28	19417	9.71
Kantartzi	FH3	10.68	18357	9.18
Chen	Osage	11.34	17726	8.86
Kantartzi	FH62	11.48	19103	9.55
Kantartzi	FH31	11.54	18400	9.20
Kantartzi	FH33	11.60	15283	7.64
Chen	R09-5137	11.70	22405	11.20
Chen	R09-4095	11.92	24683	12.34
Chen	R10-5795	11.99	20059	10.03
Chen	R10-197RY	12.01	58054	29.03
Chen	R09-4571	12.05	17183	8.59
Kantartzi	FHRIL52	12.12	29817	14.91
Kantartzi	FH73	12.16	15750	7.88
Chen	R10-453RY	12.38	15917	7.96
Chen	R08-4004	12.45	24250	12.13
Chen	R09-4798	12.45	17283	8.64
Kantartzi	FH20	12.47	18200	9.10
Chen	R10-2465	12.48	24605	12.30
Kantartzi	FH51RIL	12.50	19541	9.77
Kantartzi	FH13	12.59	23087	11.54
Arelli	DC 7816 AM	12.63	30874	15.44
Chen	R07-6614RR	12.76	22425	11.21
Kantartzi	FHRIL54	12.85	22307	11.15
Chen	UA 5213C	12.98	21602	10.80
Kantartzi	FHRIL47	13.10	26489	13.24
Kantartzi	FHRIL39	13.31	17600	8.80
Chen	R10-3747	13.54	20697	10.35
Fallen	SC10-400RR	13.83	33547	16.77
Kantartzi	FH58	14.06	20000	10.00
Chen	R10-428RY	14.48	27157	13.58
Kantartzi	FH66	14.66	24687	12.34
Shannon	S12-3318	14.78	18517	9.26
Chen	R02-6268F	14.86	21500	10.75
Blank	RIL41	14.89	27729	13.86
Shannon	S12-3064	14.99	41322	20.66
Kantartzi	FHRIL49	15.03	22665	11.33
Kantartzi	FHRIL45	15.10	33377	16.69
Chen	R10-4892	15.10	19983	9.99
Chen	R11-2354	15.11	20633	10.32

Kantartzi	FH29	15.62	18483	9.24
Chen	R07-167	15.68	25912	12.96
Chen	R09-3789	16.01	27323	13.66
Chen	R11-2517	16.03	21417	10.71
Fallen	SC10-456RR	16.08	27300	13.65
Chen	UA 5612	16.13	19700	9.85
Chen	R11-927	16.15	39067	19.53
Chen	Ozark	16.31	25433	12.72
Kantartzi	FHRIL53	16.41	23633	11.82
Chen	R09-1822	16.54	29151	14.58
Kantartzi	FH7	16.97	38864	19.43
Kantartzi	FH4	16.99	34716	17.36
Kantartzi	FH32	17.11	23533	11.77
Kantartzi	FHRIL67	17.14	23617	11.81
Kantartzi	FH24 DAL	17.25	22283	11.14
Chen	R09-345	17.26	29566	14.78
Kantartzi	FH6	17.28	32105	16.05
Kantartzi	FH57	17.31	24833	12.42
Chen	R04-1250RR	17.37	23000	11.50
Kantartzi	FH38	17.44	21867	10.93
Kantartzi	FH15	17.60	29637	14.82
Kantartzi	FH55	17.65	35066	17.53
Chen	R09-5026	17.78	29917	14.96
Kantartzi	FH68	17.81	20933	10.47
Chen	R09-4798	17.97	24800	12.40
Kantartzi	FHRIL43	18.05	24183	12.09
Kantartzi	FH9	18.06	32567	16.28
Kantartzi	FH26	18.25	22567	11.28
Kantartzi	FHRIL42	18.57	41985	20.99
Chen	R11-1192	18.62	34607	17.30
Kantartzi	FH23	18.71	23183	11.59
Shannon	S12-3443	18.86	26683	13.34
Chen	R11-1546	18.93	32100	16.05
Chen	R10-5086	18.97	37763	18.88
Kantartzi	FH2	19.20	34175	17.09
Chen	R07-2004	19.64	25317	12.66
Kantartzi	FHRIL56	20.00	24617	12.31
Chen	R10-230	20.15	30433	15.22
Kantartzi	FH27	20.25	27217	13.61
Kantartzi	FH70	20.30	46803	23.40
Chen	R11-7141	20.38	30100	15.05
Chen	R09-1589	20.44	69183	34.59
Chen	R11-89RY	20.44	28167	14.08

Chen	R05-4256	20.51	32085	16.04
Kantartzi	FH30	20.52	27550	13.78
Chen	R10-28	20.62	31067	15.53
Chen	R11-245	20.85	29167	14.58
Kantartzi	FH10	20.93	27533	13.77
Chen	R07-10397	21.22	27733	13.87
Chen	R11-4306	21.37	27350	13.68
Fallen	SC10-394RR	21.48	30850	15.43
Chen	R11-2299	21.70	27150	13.58
Fallen	SC10-397RR	21.94	43968	21.98
Kantartzi	FH76	22.06	28633	14.32
Chen	R09-430	22.64	35400	17.70
Chen	R08-1450	23.12	34750	17.38
Chen	R05-374	23.22	27700	13.85
Chen	R07-2000	23.31	33217	16.61
Chen	R04-1268RR (UA 5414RR)	23.69	30067	15.03
Kantartzi	RIL41	23.83	43048	21.52
Kantartzi	FH61	23.91	29433	14.72
Kantartzi	FHRIL64	24.14	35367	17.68
Kantartzi	FH36	24.30	29667	14.83
Chen	R11-213RY	24.82	33050	16.53
Chen	R11-2419	25.34	28767	14.38
Chen	R11-1617	25.74	32433	16.22
Chen	R10-1191	25.82	30750	15.38
Kantartzi	FH24	27.36	35167	17.58
Chen	R07-7044	27.94	55883	27.94
Chen	R11-171	28.46	41983	20.99
Kantartzi	FHRIL59	28.60	48383	24.19
Chen	R10-5828	29.15	52683	26.34
Susc	Braxton	29.48	34000	17.00
Kantartzi	FHRIL46	32.03	69883	34.94
Kantartzi	FH11	32.04	43833	21.92
Chen	R10-366RY	34.45	43400	21.70
Chen	R11-1057	35.80	43000	21.50
Chen	R11-1756	36.24	68667	34.33
Kantartzi	FH63	36.36	56300	28.15
Kantartzi	FH69	36.44	47017	23.51
Chen	R11-2282	39.66	57650	28.83

Blue, Bold, Italics = Reniform Reproduction not different than Hartwig (Resistant). LSD 0.05 = 1.568 (Hartwig).

Red, Bold, Italics = Reniform Reproduction not different than Anand (Resistant). LSD 0.05 = 3.75 (Anand)

List of Public Soybean Breeders commercial lines and varieties from the test years 2011 to 2014 are given with their Reproductive Indexes (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 2011, 2012, 2013, and 2014 with their Reproductive Indexes that exhibit variety reniform resistance and those of the susceptible check Braxton.

Year/Variety	Reproductive Index
2011	
JTN-5203	0.64
Delta Grow DG5252R2Y	1.14
Progeny 5191	2.44
Braxton (Susceptible Check)	23.00
2012	
Armor 49-C3	1.01
MPG 5214	1.04
REV®55R83	2.02
Braxton (Susceptible Check)	64.70
2013	
MPG-S-5214NRR	1.47
Delta Grow 4940	2.74
ARMOR X1410	3.15
Willcross RY2513N	3.28
Leland	6.70
Braxton (Susceptible Check)	165.90
2014	
Delta Grow DG4940RR	0.24
MPG 5214NRR	0.59
Armor AX4520	0.63
Eagle Seed ES5335RY	0.96
LG Seeds C5252R2	1.09
Asgrow AG5535 GENRR2Y	1.20
Willcross WX 2524N	1.36
Armor AX4450	1.64
Dyna-Gro S52RY75	1.68
Delta Grow DG5230GENRR2Y	1.96
Mycogen X54522NR2	2.18
Braxton (Susceptible Check)	18.89

Summary

Reniform nematode resistant soybean varieties may be useful in cotton-soybean rotations. Of the 184 private soybean lines tested in 2014 eleven exhibited adequate resistance to be considered useful in a cotton-soybean rotation (Table 3). All Varieties tested can be found in Table 1. Public breeding lines with a useful level of reniform resistance in varieties and breeding lines tested in 2014 are listed in Table 2. Of 2014's 179 public breeding lines varieties and lines 31 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 2011 are listed. Annual Reproductive Indexes of Reniform nematode have been reported by the Senior since 1998. Finding the older varieties may be a challenge as many private varieties last only a very few seasons.

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