RENIFORM NEMATODE REPRODUCTION ON SOYBEAN CULTIVARS AND BREEDING LINES IN 2011

R. T. Robbins
Univ. of Arkansas
Fayetteville, AR
E. Shipe
Clemson University
Clemson, SC
P. Arelli
USDA
Jackson, TN
G. Shannon
Univ. of Missouri
Portageville, MO
K. M. Rainey
Virginia Tech
Blacksburg, VA
P. Chen
Univ. of Arkansas
Fayetteville, AR
Stella K. Kantartzi
Southern Illinois University-Carbondale,
Carbondale, IL
L. E. Jackson
E. E. Gbur
D. G. Dombek
J. T. Velie1
Univ. of Arkansas
Fayetteville, AR

Abstract

During 2011, 147 soybean varieties from the Arkansas Variety Testing Program and 134 breeding lines and varieties from Public Soybean Breeders: 68 from Arkansas (Chen), 21 from Clemson (Shipe), 4 from the USDA Jackson TN (Arelli), 16 from the Missouri (Shannon), 1 from Virginia Tech (Rainey), and 24 from Southern Illinois (Kantartzi) were tested in the greenhouse to determine their suitability as hosts for the reniform nematode, *Rotylenchulus reniformis*. All treatments were inoculated with 2,000 vermiform RN. The Variety Testing Varieties were grown for 82 days and the Public Breeders Lines for 104 days. The RN resistant varieties Anand, Forrest, and Hartwig, the RN susceptible variety Braxton, and fallow reniform nematode infested soil served as controls. The mean number of vermiform nematodes extracted from the soil of each treatment was calculated, as were the reproductive indices (RI = Pf/Pi), and PF/PI's of Anand, Hartwig, and Forrest for both tests. Arkansas Variety testing Program cultivars with RI's significantly greater than the RI on the resistant checks Anand, Hartwig and Forrest were considered suitable hosts for *R. reniformis*. Of the Arkansas test varieties 144 of 147 supported more reproduction than Anand, Hartwig and Forrest. The following varieties; Progeny 5191, Delta Grow DG5252R2Y, and JTN-5203 (Exp. Variety from USDA Jackson, TN) were not different than Anand, Hartwig and Forrest. The reniform nematode did not reproduce more than on Anand on 17 of the 134 breeding lines and varieties submitted by Public Soybean Breeders and may be of interest in reniform nematode resistant soybean breeding programs. The soybean varieties and lines that did not support more reproduction than the 3 resistant checks (Anand, Hartwig and Forrest) may be useful in a Cotton-Soybean Rotation to reduce the numbers of reniform nematodes and allow cotton to be grown economically. This is especially important because many chemical nematicides are being phased out.

Introduction

In the United States from Texas eastward reniform nematode (*Rotylenchulus reniformis*) causes considerable damage and yield loss to cotton and soybean. Presently no commercial upland cotton varieties have reniform nematode resistance, whereas several sources of reniform nematode resistance exist in soybean. This resistance is

often linked to resistance to the soybean cyst nematode (*Heterodera glycines*). Use of reniform nematode resistant soybean in a rotation with cotton can be a useful option. Public soybean breeding lines from programs at Arkansas, Clemson, Missouri, North Carolina, Virginia Tech, and USDA in 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 RN 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. During the 1999 to 20011 period yearly tests have shown the host status for over 1,950 soybean lines (Robbins et al. 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007a, 2008, 2009, 2010, 2011). 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) The objectives of the 2011 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.

Methods

The soybean test lines and cultivars in 2011 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 (ca. 86% sand, 11% silt, 3 % 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 three, 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 a survivor control. After 82 days for the private varieties and 104 days for the public 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

Three lines in the Arkansas Soybean Variety program tested had log ratios not significantly ($P \leq 0.05$) higher than Anand, Forrest, and Hartwig (Red in Table 1). This indicates they were not different in supporting reproduction from the three resistant checks.

Table 1. *Rotylenchulus* reniformis reproduction on 147 selected soybean cultivars and lines from the Arkansas Soybean Variety Testing Program in 2011 tests.

Cultivar or Check	Cultivar Log +1 Mean	Nematode Count Mean	Cultivar RI = Pf/Pi Mean
Fallow	0.107	780	0.39
JTN-5203	0.163	1284	0.64
Delta Grow DG5252R2Y	0.242	2280	1.14
Hartwig	0.251	2684	1.34

Anand	0.333	2748	1.37
Forrest	0.410	5160	2.58
PROGENY 5191	0.356	4884	2.44
Hanover	0.702	13100	6.55
HBK RY5121	0.787	19412	9.71
Morsoy Xtra 48X00	0.849	21212	10.61
Delta Grow DG4875R2Y	0.804	21408	10.70
USG 75R31R	0.911	21608	10.80
Nidera N-Exp-52011	0.966	23200	11.60
Dyna-Gro 32RY55	0.969	24112	12.06
Delta Grow DG5110R2Y	0.849	24832	12.42
Davis D-246RR2Y	0.922	25068	12.53
Croplan R2C4110	0.987	25100	12.55
Croplan R2C4801	0.977	25268	12.63
Dyna-Gro 39D48	0.992	25500	12.75
Pioneer 94Y81	1.013	25800	12.90
Armor 48-R40	1.014	26900	13.45
Morsoy 4824	1.012	26900	13.45
ASGROW AG5632	1.016	27000	13.50
ASGROW AG5332	0.921	27208	13.60
Syngenta S39-U2 Brand	0.955	27484	13.74
REV®48R33™	1.016	27800	13.90
Davis D-149RRCNS	0.998	27804	13.90
REV®51R53™	1.027	28000	14.00
Delta Grow DG5545RR	1.046	28200	14.10
S08-14087	1.039	28300	14.15
Morsoy Xtra 46X29	1.047	29200	14.60
PROGENY 4928 LL	1.062	29400	14.70
Croplan R2C4220	0.959	29764	14.88
Morsoy 5209	0.960	29884	14.94
Croplan R2C4660	1.059	30300	15.15
DB00-087-08	1.052	31200	15.60
Morsoy Xtra 51X31	0.996	31508	15.75
Morsoy Xtra 53X51	1.075	31600	15.80
Morsoy Xtra 54X41	0.846	32144	16.07
Armor X1210	1.110	32800	16.40
Go Soy 4411 LL	1.096	33100	16.55
Syngenta S46-A1 Brand	1.107	33300	16.65
Davis D-147RRCNS	0.988	33496	16.75
ASGROW AG5832	1.086	33500	16.75
Morsoy 4707	1.095	34000	17.00
ASGROW AG4632	1.096	34100	17.05
REV®49R43™	1.126	34200	17.10

PROGENY 5321 RY	1.119	34300	17.15
Syngenta S51-J3 Brand	1.092	34700	17.35
ASGROW AG4232	1.128	35000	17.50
HBK R4830	0.998	35052	17.53
Stine 50LC82	1.128	35200	17.60
Morsoy Xtra 46X71	1.113	35300	17.65
Schillinger 5220. RC	1.115	35300	17.65
Delta King DK 5363	1.062	35356	17.68
HBK RY5221	1.027	35820	17.91
ASGROW AG4832	1.118	36300	18.15
Croplan R2C4520	1.067	36760	18.38
Armor X1213	1.139	37300	18.65
HBK RY4721	1.131	37300	18.65
Atlanta 1047RR2Y	1.118	37900	18.95
Delta Grow DG4861LL	1.133	37900	18.95
Armor 53-R15	1.140	38000	19.00
Croplan R2C5360	1.137	38100	19.05
S08-17361	1.124	38116	19.06
Delta Grow DG5275R2Y	1.018	38552	19.28
Morsoy 5168	1.165	38700	19.35
USG 74D41R	1.163	38700	19.35
USG 74H81	1.073	38800	19.40
Nashville 749RR	1.018	39076	19.54
Morsoy 5388	1.165	39200	19.60
REV®56R63™	1.133	39300	19.65
Delta Grow DG5656R2Y	1.159	39500	19.75
Armor X1255	1.161	39800	19.90
ASGROW AG5532	1.174	40000	20.00
ASGROW AG5232	1.100	40200	20.10
Armor X1218	1.179	40500	20.25
REV®47R53™	1.155	40500	20.25
PROGENY 4611 RY	1.134	40600	20.30
USG 74F11R	1.148	41300	20.65
Armor X1217	1.144	41400	20.70
Stine 48RC32	1.127	41500	20.75
REV®46R73™	1.144	41600	20.80
Armor X1216	1.165	41900	20.95
PROGENY 4811 RY	1.192	42000	21.00
USG 75B21R	1.172	42400	21.20
HALO 4:75	1.164	42900	21.45
PROGENY 3911 RY	1.132	42900	21.45
Armor X1215	1.055	43496	21.75
Go Soy 4810 LL	1.210	43600	21.80

Go Soy 5111 LL	1.107	43752	21.88
Miami	0.991	44016	22.01
Syngenta S42-T4 Brand	1.158	44300	22.15
Armor X1208	1.181	45000	22.50
Pioneer 95Y71	1.210	45100	22.55
Morsoy 4955	1.168	45300	22.65
Morsoy Xtra 49X10	1.195	45300	22.65
Dyna-Gro 37LL50	1.213	45700	22.85
Morsoy 4860	1.177	46000	23.00
Braxton	1.235	46000	23.00
Houston 747RR	1.193	46200	23.10
REV®48R22™	1.212	46300	23.15
Armor X1209	1.097	46392	23.20
Armor X1253	1.231	46600	23.30
V04-1022	1.228	47100	23.55
HBK RY5421	1.239	47300	23.65
Morsoy Xtra 47X31	1.193	47400	23.70
PROGENY 5811 RY	1.220	47500	23.75
Go Soy 5911 LL	1.235	47900	23.95
PROGENY 4911 RY	1.216	48100	24.05
ASGROW AG4732	1.222	48300	24.15
R06-2082RR	1.121	49076	24.54
Armor X1211	1.221	49200	24.60
Dyna-Gro 39RY43	1.220	49200	24.60
PROGENY 5261 LL	1.160	50300	25.15
Morsoy 5429	1.226	50700	25.35
ASGROW AG4932	1.248	50900	25.45
Delta Grow 5565R2Y	1.269	51200	25.60
Nidera N-Exp-55011	1.264	51400	25.70
R04-1268RR	1.231	51800	25.90
AGS 6011 LL	1.295	51900	25.95
Eagle Seed ES5507	1.230	52100	26.05
PROGENY 5111 RY	1.227	52700	26.35
Armor X1205	1.128	53128	26.56
REV®48R21™	1.259	54600	27.30
AGS 6011 LL	1.295	55100	27.55
Armor X1204	1.324	56700	28.35
Dyna-Gro 31RY45	1.221	56800	28.40
PROGENY 5711 RY	1.242	56900	28.45
Nidera N-Exp-58011	1.295	57000	28.50
Croplan R2C5081	1.300	57200	28.60
PROGENY 5960 LL	1.256	57400	28.70
HBK RY5226	1.136	57460	28.73

PROGENY 5655 RY	1.308	57600	28.80
PROGENY 4211 RY	1.331	57700	28.85
PROGENY 5460 LL	1.259	60200	30.10
PROGENY 5160 LL	1.224	61876	30.94
Delta Grow DG4670R2Y	1.328	62900	31.45
Armor X1206	1.231	63300	31.65
HALO 5:25	1.300	63800	31.90
USG 75G90L	1.347	65500	32.75
Dyna-Gro 34LL53	1.304	65900	32.95
Armor X1247	1.269	66400	33.20
Delta Grow DG5625R2Y	1.366	66400	33.20
Whitney 1154LL	1.383	87000	43.50

Blue not different from Anand, Hartwig or Forrest

From a total of 134 Public Breeder lines and cultivars in the test of the Arkansas, Clemson, USDA Jackson TN, Missouri, Southern Illinois, and Virginia Tech 17 were not significantly higher than Forrest (Red, in Table 2). From the 17 resistant lines and cultivars tested; six were from Arkansas, five were from Clemson, three were from Missouri, two were from USDA Jackson, one from Southern Illinois and none from Virginia Tech. These lines may be useful in breeding new soybean varieties with resistance to the reniform nematode. They would be especially important if they are also shown to also have soybean cyst and root knot nematode resistance.

Table 2. *Rotylenchulus reniformis* reproduction on 134 Breeding Lines and selected cultivars in 2011 tests.

Soybean Line	Breeder	Cultivar Log+1 Mean	Reniform counts Mean	Cultivar RI+ Pf/Pi Mean
JTN-5303	*Arelli*	*0.127*	*624*	*0.31*
Fallow	*Check*	*0.137*	*672*	*0.34*
S08-14892	*Shannon*	*0.172*	*840*	*0.42*
JTN-5503	*Arelli*	*0.183*	*888*	*0.44*
Anand	*Check*	*0.203*	*1020*	*0.51*
Jake	*Chen*	*0.231*	*1164*	*0.58*
SC98-1930	*Shipe*	*0.264*	*1320*	*0.66*
R07-10231	*Chen*	*0.347*	*1728*	*0.86*
JTN-5503	*Chen*	*0.368*	*1836*	*0.92*
Hartwig	*Check*	*0.408*	*2172*	*1.09*
R07-10244	*Chen*	*0.432*	*2100*	*1.05*
SC06-045	*Shipe*	*0.601*	*3024*	*1.51*
R07-1810	*Chen*	*0.685*	*3516*	*1.76*
S09-14175	*Shannon*	*0.954*	*4740*	*2.37*
Forrest	*Check*	*1.000*	*4840*	*2.42*
LS07-1934	*Kantartzi*	*1.197*	*6600*	*3.30*
SC06-051	Shipe	1.299	6588	3.29

S09-14199	Shannon	1.482	7404	3.70
MOTTE	Shipe	1.869	10800	5.40
SANTEE	Shipe	1.870	9116	4.56
R05-269	Chen	1.872	13896	6.95
S09-18244	Shannon	2.039	14148	7.07
S09-13176	Shannon	2.062	10908	5.45
LS07-2014	Kantartzi	2.458	12740	6.37
Hanover = V03-4705	Rainey	2.480	16572	8.29
SC02-208	Shipe	2.621	13936	6.97
SC05-642	Shipe	2.661	13640	6.82
LS07-2935	Kantartzi	2.758	15368	7.68
R07-1769	Chen	2.874	15348	7.67
SC07-786	Shipe	3.006	15800	7.90
SC07-1490	Shipe	3.057	17156	8.58
S08-6786	Shannon	3.057	18964	9.48
R06-4475	Chen	3.259	16640	8.32
Glenn	Chen	3.264	19564	9.78
Caviness	Chen	3.300	21716	10.86
LS08-5515	Kantartzi	3.347	20724	10.36
LS05-3229	Kantartzi	3.363	16300	8.15
SC06-306	Shipe	3.476	26112	13.06
S09-13185	Shannon	3.487	17200	8.60
LS08-4418	Kantartzi	3.558	19508	9.75
LS08-4934	Kantartzi	3.581	19404	9.70
R98-209	Chen	3.583	19268	9.63
LS08-4542	Kantartzi	3.609	22320	11.16
LS08-4348	Kantartzi	3.613	19396	9.70
R05-3817	Chen	3.656	20200	10.10
R07-1738	Chen	3.658	22284	11.14
LS08-6003	Kantartzi	3.688	20700	10.35
R04-1268RR	Chen	3.878	20400	10.20
LS08-5852	Kantartzi	3.899	22000	11.00
UA 4805	Chen	3.921	22100	11.05
SC06-5733	Shipe	3.946	24500	12.25
R08-141	Chen	3.947	26116	13.06
R97-1634	Chen	4.032	23932	11.97
SC06-013	Shipe	4.156	21500	10.75
AG4605	Chen	4.166	21500	10.75
S09-14162	Shannon	4.188	20800	10.40
AG5905	Chen	4.224	21400	10.70
RO1-581F	Chen	4.277	21600	10.80

AG5606	Chen	4.283	20900	10.45
LS08-6034	Kantartzi	4.285	22744	11.37
R07-1857	Chen	4.311	22900	11.45
LS07-1942	Kantartzi	4.335	24948	12.47
R07-1685	Chen	4.402	22940	11.47
R06-4433	Chen	4.422	24304	12.15
JTN-5111	Arelli	4.454	22100	11.05
R08-265	Chen	4.509	31870	15.94
R06-1270	Chen	4.528	26172	13.09
LS08-4941	Kantartzi	4.557	23656	11.83
R08-2687	Chen	4.624	30848	15.42
R07-6669	Chen	4.637	22700	11.35
LS07-3125	Kantartzi	4.731	25968	12.98
LS08-3120	Kantartzi	4.786	30564	15.28
AG4907	Chen	4.789	24000	12.00
SC06-5214	Shipe	4.847	32804	16.40
UARK-5798	Chen	4.865	27500	13.75
Narow	Chen	4.874	23700	11.85
R06-2082RR	Chen	4.901	33516	16.76
R05-374	Chen	4.906	27000	13.50
S08-9727	Shannon	4.934	33176	16.59
S09-18186	Shannon	4.984	27700	13.85
S09-14007	Shannon	5.112	25500	12.75
R03-1250	Chen	5.113	27700	13.85
R07-10322	Chen	5.132	25700	12.85
SC06-5640	Shipe	5.167	31564	15.78
R07-6654	Chen	5.181	32000	16.00
LS03-4294	Kantartzi	5.200	30688	15.34
LS07-1343	Kantartzi	5.200	26700	13.35
R01-3474F	Chen	5.224	28700	14.35
R04-572	Chen	5.256	27300	13.65
S09-10857	Shannon	5.351	28200	14.10
R01-327	Chen	5.374	33672	16.84
R99-1613F	Chen	5.400	28200	14.10
SC06-247	Shipe	5.405	38456	19.23
R04-342	Chen	5.415	28900	14.45
LS07-3131	Kantartzi	5.425	29432	14.72
UA 4910	Chen	5.571	27700	13.85
Ozark	Chen	5.573	27400	13.70
SC06-007	Shipe	5.684	28700	14.35
LS08-4637	Kantartzi	5.714	32000	16.00

R05-4114	Chen	5.799	31600	15.80
LS08-6332	Kantartzi	5.844	29000	14.50
JTN-5211	Arelli	5.858	29600	14.80
LS08-4141	Kantartzi	5.864	932	20.47
R04-122	Chen	5.941	29200	14.60
R07-5351	Chen	6.065	29800	14.90
MAXCY	Shipe	6.068	38000	19.00
Lonoke	Chen	6.120	31600	15.80
R01-976	Chen	6.122	31400	15.70
S08-17361	Shannon	6.314	38484	19.24
SC06-5306	Shipe	6.366	35200	17.60
S09-14180	Shannon	6.406	39100	19.55
LS08-5837	Kantartzi	6.613	35000	17.50
R07-1882	Chen	6.653	37900	18.95
S08-17361	Shannon	6.712	37200	18.60
R01-2731F	Chen	6.719	34200	17.10
Braxton	Check	6.755	34300	17.15
SC06-291	Shipe	6.946	44408	22.20
R05-3239	Chen	6.956	46944	23.47
LS08-5552	Kantartzi	7.037	43000	21.50
Walters	Chen	7.063	38400	19.20
R01-416F	Chen	7.107	36300	18.15
SC06-260	Shipe	7.134	41100	20.55
R04-522	Chen	7.161	35800	17.90
Desha	Chen	7.276	38700	19.35
Osage	Chen	7.628	46528	23.26
R02-3065	Chen	7.700	68752	34.38
R08-991	Chen	7.774	43500	21.75
R04-357	Chen	7.937	47200	23.60
HAGOOD	Shipe	8.703	42625	21.31
R08-1178	Chen	9.139	48000	24.00
R05-235	Chen	9.169	47100	23.55
Lee	Chen	9.170	53100	26.55
5002T	Chen	9.785	57000	28.50
Hutcheson	Chen	9.923	62800	31.40
R04-1250RR	Chen	10.395	60900	30.45
S09-14144	Shannon	10.465	89800	44.90
UARK-5896	Chen	10.639	63400	31.70
R08-47	Chen	12.726	69100	34.55

Red is not different than Forrest, *Red italics is not different than Hartwig*, Red Underlined is not different than Anand .

Table 3 lists the public varieties from the test years 2008, 2009, 2010, and 2011. These varieties would be especially important for a soybean-cotton rotation where reniform nematode is present.

Table 3. Soybean varieties tested in 2008, 2009, and 2010 showing Reniform nematode resistance that could be of use in a Cotton-Soybean rotation.

2008	2009	2010	2011
AgVentureAV 53D3NRR	DB04-10836	Armor ARX492	JTN-5203
Armor 39-K4	DB04-10997	ASGROW AG5431	Delta Grow DG5252R2Y
ASGROW AG 4705	MorSoy RT4919N	ASGROW AG5531	Progeny 5191
ASGROW AG 5606	Pioneer 95Y30	HBK RY5520	
Eagle Seed ES 4818RR	V03-4705	SSC-049N	
Eagle Seed ES 4906RR		SSC-051N	
Eagle Seed ES 5121RR		USG 75T40	
MPG 5308nRR			
Progeny 4508RR			

Summary

Reniform nematode resistant soybean varieties maybe useful in cotton-soybean rotations. Of 147 private soybean varieties tested in 2011 only 3 showed adequate resistance to be considered useful in a cotton-soybean rotation. 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 2011 are listed in table 2. Of 134 varieties and lines 17 are of possible use in reniform resistance breeding programs. Those with resistance to root-knot nematode would be especially important in breeding programs.

In table 3 all soybean varieties with levels of resistance to reniform nematode useful in cotton-soybean rotations are listed. Finding the older varieties may be a challenge as many private varieties last only a very few seasons.

References

Jenkins, W. R., 1964. A rapid centrifugal-flotation technique for separating nematodes from soil. Plant Disease Reporter 48:692.

Robbins, R. T., L. Rakes, and C. R. Elkins. 1994. Reproduction of the reniform nematode on thirty soybean cultivars. Supplement to the Journal of Nematology 26:659-664.

Robbins, R. T., and L. Rakes. 1996. Resistance to the reniform nematode in selected soybean cultivars and germplasm lines. Journal of Nematology 28:612-615.

Robbins, R. T., L. Rakes, L. E. Jackson, and D. G. Dombek. 1999. Reniform nematode resistance in selected soybean cultivars. Supplement to the Journal of Nematology 31:667-677.

Robbins, R. T., L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2000. Host suitability in soybean cultivars for the reniform nematode, 1999 tests. Supplement to the Journal of Nematology Vol. 32:614-621.

Robbins, R. T., L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2001. Host suitability in soybean cultivars for the reniform nematode, 2000 tests. Supplement to the Journal of Nematology Vol. 33:314-317.

Robbins, R. T., E. R. Shipe, L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2002. Host suitability in soybean cultivars for the reniform nematode, 2001 tests. Supplement to the Journal of Nematology Vol. 33 378-383.

Robbins, R. T., E. R. Shipe, L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2003. Host suitability in soybean cultivars for the reniform nematode, 2001 tests. Proceeding, Beltwide Cotton Conferences, Nashville, TN, January 2003.

Robbins, R. T., L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2004. Reniform Nematode Reproduction on Soybean in Tests conducted in 2003. Proceeding, Beltwide Cotton Conferences, San Antonio, TX, January 2004.

Robbins, R. T., P. Chen, L. Rakes, L. E. Jackson, E. E. Gbur,D. G. Dombek, and E. Shipe. 2005. Reniform nematode reproduction on soybean cultivars in tests conducted in 2004. Proceedings of the Beltwide Cotton Conferences, New Orleans, 137-145.

Robbins, R. T., L. Rakes, L. E. Jackson, E. E. Gbur, D. G. Dombek, P. Chen, E. Shipe and G. Shannon. 2006. Reniform nematode reproduction on soybean cultivars and breeding lines in 2005 tests. Proceedings of the Beltwide Cotton Conferences, San Antonio, 46-59.

Robbins, R. T., E. Shipe,P. Arelli, P. Chen, G. Shannon, L. Rakes, L. E. Jackson, E. E. Gbur, and D. G. Dombek. 2007a. Reniform nematode reproduction on soybean cultivars and breeding lines in 2006 tests. Proceedings of the Beltwide Cotton Conferences, New Orleans, 161-169.

Robbins, R. T., E. Shipe, G. Shannon, P. Arelli, and P. Chen. 2007b. Public soybean breeding lines tested for reniform nematode (*Rotylenchulus reniformis*) reproduction. Journal of Nematology 39:92.

Robbins, R. T., E. Shipe, P. Arelli, P. Chen, L. Rakes, L. E. Jackson, E. E. Gbur and D. G. Dombek. 2008. Reniform Nematode Reproduction on Soybean Cultivars and Breeding Lines in 2007. Proceedings of the Beltwide Cotton Conferences, Nashville, TN, 330-336.

Robbins, R. T., E. Shipe, P. Arelli, P. Chen, L. Rakes, L. E. Jackson, E. E. Gbur and D. G. Dombek. 2009. Reniform Nematode Reproduction on Soybean Cultivars and Breeding Lines in 2008. San Antonio, TX 2009 Proceedings of the Beltwide Cotton Conferences Pgs. 104-114.

Robbins, R.T., P. Chen, L. E. Jackson, E. E. Gbur, D. G. Dombek, E. Shipe, P. Arelli, G. Shannon, and C. Overstreet. 2010. Reniform Nematode Reproduction on Soybean Cultivars and Breeding Lines in 2009. New Orleans, LA 2010. Proceedings of the Beltwide Cotton Conferences Pgs. 190-199.

Robbins, R. T., E. Shipe, P. Arelli, P. Chen, G. Shannon, K. M. Rainey, L. E. Jackson, E. E. Gbur, D. G. Dombek, and J. T. Velie. 2011. Reniform nematode reproduction on soybean cultivars and breeding lines in 2010. Proceedings of the 2011 Beltwide Cotton Conferences, Atlanta, Georgia, January 4-7, 2011, Pgs. 167-174.