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# RENIFORM NEMATODE REPRODUCTION ON SOYBEAN IN TESTS CONDUCTED IN 2003

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## Abstract

In 2003 greenhouse pot experiments, 129 soybean varieties from the Arkansas variety testing program were tested to determine their suitability as hosts for the reniform nematode, *Rotylenchulus reniformis*. The *R. reniformis*-resistant varieties Forrest and Hartwig, the susceptible variety Braxton, and fallow-*R. reniformis*-infested soil served as controls. Total number of eggs and nematodes extracted from both the soil and roots from each pot, reproductive indices (RI = Pf/Pi), RI/RI of Forrest (RF), RI/RI of Hartwig (RH), log ratio [$\log_{10}$ (RF + 1)], log ratio [$\log_{10}$ (RH + 1)], RF calculated from $\log_{10}$ (RF + 1), and RH calculated from $\log_{10}$ (RH + 1) were calculated for each cultivar or breeding line. Varieties with RF=s significantly greater than the RF on Forrest (1.00) were considered suitable hosts for *R. reniformis*. In the 2003 Arkansas variety test 122 of 129 lines had significantly more reproduction than Forrest when the log ratio [$\log_{10}$ (RF + 1)] were compared. All lines including Forrest had more reproduction than Hartwig when the log ratio [$\log_{10}$ (RH + 1)] were compared.

## Introduction

Robbins et al. (1994) reported on reproduction of the reniform nematode on 30 soybean cultivars. Robbins & Rakes (1996) reported on 16 soybean cultivars, 45 germplasm lines, and 2 cultivars (Hartwig, Cordell) with resistance from PIs 437654 and 90763, respectively, and the differentials used in the soybean cyst nematodes race determination tests. Robbins et al. (1999) reported on 282 soybean lines from the Arkansas and Mississippi Soybean Variety Testing programs and Robbins et al. (2000) reported on 226 cultivars from the Arkansas and Mississippi Soybean Variety Testing programs and varieties submitted by extension nematologists from Auburn and Louisiana State University. Robbins et al. (2001) reported on 115 cultivars from the Arkansas and Mississippi Soybean Variety Testing programs and three cultivars submitted by a Texas extension nematologist. Robbins et al. (2002) found 137 of 139 lines from Arkansas, Mississippi, and Louisiana reproduced significantly more than Forrest. Robbins et al. (2003) found 58 of 127 lines from the Arkansas, Mississippi, and Louisiana test and 20 of 34 breeding lines from the Clemson test reproduced significantly more than Forrest. These papers form the basis for reniform nematode reproduction information on contemporary soybean lines.

The objectives of the 2003 study were to 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 and to identify useful breeding lines for use in selection of new reniform resistant cultivars

## Materials and Methods

The 129 soybean cultivars 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 $cm^3$ of pasteurized fine sandy loam soil (ca. 91% sand, 5% silt, 4 % clay, <1% O.M.). 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. On the same day (July 21) a total of 1,200 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. Pots were arranged in a randomized complete block design, with five replications per cultivar. Soybean cultivars Forrest and Hartwig were included as resistant controls and Braxton as a susceptible control.

After 14 weeks (July 21-October 28, 2002), the number of reniform nematode eggs and vermiform nematodes contained in egg masses on the roots and the numbers of vermiform nematodes in the soil of each pot were determined. The total number of reniform nematode eggs and vermiform nematodes per pot was calculated by adding the number from the soil to the number from the roots. 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 Forrest (RF) and Hartwig (RH) was calculated. The log ratio data [$\log_{10}$ (RF + 1)] and log ratio data [$\log_{10}$ (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 and Discussion

Seven cultivars had log ratios not significantly higher than Forrest. These cultivars were Croplan Genetics RC4992, DT99-17145, Terral TVX57R301, Progeny 4884RR, Delta Grow 5650RR, FFR 4922RR, and Pioneer Brand 94M70 (Table 1 underlined). All seven cultivars had higher numerical ratios than Forrest. All cultivars, including Forrest, had higher ratios than Hartwig (Table 1).

The main objective of these tests was to identify soybean varieties and breeding lines with low reniform nematode reproductive indices. The varieties with low reniform nematode reproductive indices may be important to use in rotation with cotton in fields with large numbers of the reniform nematode.

## Literature Cited

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Table 1. Reproduction of *Rotylenchulus reniformis* on 129 selected soybean cultivars and lines from the Arkansas Soybean Variety Testing Program in 2003.

| Line or cultivar | Mean reniform nematodes/pot | Pf/Pi | RH | RF |
|---|---|---|---|---|
| Fallow | 936 | 0.78 | 0.12 | 0.03 |
| Hartwig | 7,846 | 6.54 | 1.00 | 0.28 |
| Forrest | 28,326 | 23.60 | 3.61 | 1.00 |
| *Croplan Genetics RC4992* | 73,600 | 61.33 | 9.38 | 2.60 |
| *DT99-17145* | 74,540 | 62.12 | 9.50 | 2.63 |
| *Terral TVX57R301* | 76,810 | 64.01 | 9.79 | 2.71 |
| *Progeny 4884RR* | 78,467 | 65.39 | 10.00 | 2.77 |
| *Delta Grow 5650RR* | 78,960 | 65.80 | 10.06 | 2.79 |
| *FFR 4922RR* | 83,945 | 69.95 | 10.70 | 2.96 |
| *Pioneer Brand 94M70* | 85,056 | 70.88 | 10.84 | 3.00 |

**Table 1. cont'd.**

| Line or cultivar | Mean reniform nematodes/pot | Pf/Pi | RH | RF |
|---|---|---|---|---|
| Genesis D524RR | 94,780 | 78.98 | 12.08 | 3.35 |
| DEKALB DKB44-52 | 102,840 | 85.70 | 13.11 | 3.63 |
| Dyna Gro SXO3152 | 103,788 | 86.49 | 13.23 | 3.66 |
| Delta Grow 5460RR | 106,735 | 88.95 | 13.60 | 3.77 |
| PGY 5703RR | 114,360 | 95.30 | 14.58 | 4.04 |
| Caviness RR | 117,140 | 97.62 | 14.93 | 4.14 |
| USG 7562nRR | 120,240 | 100.20 | 15.33 | 4.24 |
| Genesis D491RR | 120,870 | 100.72 | 15.41 | 4.27 |
| Delta King XTJ406 | 122,474 | 102.06 | 15.61 | 4.32 |
| Deltapine DP4724RR | 128,965 | 107.47 | 16.44 | 4.55 |
| Croplan Genetics RC4842 | 131,100 | 109.25 | 16.71 | 4.63 |
| Garst XR57N20 | 134,460 | 112.05 | 17.14 | 4.75 |
| FFR 5702RR | 135,660 | 113.05 | 17.29 | 4.79 |
| PGY 5503RR | 136,700 | 113.92 | 17.42 | 4.83 |
| Garst 6112RR/N | 136,780 | 113.98 | 17.43 | 4.83 |
| Morsoy RT5903 | 138,143 | 115.12 | 17.61 | 4.88 |
| Southern States RT4930 | 140,698 | 117.25 | 17.93 | 4.97 |
| Progeny 5415RR | 141,550 | 117.96 | 18.04 | 5.00 |
| NK Brand S50-N3 | 142,115 | 118.43 | 18.11 | 5.02 |
| FFR 5542RR | 142,334 | 118.61 | 18.14 | 5.02 |
| DEKALB DKB46-51 | 144,260 | 120.22 | 18.39 | 5.09 |
| Terral TVX48R1U1 | 144,500 | 120.42 | 18.42 | 5.10 |
| Maverick | 147,020 | 122.52 | 18.74 | 5.19 |
| DEKALB DKB57-51 | 151,280 | 126.07 | 19.28 | 5.34 |
| ES XVT-19RR | 152,800 | 127.33 | 19.48 | 5.39 |
| Terral TVX58R2W1 | 155,880 | 129.90 | 19.87 | 5.50 |
| PGY 4949RR | 160,122 | 133.44 | 20.41 | 5.65 |
| ES XVT-17RR | 160,580 | 133.82 | 20.47 | 5.67 |
| Terral TVX56R1B2 | 161,100 | 134.25 | 20.53 | 5.69 |
| Delta Grow 4960RR | 163,830 | 136.53 | 20.88 | 5.78 |
| Asgrow AG5605 | 164,121 | 136.77 | 20.92 | 5.79 |
| Armor AXR5881 | 164,440 | 137.03 | 20.96 | 5.81 |
| Dyna Gro 3518nRR | 164,880 | 137.40 | 21.02 | 5.82 |
| Asgrow AG3905 | 165,580 | 137.98 | 21.10 | 5.85 |
| DT99-17483 | 166,220 | 138.52 | 21.19 | 5.87 |
| Delta King XTJ405 | 167,420 | 139.52 | 21.34 | 5.91 |
| DEKALB DKB44-51 | 168,420 | 140.35 | 21.47 | 5.95 |
| Delta King XTJ407 | 170,560 | 142.13 | 21.74 | 6.02 |
| HBK R5123 | 170,580 | 142.15 | 21.74 | 6.02 |
| DEKALB DKB53-51 | 171,120 | 142.60 | 21.81 | 6.04 |
| DT99-17574 | 172,160 | 143.47 | 21.94 | 6.08 |
| Delta King XTJ404 | 175,220 | 146.02 | 22.33 | 6.19 |
| HBK R4623 | 176,250 | 146.88 | 22.46 | 6.22 |
| R98-209 | 178,464 | 148.72 | 22.75 | 6.30 |
| Terral TVX56R3K1 | 179,280 | 149.40 | 22.85 | 6.33 |
| Delta King XTJ403 | 181,500 | 151.25 | 23.13 | 6.41 |
| Dyna Gro SXO3149 | 183,600 | 153.00 | 23.40 | 6.48 |
| Pioneer Brand 93B68RR | 187,030 | 155.86 | 23.84 | 6.60 |
| Terral TVX39RS301 | 187,220 | 156.02 | 23.86 | 6.61 |
| Progeny PGY 4703RR | 188,380 | 156.98 | 24.01 | 6.65 |
| Terral TVX47R1K2 | 188,740 | 157.28 | 24.06 | 6.66 |
| Delta King XTJ4R58 | 190,406 | 158.67 | 24.27 | 6.72 |
| Terral TV52R301 | 191,423 | 159.52 | 24.40 | 6.76 |
| Delta King XTJ401 | 194,160 | 161.80 | 24.75 | 6.85 |
| Terral TVX58R1V2 | 199,220 | 166.02 | 25.39 | 7.03 |
| R97-1634 | 199,420 | 166.18 | 25.42 | 7.04 |
| MPV 5504nRR | 201,000 | 167.50 | 25.62 | 7.10 |
| Terral TVX49R2Z1 | 201,528 | 167.94 | 25.69 | 7.16 |
| Morsoy RT5773 | 203,240 | 169.37 | 25.90 | 7.18 |
| MPV 4904nRR | 204,102 | 170.09 | 26.01 | 7.21 |
| Delta King XTJ448 | 204,180 | 170.15 | 26.02 | 7.21 |

**Table 1. cont'd.**

| Line or cultivar | Mean reniform nematodes/pot | Pf/Pi | RH | RF |
|---|---|---|---|---|
| USG 7440nRR | 204,660 | 170.55 | 26.09 | 7.23 |
| Asgrow AG4502 | 204,780 | 170.65 | 26.10 | 7.31 |
| Armor AXR5981 | 207,120 | 172.60 | 26.40 | 7.31 |
| Dyna Gro 3481nRR | 207,960 | 173.30 | 26.51 | 7.34 |
| S99-2447-02RR | 208,320 | 173.60 | 26.55 | 7.35 |
| V96-0340 | 211,300 | 176.08 | 26.93 | 7.46 |
| Delta Grow 5260RR | 212,680 | 177.23 | 27.11 | 7.51 |
| Delta King XTJ447 | 215,880 | 179.90 | 27.52 | 7.62 |
| Garst XR46Y02 | 216,040 | 180.03 | 27.54 | 7.63 |
| Armor AXR5313 | 216,420 | 180.35 | 27.58 | 7.64 |
| DT99-16864 | 217,740 | 181.45 | 27.75 | 7.69 |
| Dyna Gro 33B52 | 218,060 | 181.72 | 27.79 | 7.70 |
| Delta King XTJ452 | 218,860 | 182.38 | 27.90 | 7.73 |
| NK Brand S37-N4 | 218,960 | 182.47 | 27.91 | 7.73 |
| Terral TVX49R2Y4 | 219,720 | 183.10 | 28.01 | 7.76 |
| Garst XR48Y11 | 220,160 | 183.47 | 28.06 | 7.77 |
| Terral TVX59R301 | 222,600 | 185.50 | 28.37 | 7.86 |
| Delta King XTJ446 | 222,980 | 185.82 | 28.42 | 7.87 |
| Morsoy RT5553 | 223,160 | 185.97 | 28.44 | 7.88 |
| NK Brand S49-Q9 | 226,320 | 188.60 | 28.85 | 7.99 |
| Southern States RT5602 | 226,800 | 189.00 | 28.91 | 8.01 |
| Armor AXR4959 | 227,740 | 189.78 | 29.03 | 8.04 |
| USG 7524nRR | 230,500 | 192.08 | 29.38 | 8.14 |
| USG 7563nRR | 232,200 | 193.50 | 29.60 | 8.20 |
| Garst XR50N12 | 237,300 | 197.75 | 30.25 | 8.38 |
| Delta King XTJ450 | 238,280 | 198.57 | 30.37 | 8.41 |
| Terral TVX39R302 | 238,883 | 199.07 | 30.45 | 8.43 |
| Delta King XTJ439 | 240,260 | 200.22 | 30.62 | 8.48 |
| DT99-17531 | 242,040 | 201.70 | 30.85 | 8.54 |
| Genesis D484RR | 242,060 | 201.72 | 30.85 | 8.55 |
| Dyna Gro 38K57 | 243,460 | 202.88 | 31.03 | 8.60 |
| Terral TVX47R2P1 | 245,220 | 204.35 | 31.26 | 8.66 |
| ES XVT-41RR | 248,780 | 207.32 | 31.71 | 8.78 |
| Genesis C444RR | 250,940 | 209.12 | 31.98 | 8.86 |
| NK Brand S57-P1 | 252,800 | 210.67 | 32.22 | 8.92 |
| DT98-11850 | 254,660 | 212.22 | 32.46 | 8.99 |
| Progeny 5822R | 260,160 | 216.80 | 33.16 | 9.18 |
| Delta King XTJ457 | 260,520 | 217.10 | 33.21 | 9.20 |
| HBK R5422 | 263,600 | 219.67 | 33.60 | 9.31 |
| Genesis D421RR | 264,340 | 220.28 | 33.69 | 9.33 |
| Croplan Genetic RC5555 | 265,220 | 221.02 | 33.80 | 9.36 |
| N99-186 | 269,360 | 224.47 | 34.33 | 9.51 |
| PGY 3900RR | 272,849 | 227.37 | 34.78 | 9.63 |
| Morsoy RT5252 | 276,040 | 230.03 | 35.18 | 9.75 |
| NK Brand S43-B1 | 278,360 | 231.97 | 35.48 | 9.83 |
| HBK R5823 | 280,000 | 233.33 | 35.69 | 9.89 |
| AGSE 587RR | 289,420 | 241.18 | 36.89 | 10.22 |
| Terral TVX49R1L2 | 296,400 | 247.00 | 37.78 | 10.46 |
| Terral TVX59R201 | 298,660 | 248.88 | 38.07 | 10.54 |
| Deltapine DPX4446RR | 301,060 | 250.88 | 38.37 | 10.63 |
| DT99-17400 | 306,920 | 255.77 | 39.12 | 10.84 |
| HBK 5592 | 323,380 | 269.48 | 41.22 | 11.42 |
| Dyna Gro SXO3157 | 325,200 | 271.00 | 41.45 | 11.48 |
| ES XVT-46RR | 325,540 | 271.28 | 41.49 | 11.49 |
| Terral TVX57R2M1 | 326,820 | 272.35 | 41.6 | 11.54 |
| USG 5002T | 370,060 | 308.38 | 47.17 | 13.06 |
| Braxton | 371,660 | 309.72 | 47.37 | 13.12 |
| DT99-17445 | 381,520 | 317.93 | 48.63 | 13.47 |
| PGY 4860RR | 434,180 | 361.82 | 55.34 | 15.33 |