SECTION 10

Evaluation of resistant soybean lines and Cobalt to control soybean aphids (*Aphis glycines*) and other insect pests of soybean in Illinois, 2011

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Location

We established one trial at the Adam Yoeckel Farm near Morrison (Whiteside County). Funding for this experiment was provided by the Illinois Soybean Association.

Experimental Design and Methods

The experimental design was a split-plot, randomized complete block with four replications. The plot size for each treatment was 20 ft (eight rows) x 30 ft. One half (four rows) of each plot was treated with a foliar-applied insecticide for yield comparisons. The remaining half was not treated with an insecticide. Six experimental soybean lines were provided from the soybean breeding program at the University of Illinois—four of the lines contained resistance to soybean aphids. The resistant lines LD05-16657a and LD06-16721a contained the *Rag1* resistance gene (their susceptible near-isoline was Dwight). The resistant lines LD09-15081a and LD09-15179a contained the *Rag2* gene (their susceptible near-isoline was LD02-4485). These genes do not provide protection against feeding by any of the other insect pests we assessed during this trial.

Densities of soybean aphids were determined by counting the total number of soybean aphids on each of three plants in each subplot. Densities of other insect pests were determined by taking 20 sweeps per plot with a 15-inch diameter sweep net. After the application of insecticides, densities of soybean aphids were assessed on 27 August, and on 3 and 10 September (7, 14, and 21 days after treatment [DAT], respectively). Densities of other insect pests were assessed on 27 August (7 DAT).

Planting, Insecticide Application, and Yield

The trial was planted on 10 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1 inch. Insecticide was applied on 20 August with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each subplot on 6 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 10.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean densities of soybean aphids, other insect pests of soybean, and yield are presented in Table 10.2. Although some soybean aphids and other insect pests were observed on 17 or 19 August, the focus of this discussion will be on the densities of insects following the application of Cobalt (20 August).

TABLE 10.1 • Agronomic information for efficacy trial of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Planting date	10 May
Harvest date	6 October
Lines	Dwight LD05-16657a LD06-16721a LD02-4485 LD09-15081a LD09-15179a
Row spacing	30 inches
Seeding rate	140,000/acre
Previous crop	Corn
Tillage	Spring—vertical tillage

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Mean densities of soybean aphids were very low across all sampling dates. No significant differences were observed between treatments through 3 September (14 DAT). On 10 September (21 DAT), LD05-16657a with Cobalt had statistically more soybean aphids per plant than all other treatments; however, this density was well below the economic threshold of 250 soybean aphids per plant (Ragsdale et al. 2007). Mean densities of other insect pests were very low. No significant differences were observed among any of the treatments across all sampling dates.

While the addition of Cobalt resulted in significantly greater mean yields for Dwight, LD02-4485, and LD09-15179a, differences in yield are difficult to interpret because densities of pests were very low. For example, the aphid-susceptible line LD02-4485 had the greatest yield among all of the treatments (44.4 bu/A). A small, but significant, increase in yield (39.3 to 42.8 bu/A) was observed when Cobalt was applied to Dwight (not resistant to soybean aphids).

TABLE 10.2 • Evaluation of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Product	Resistance to Soybean Aphids	Rate[1]	Mean no. soybean aphids per plant[2,3]				Mean no. bean leaf beetles per plot[3,4]		Mean no. brown stink bugs per plot[3,4]		Mean no. corn rootworm beetles per plot[3,4]	
			17 Aug (0 DAT[5])	27 Aug (7 DAT[5])	3 Sep (14 DAT[5])	10 Sep (21 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])
Dwight	No	—	5.6 a	3.2 a	2.4 a	1.5 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a
LD05-16657a	Yes[6]	—	0.2 a	1.3 a	12.7 a	3.6 b	0.0 a	0.8 a	0.5 a	0.0 a	0.5 a	0.3 a
LD06-16721a	Yes[6]	—	0.9 a	0.4 a	2.5 a	1.3 b	0.0 a	0.1 a	0.0 a	0.0 a	1.0 a	0.1 a
LD02-4485	No	—	1.3 a	4.6 a	17.9 a	1.4 b	0.0 a	0.1 a	0.5 a	0.0 a	0.3 a	0.1 a
LD09-15081a	Yes[7]	—	0.8 a	0.7 a	2.8 a	1.3 b	0.0 a	0.1 a	0.5 a	0.0 a	0.8 a	0.4 a
LD09-15179a	Yes[7]	—	0.2 a	1.1 a	4.2 a	0.7 b	0.0 a	0.0 a	0.3 a	0.0 a	0.3 a	0.0 a
Dwight + Cobalt	No	13	2.5 a	0.2 a	0.1 a	0.5 b	0.0 a	0.4 a	0.0 a	0.0 a	0.3 a	0.1 a
LD05-16657a + Cobalt	Yes[6]	13	1.1 a	1.6 a	7.7 a	26.8 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
LD06-16721a + Cobalt	Yes[6]	13	0.4 a	0.5 a	1.2 a	0.0 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a
LD02-4485 + Cobalt	No	13	2.6 a	3.3 a	3.2 a	0.5 b	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a
LD09-15081a + Cobalt	Yes[7]	13	0.4 a	0.3 a	0.3 a	0.2 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a
LD09-15179a + Cobalt	Yes[7]	13	0.2 a	0.5 a	4.3 a	1.7 b	0.3 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of soybean aphids on three plants in each subplot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each subplot in each of four replications.
[5] DAT = days after treatment (with insecticide).
[6] Resistance was conferred by the *Rag1* gene.
[7] Resistance was conferred by the *Rag2* gene.
[8] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).

TABLE 10.2 (CONTINUED) • Evaluation of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Product	Resistance to Soybean Aphids	Rate[1]	Mean no. grasshoppers per plot[3,4]		Mean no. green cloverworms per plot[3,4]		Mean no. green stink bugs per plot[3,4]		Mean no. Japanese beetles per plot[3,4]		Mean no. soybean loopers per plot[3,4]		Mean yield (bu/acre)[8,9] 6 Oct
			19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	
Dwight	No	—	5.0 a	0.0 a	0.3 a	0.0 a	1.3 a	0.8 a	4.3 a	3.0 a	0.3 a	0.0 a	39.3 cd
LD05-16657a	Yes[6]	—	3.3 a	0.0 a	0.0 a	0.5 a	0.3 a	1.3 a	2.5 a	1.8 a	0.0 a	0.0 a	36.8 d
LD06-16721a	Yes[6]	—	6.3 a	0.3 a	0.0 a	0.0 a	1.3 a	0.1 a	9.3 a	4.4 a	0.3 a	0.0 a	36.7 d
LD02-4485	No	—	4.8 a	0.0 a	0.0 a	0.0 a	1.8 a	1.8 a	2.3 a	1.1 a	0.0 a	0.0 a	44.4 a
LD09-15081a	Yes[7]	—	4.5 a	0.3 a	0.0 a	0.0 a	0.0 a	0.1 a	4.0 a	2.4 a	0.0 a	0.0 a	43.0 ab
LD09-15179a	Yes[7]	—	1.8 a	0.0 a	0.5 a	0.0 a	0.3 a	1.0 a	2.8 a	2.5 a	0.5 a	0.0 a	37.3 d
Dwight + Cobalt	No	13	1.0 a	0.3 a	0.3 a	0.0 a	1.5 a	0.5 a	2.3 a	0.1 a	0.0 a	0.0 a	42.8 ab
LD05-16657a + Cobalt	Yes[6]	13	5.3 a	0.0 a	0.3 a	0.3 a	0.3 a	0.8 a	4.3 a	3.3 a	0.0 a	0.0 a	37.3 d
LD06-16721a + Cobalt	Yes[6]	13	6.5 a	0.5 a	0.0 a	0.0 a	1.5 a	0.8 a	4.8 a	1.5 a	0.0 a	0.0 a	36.8 d
LD02-4485 + Cobalt	No	13	2.0 a	0.3 a	0.5 a	0.3 a	1.0 a	0.3 a	2.0 a	0.5 a	0.0 a	0.0 a	41.3 bc
LD09-15081a + Cobalt	Yes[7]	13	3.0 a	0.0 a	0.3 a	0.0 a	0.8 a	0.3 a	4.3 a	2.5 a	0.0 a	0.0 a	40.5 bc
LD09-15179a + Cobalt	Yes[7]	13	1.8 a	0.3 a	0.0 a	0.5 a	0.3 a	0.5 a	3.8 a	0.5 a	0.0 a	0.0 a	42.2 abc

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[4] Means were derived from the numbers of insects per 20 sweeps in each subplot in each of four replications.
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[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).