SECTION 7

Evaluation of resistant soybean lines to control soybean aphids *(Aphis glycines)* in Illinois, 2008

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Location

We established one trial to evaluate the efficacy of several resistant soybean lines to control soybean aphids. The trial was located at the David and Carol Cook Farm near Morrison (Whiteside County). Funding for this experiment was provided by the Illinois Soybean Association and the North Central Soybean Research Program.

Experimental Design and Methods

The experimental design was a randomized complete block with three replications. The plot size for each treatment was 10 ft (four rows) x 12 ft. Eleven experimental soybean lines and one commercially available soybean variety were selected. Three soybean lines with putative resistance to soybean aphids (LD05-16060, LD05-16529, and LD05-16611) and their respective aphid-susceptible near-isolines (SD01-76R, LD05-16159, and LD05-16621) were provided from the soybean breeding program at the University of Illinois. Other lines with putative resistance to soybean aphids were provided from the soybean breeding programs at Michigan State University (E06901, E06902, E07901, and E07906-2) and South Dakota State University (SD(LD)05R-16137). An aphid-susceptible, commercially-available variety (GR-2332) was provided from Midwest Seed Genetics (Carroll, Iowa).

Densities of soybean aphids were determined by counting the total number of soybean aphids on three plants in each plot. Soybean aphid densities were assessed on 30 July; 6, 14, 20, and 28 August; and 4 September. Two rows of each plot were mechanically harvested on 10 October, and the weights were adjusted to bushels per acre (bu/A) at 13% moisture.

Planting Information

All plots were planted on 20 May using a four-row, Almaco constructed planter with John Deere 7300 row units. Precision cone units were used to plant the seeds.

Agronomic Information

Agronomic information is listed in Table 7.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using SAS (Statistical Analysis System), version 9.1 (Copyright© 2003 SAS Institute, Cary, NC).

Results and Discussion

Densities of soybean aphids assessed on six dates (30 July through 4 September) are presented in Table 7.2.

Densities of soybean aphids were small (<35 aphids per plant) when sampling began on 30 July (Table 7.2), but they increased noticeably through 28 August when most plots had the highest densities of the evaluation period. The average number of soybean aphids per plant in plots with susceptible cultivars reached 344 on 28 August. This average was well above the currently accepted economic threshold of 250 soybean aphids per plant (Ragsdale et al. 2007). Densities of soybean aphids decreased by 4 September but were still large in plots with susceptible cultivars (Table 7.2). Some soybean lines (SD01-76R, SD(LD)05-16137, E06902, and E07901) were not sampled on 4 September because the plants were beginning to senesce.

When densities of soybean aphids were largest—14 through 28 August—resistant lines from the University of Illinois had significantly fewer soybean aphids per plant than their susceptible isolines, except for LD05-16060 on 28 August

TABLE 7.1 • Agronomic information for efficacy trial of resistant soybean lines to control soybean aphids, Morrison (Whiteside County), University of Illinois, 2008

Planting date	20 May
Row spacing	30 inches
Seeding rate	175,000/acre
Previous crop	Corn
Tillage	Spring—disk
Harvest date	10 October

(Table 7.2). The statistically similar numbers of soybean aphids per plant on LD05-16060 (86.33) and SD01-76R (72.44) on 28 August may have been caused by early senescence of SD01-76R, leading to fewer leaves examined for soybean aphids (Table 7.2). Susceptible isolines were not provided for resistant lines from Michigan State University or South Dakota State University, which had significantly fewer soybean aphids per plant than the susceptible Illinois lines LD05-16519 and LD05-16621 from 14 through 28 August (Table 7.2). A similar trend was observed between resistant lines from Michigan State University and South Dakota State University and the Illinois susceptible line SD01-76R on 14 and 20 August, except for E06902 on 14 August (Table 7.2).

From 6 August through 28 August, the aphid-susceptible, commercially-available cultivar GR-2332 had significantly more soybean aphids per plant than all resistant lines, except for LD05-16529 on 28 August.

Yield data for this experiment are presented in Table 7.2. Yields from soybean aphid-resistant lines from the University of Illinois were not significantly greater than yields from their susceptible isolines (Table 7.2). The aphid-susceptible, commercially-available variety GR-2332 had a significantly higher yield than the soybean aphid-resistant lines from Michigan State University and South Dakota State University, as well as the resistant line LD05-16060 from Illinois (Table 7.2). High densities of soybean aphids after the R5 (beginning seed) growth stage, which is the pattern of infestation we observed, do not consistently have a demonstrated negative effect on soybean yield, leading us to propose that yield differences in this experiment were due primarily to differences in yield potential among lines (Ragsdale et al. 2007). The resistant lines evaluated in this experiment were able to suppress soybean aphid densities below the economic threshold and show potential for future development.

TABLE 7.2 • Evaluation of resistant soybean lines to control soybean aphids, Morrison (Whiteside County), University of Illinois, 2008

Cultivar	Resistant	Mean no. aphids per plant[1,2]						Mean yield (bu/acre)[3] 10 Oct
		30 July	6 Aug	14 Aug	20 Aug	28 Aug	4 Sept	
SD01-76R	No	4.89 bc	7.89 def	40.89 b	151.33 b	72.44 cd	—[4]	42.23 e
LD05-16060	Yes	17.56 bc	3.67 efg	11.22 de	46.10 d	86.33 cd	11.90 cd	49.56 de
LD05-16519	No	27.89 a	17.44 cd	88.00 a	292.67 a	489.11 a	172.80 ab	54.03 bcd
LD05-16529	Yes	8.56 bc	51.44 b	55.33 bc	42.56 cd	148.56 bc	129.00 bc	59.79 abc
LD05-16621	No	16.22 ab	20.89 bc	138.33 a	202.11 ab	521.11 a	380.60 a	64.71 a
LD05-16611	Yes	3.78 c	7.22 de	20.22 cd	73.00 c	112.11 cd	81.00 bc	63.07 ab
SD(LD)05-16137	Yes	0.22 c	0.33 g	3.89 ef	9.22 e	47.22 de	—[4]	51.89 cd
E06901	Yes	0.00 c	0.11 g	1.89 ef	3.00 e	10.22 ef	12.60 cd	26.79 f
E06902	Yes	0.11 c	0.67 fg	37.78 bc	59.67 c	111.67 cd	—[4]	29.64 f
E07901	Yes	2.67 c	2.22 efg	20.11 cd	31.89 cd	89.22 cd	—[4]	30.36 f
E07906-2	Yes	0.00 c	0.00 g	0.11 f	1.78 e	3.11 f	0.30 d	31.75 f
GR-2332	No	34.11 a	67.33 a	138.22 a	341.67 a	291.78 ab	337.00 a	66.97 a

[1] Means were derived from the numbers of soybean aphids on three plants in each plot in each replication. Means followed by the same letter do not differ significantly (P = 0.05, PROC GLM, SAS).
[2] Statistical analyses were conducted using a log transformation; actual means are shown.
[3] Soybeans were harvested from the center two rows of each plot, and weights were converted to bushels per acre (bu/A) at 13% moisture. Means followed by the same letter do not differ significantly (P = 0.05, PROC GLM, SAS).
[4] Densities of soybean aphids could not be assessed because plants were beginning to senesce.