Iowa State University
2006 Soybean aphid insecticide trials

Table of Contents

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Department of Entomology
Iowa State University
Ames, Iowa 50011-3140

Kevin D. Johnson, graduate research assistant,
Department of Entomology

Matthew O'Neal, assistant professor,
Department of Entomology

Wayne Ohnesorg, Graduate research assistant,
Department of entomology

Graduate Research Assistants:	Nick Schmidt Wayne Ohnesorg
University Farm Managers	Dave Haden
	Jim Secor
	Dave Starret
	Kenneth Pecinovsky
	Nicholas Piekema
Funding and Product Availability	Iowa Soybean Assosciation
	BASF
	Bayer Crop Sciences
	Dow AgroSciences
	DuPont
	FMC
	Syngenta Crop Protection
	Valent Agricultural Products

Introduction to Soybean Aphids

Iowa soybean growers were introduced to a new pest when the soybean aphid, *Aphis glycines* Matsumura (Homoptera: Aphididae), arrived in 2000 and by 2003 soybean aphids were found in every county. Soybean aphids have been shown to reduce soybean yields by as much as 40% in Midwestern states, making the soybean aphid a potentially devastating pest. Since being discovered in 2000, Iowa has experienced large populations (> 1,000/plant) in three of the six years this pest has been in the state (Lang 2003, M. O'Neal unpublished data). In 2005, Iowa once again experienced damaging populations of soybean aphids. Yield reductions in excess of ten bushels per acre were experienced in university test plots across Iowa. This reduction in yield occurred in spite of lower populations than experienced in past years with large populations (Lang 2003, M. O'Neal unpublished). The 2005 growing season has illustrated the need for continued research on soybean aphid management in Iowa.

Soybean Aphid Biology:

Soybean aphid has a complex lifecycle with sexual stages found on the primary host plant (*Rhamnus* spp., buckthorn), and asexual stages occurring on the secondary host plant, soybean (Wang et al. 1962). Soybean aphids migrate to *R. cathartica* from soybean fields, where a sexually reproductive generation produces eggs that over winter on the plant. In the spring, these eggs hatch and eventually producing alates (winged adults) that migrate back to soybean, arriving in early to mid June (Rice 2003, Fox 2002). Soybean aphids reproduce asexually while on soybeans, increasing their numbers rapidly. Natural enemies can play a key role in suppressing soybean aphid populations both in its native Asia (Liu et al. 2004) and the North Central US (Fox et al. 2004, Rutledge et al. 2004). In Asia, where soybean aphids are rarely a pest, coccinellids (ladybird beetles) are among the most common natural enemies, and soybean aphid colonies typically support parasitism rates of 40% (Liu et al. 2004.). Iowa soybean fields contain many aphid predators (Bechinski and Pedigo 1981), yet large populations of aphids have occurred in three of the past six years that the aphid has been in the state (Lang 2003, M. O'Neal

unpublished). We also know that natural enemies are impacting aphid populations (Fox et al. 2004, N. Schmidt and M. O'Neal unpublished data).

Materials and Methods

We established experiments at the Iowa State University Northeast research farm in Floyd County, Iowa and at the Iowa State University Northwest research farm located in O'Brien County, Iowa. In total, we evaluated 15 products alone or in combination in 2006 (Table 1). All experiments included an untreated control and a "zero aphid" treatment in which foliar insecticides (a tank mix of a organophosphate and a pyrethroid) were applied every time aphids were detected. The combination of these two treatments allow for estimation of total yield loss due to soybean aphids. We monitored aphid populations both before and after foliar insecticides were applied. Yield data was collected at harvest (weight, moisture), and a seed sample was also collected for quality component analysis (protein, oil). Data were also collected regarding the impact of selected insecticides on beneficial insects, primarily predators of the soybean aphid.

Estimation of soybean aphid populations

Soybean aphids were counted on consecutive plants at randomly selected locations within each plot. The number of plants counted ranged from 20 to 5. The number of plants counted was determined by the percentage of plants infested with aphids. When 0% to 80% of plants were infested with aphids, twenty plants were counted; when 81% to 99% of plants were infested, ten plants were counted; at 100% infestation, five plants were counted. All aphids (adults, nymphs and winged aphids) were counted on each plant.

Estimation of cumulative aphid days

To estimate the total exposure of soybean plants to soybean aphids we calculated 'cumulative aphid days' based on the number of aphids per plant counted on each sampling date. The exposure of soybean plants to aphids between two sampling dates (the 'aphid days') is calculated with the following equation:

Aphid days = [mean aphids/plant at previous date + current mean aphids/plant/ 2] X number of days between sampling.

Summing the aphid days accumulated during the growing season (cumulative aphid days) provides a measure of the total aphid exposure that a soybean plant experienced. Cumulative aphid days will be reported as post-insecticide application.

Aphid predatory insect sampling In 2006, the insect communities in specific insecticide treatments of interest at the Floyd County location were sampled using sweep-nets. Sweep-net sampling started when the plants had six fully developed nodes. Sampling consisted of 20 pendulum sweeps with a 38 cm sweep net running the direction of the row. Samples were places in plastic bags and returned to the lab, and were stored at -20°C until samples could be processed. Only known aphid predators of either native aphids or *A. glycines* were reported and included in the analysis. Predatory insects were identified visually to the family level and to the species level for the Coccinellidae and Anthocoridae.

Yield and quality analysis. Yields were determined by weighing grain with a grain hopper which rested on a digital scale sensor custom designed for each of the three harvesters. Yields were corrected to 13% moisture and reported as bushels per acre. Seed samples were collected at the time of harvest and later analyzed for percentage protein and oil concentrated. All seed samples were analyzed using an Infratech 1221 near-infrared whole grain analyzer (Tecator AB, Hooganas, Sweden).

Statistical analysis

One way analysis of variance (ANOVA) was used to determine treatment effects within each experiment. All experiments were conducted within replicated field trials using a randomized, complete block design. The impact of treatments applied within each experiment on accumulation of aphid days was determined using log-transformed data to meet the assumptions of ANOVA. Means separation for all studies was achieved using a least significant difference test ($P \leq 0.05$). Treatment impacts on yield, protein, oil, and

beneficial were determined using untransformed data. All statistical analysis was performed using SAS® software (SAS 2001).

Northeast research farm, Floyd County

Insecticide Efficacy

At the northeast research farm in Floyd County, we established a randomized complete block design experiment, which consisted of 12 treatments (Table 1). All treatments were replicated six times with the untreated control replicated 12 times. Plots measured 50' in length and 30' in width. No-till production practices were used to establish soybeans (NK S23-Z3 RR). When foliar insecticides were applied (31 July), aphid populations averaged 85 aphids per plant. Soybean aphid populations were assessed approximately every 7 days following treatment applications, and cumulative aphid days were calculated for each treatment (Fig. 1).

Combination of foliar and seed applied insecticide

In a second experiment at the northeast research farm in Floyd County, we established a randomized complete block design experiment, which consisted of 7 treatments (Table 2). All treatments were replicated six times. Plots measured 50' in length and 30' in width. No-till production practices were used to establish soybeans (Crows 2317). Soybean aphid populations were assessed approximately every 7 days (Fig. 3).

Northwest research farm, O'Brien County

At the northwest research farm in O'Brien County, we designed a randomized complete block design, which consisted of 13 treatments (Table 3). All treatments were replicated four times. Plots measured 100' in length and 20' in with. Conventional production practices were used to establish soybeans (Pioneer 92M32). When foliar insecticides were applied on 14 August, aphid populations averaged 6 aphids per plant. Every 7 days,

soybean aphids were counted on consecutive plants from a randomly selected location. Cumulative aphid days were calculated for each treatment (Fig. 3).

References

Bechinski, E.J. and L.P. Pedigo. 1981. Ecology of predaceous arthropods in Iowa soybean agroecosystems. Environ. Entomol. 10: 771-778.

Clark, A.J. and K.L. Perry. 2002. Transmissibility of field isolates of soybean viruses by *Aphis glycines*. Plant Dis. 86: 1219-1222.

DeWitt, J. and J. Tollefson. 2003. Soybean aphids making a mark. Integrated Crop Management www.ipm.iastate.edu/ipm/icm/2003/8-18-2003/aphids.html.

Fox, T. B. 2002. Biological control of soybean (*Aphis glycines* Matsumura) aphid in Michigan, MS Thesis. Department of Entomology, Michigan State University.

Fox, T.B., D.A. Landis, F.F. Cardoso, C.D. DiFonzo. 2004. Predators suppress *Aphis glycines* Matsumura population growth in soybean. Environ. Entomol. 33: 608-618.

Lang, B. 2003. Three years of soybean aphid in northeast Iowa. Proceedings 15th Annual Integrated Crop Management Conference, Dec 3-4, 2003. Iowa State University, Ames Iowa.

Liu, J., K.Wu, K. R. Hopper, and K. Zhoa. 2004. Population dynamics of *Aphis glycines* (Homoptera: Aphididae) and its natural enemies in soybean in Northern China. Annals Ent. Soc. Am. 97: 235-239.

O'Neal, M., and K. Johnson. 2005. Soybean aphids attack: Does it pay to spray low populations? Iowa State University, Integrated Crop Newsletter IC-494 (22). http://www.ipm.iastate.edu/ipm/icm/2005/8-22/aphidlowpop.html

Ostlie, K. 2002. Managing soybean aphid. University of Minnesota Extension Service. www.soybeans.umn.edu/crop/insects/aphid/aphid_publication_managingsba.htm.

Rice, M. E. 2003. Scout fields now for soybean aphids. Integrated Crop Management www.ipm.iastate.edu/ipm/icm/2003/7-14-2003/scoutforaphids.html.

Rice, M.E., M. O'Neal, and P. Pedersen M.E. O'Neal. 2005. Soybean Aphids in Iowa-2005. Iowa State University, University Extension, SP-247.

Rutledge, C.E., R.J. O'Neil, T.B. Fox and D.A. Landis. 2004. Soybean aphid predators and their use in IPM. Annals Ent. Soc. Am. 97: 240-248.

Wang, C.L., N.I. Siang, G.S. Chang and H.F. Chu. 1962. Studies on the soybean aphid, *Aphis glycines* Matsumura. Acta Entomologica Sinica. 11: 31-44.

SAS Institute. 2001. SAS/STAT user's guide, version 6.12. SAS Institute, Cary, NC.

Table 1. Insecticide treatments and rates at Floyd County, IA applied 1 August 2006.

	Treatment[1]	Class[2]	Rate[3]
Checks			
	untreated zero aphid check[4]	PY + OP	3.2 oz + 8 oz
Seed treatments			
	Gaucho	Nic	62.5 g per100 kg
	Cruiser 50	Nic	50 g per100 kg
	Cruiser 100	Nic	100 g per100 kg
Foliar insecticides			
Reduced risk			
	Trimax	Nic	1.5 oz
	Fulfill	Pymetrozine	2.3 oz
Broad-spectrum			
	Warrior	Py	3.2 oz
	Danitol	PY	16 oz
	Baythroid XL	PY	2 oz
	Dimethoate	OP	16 oz

[1]Plots were planted 6 May.
[2]Class notations are Pyrethroid (PY), Neonicotinoids (Nic), and Organophosphate (OP).
[3]Rates are shown as formulated product per acre
[4]Zero aphid treatment (Warrior + Lorsban 4E) received an insecticide treatment 3 times (5 June, 13 July, and 1 August).

Table 2. Combination of foliar and seed applied insecticide treatments and rates at Floyd County, IA.

	Treatment[1]	Class[2]	Rate[3]
Checks			
	untreated zero aphid check[4]	PY + OP	3.2 oz + 8 oz
Seed treatments			
	Gaucho	Nic	62.5 g per100 kg
Foliar insecticides			
13 July			
	Gaucho + Warrior	Nic + PY	62.5 g per100 kg + 3.2 oz
	Gaucho + Trimax	Nic + Nic	62.5 g per100 kg + 1.5 oz
1 August	Gaucho + Warrior	Nic + PY	62.5 g per100 kg + 3.2 oz
	Gaucho + Trimax	Nic + Nic	62.5 g per100 kg + 1.5 oz

[1]Plots were planted 17 May.
[2]Class notations are Pyrethroid (PY) and Neonicotinoids (Nic).
[3]Rates are shown as formulated product per acre
[4]Zero aphid treatment (Warrior + Lorsban 4E) received an insecticide treatment 3 times (5 June, 13 July, and 1 August).

Table 3. Insecticide treatments and rates at O'Brien County, IA applied 14 August 2006

Treatment[1]		Class[2]	Rate[3]
Checks			
	Untreated zero aphid check [4]	PY + OP	3.2 oz + 8 oz
Foliar insecticides			
	Warrior	PY	3.2 oz
	Baythriod XL	PY	2 oz
	Orthene 97	OP	¾ lb
	V-10191	NA	50 oz
	Orthene 97 + Lorsban 4E	OP + OP	¾ lb + 4 oz
	Danitol	PY	16 oz
	Lorsban 4E	OP	16 oz
	Lorsban 4E + Proaxis	OP + PY	8 ox + 1.25 oz
	Proaxis	PY	3.2 oz
	Mustang Max + Lorsban 4E	PY + OP	3 oz + 4 oz
	F-6113 1.25EC	NA	4.27 oz

[1]Plots were planted 23 May.
[2]Class notations are Pyrethroid (PY) and Organophosphate (OP) some tank-mixes contain more than one product.
[3]Rates are shown as formulated product per acre.
[4]Zero aphid treatment (Warrior + Lorsban 4E) received an insecticide treatment 3 times (5 June, 13 July, and 1 August)

Insecticide Evaluation Results

Northeast research farm, Floyd County

Table 4. Aphid populations one day before foliar insecticide applied at Floyd County, IA.

Date 7/31/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	61 ± 23	BCD
	Zzro aphid check	5 ± 1	D
Seed treatments			
	Gaucho	14 ± 4	CD
	Cruiser 50	39 ± 10	BCD
	Cruiser 100	53 ± 32	BCD
Foliar insecticides			
Reduced risk	Trimax	64 ± 29	BCD
	Fulfill	143 ± 64	A
Broad-spectrum	Warrior	105 ± 40	AB
	Danitol	85 ± 26	AB
	Baythroid XL	83 ± 44	ABC
	Dimethoate	53 ± 20	BCD

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 5. Aphids per plant three days post-insecticide application at Floyd County, IA

Date 8/4/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	61 ± 8	AB
	zero aphid check	1 ± 1	C
Seed treatments			
	Gaucho	81 ± 29	A
	Cruiser 50	76 ± 36	AB
	Cruiser 100	38 ± 13	AB
Foliar insecticides			
Reduced risk	Trimax	64 ± 33	AB
	Fulfill	11 ± 4	C
Broad-spectrum	Warrior	8 ± 2	C
	Danitol	3 ± 1	C
	Baythroid XL	11 ± 5	BC
	Dimethoate	42 ± 13	ABC

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 6. Aphids per plant 13 days post-insecticide application at Floyd County, IA.

Date 8/14/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	67 ± 11	A
	zero aphid check	1 ± 1	C
Seed treatments			
	Gaucho	38 ± 9	AB
	Cruiser 50	48 ± 14	A
	Cruiser 100	59 ± 15	A
Foliar insecticides			
Reduced risk	Trimax	45 ± 17	A
	Fulfill	8 ± 3	BC
Broad-spectrum	Warrior	1 ± 5	C
	Danitol	85 ± 26	A
	Baythroid XL	9 ± 5	BC
	Dimethoate	39 ± 17	ABC

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 7. Aphids per plant 18 days post-insecticide application at Floyd County, IA.

Date 8/18/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	78 ± 8	B
	zero aphid check	1 ± 1	D
Seed treatments			
	Gaucho	105 ± 15	A
	Cruiser 50	62 ± 18	B
	Cruiser 100	69 ± 15	B
Foliar insecticides			
Reduced risk	Trimax	35 ± 12	C
	Fulfill	18 ± 4	BC
Broad-spectrum	Warrior	1 ± 1	D
	Danitol	1 ± 1	D
	Baythroid XL	17 ± 9	BC
	Dimethoate	28 ± 7	C

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 8. Cumulative aphid days post-insecticide application at Floyd County, IA.

Date 8/18/2006	Treatment	Cumulative aphid days ± SEM	Statistical Grouping[1]
Checks			
	Untreated	3272 ± 387	A
	zero aphid check	21 ± 7	F
Seed treatments			
	Gaucho	2451 ± 331	A
	Cruiser 50	2626 ± 608	A
	Cruiser 100	2203 ± 260	A
Foliar insecticides			
Reduced risk			
	Trimax	1825 ± 525	AB
	Fulfill	378 ± 75	BCD
Broad-spectrum			
	Warrior	97 ± 29	DE
	Danitol	45 ± 29	E
	Baythroid XL	324 ± 143	CD
	Dimethoate	1392 ± 441	ABC

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 9. Yield and quality component analysis, Northwest Research Farm Floyd County, IA

Product [1,6]	Yield [2]	Protein [8]	Oil [4]
Check	58.0 ± 0.9	34.2 ± 0.2	19.4 ± 0.1
Zero aphid check	59.2 ± 1.1	34.0 ± 0.1	19.7 ± 0.1
Gaucho	58.4 ± 1.0	34.0 ± 0.1	19.7 ± 0.1
Cruiser 50	60.8 ± 0.6	34.2 ± 0.2	19.6 ± 0.1
Cruiser 100	58.7 ± 0.7	34.2 ± 0.1	19.5 ± 0.1
Trimax	59.4 ± 1.1	34.4 ± 0.2	19.6 ± 0.1
Fufill	60.2 ± 1.1	34.5 ± 0.2	19.6 ± 0.1
Warrior	58.9 ± 0.5	34.4 ± 0.2	19.4 ± 0.1
Danitol	61.8 ± 0.7	34.2 ± 0.1	19.4 ± 0.1
Baythroid XL	63.5 ± 1.1	34.2 ± 0.1	19.5 ± 0.1
Dimethoate	59.7 ± 1.0	34.2 ± 0.1	19.6 ± 0.1

[1] All foliar treatments were applied on 1 August.
[2] Yield reported as average bu/ac at 13% moisture.
[3] Protein reported as average % weight at 13% moisture.
[4] Oil reported as average % weight at 13% moisture.
[6] There were no significant differences between treatments ($P \leq 0.05$).

Combination of foliar and seed applied insecticide, Floyd County

Table 10. Season long cumulative aphid days at Floyd County, IA

Date 8/31/2006 Application date	Treatment	Cumulative aphid days ± SEM	Statistical Grouping[1]
Checks			
	Untreated	1544 ± 231	A
	Zero aphid check	12 ± 5	E
	Gaucho	1080 ± 340	AB
13 July			
	Gaucho + Warrior[2]	348 ± 86	BC
	Gaucho + Trimax[2]	320 ±55	BC
8 August			
	Gaucho + Warrior[3]	77 ± 22	D
	Gaucho + Trimax[3]	203 ± 67	C

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$
[2] Warrior and Trimax were applied targeting the emergence of first generation bean leaf beetle (13 July).
[3] Warrior and Trimax were applied targeting the soybean aphid populations (8 August).

Table 11. Yield and quality component analysis, Northeast Research Farm Floyd County, IA

Product [1,6]	Yield [2]	Protein [8]	Oil [4]
Check	54 ± 0.3	33.3 ± 0.2	19.5 ± 0.1
Zero aphid check	55 ± 1.5	33.2 ± 0.2	19.7 ± 0.3
Gaucho	55 ± 1.0	33.4 ± 0.2	19.4 ± 0.2
Gaucho + Warrior[2]	53 ± 1.3	33.4 ± 0.2	19.6 ± 0.1
Gaucho + Trimax[2]	54 ± 1.6	33.3 ± 0.2	19.3 ± 0.2
Gaucho + Warrior[2]	55 ± 1.1	33.2 ± 0.2	19.5 ± 0.1
Gaucho + Trimax[2]	54 ± 1.1	33.1 ± 0.2	19.6 ± 0.1

[1] All foliar treatments were applied on 1 August.
[2] Yield reported as average bu/ac at 13% moisture.
[3] Protein reported as average % weight at 13% moisture.
[4] Oil reported as average % weight at 13% moisture.
[6] There were no significant differences between treatments ($P \leq 0.05$).

Northwest research farm, O'Brien County

Table 12. Aphids per plant three days post-insecticide application at O'Brien County, IA

Date 8/17/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	10± 4	A
	Zero aphid check	1 ± 1	B
Foliar insecticides			
	Warrior	1 ± 1	B
	Baythroid XL	2 ± 1	B
	Orthene 96	1 ± 1	B
	V-10191	0 ± 0	B
	Orthene 97 +Lorsban 4E	0 ± 0	B
	Danitol	0 ± 0	B
	Lorsban 4E	1 ± 1	B
	Lorsban 4E + Proaxis	1 ± 1	B
	Proaxis	1 ± 1	B
	Mustang Max + Lorsban 4E	0 ± 0	B
	F-6113	0 ± 0	B
	GF-1846	0 ± 0	B

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 13. Aphids per plant 10 days post-insecticide application at O'Brien County, IA

Date 8/24/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	17 ± 3	A
	Zero aphid control	0 ± 0	B
Foliar insecticides			
	Warrior	0 ± 0	B
	Baythroid XL	1 ± 1	B
	Orthene 96	0 ± 0	B
	V-10191	0 ± 0	B
	Orthene 97 +Lorsban 4E	0 ± 0	B
	Danitol	0 ± 0	B
	Lorsban 4E	0 ± 0	B
	Lorsban 4E + Proaxis	0 ± 0	B
	Proaxis	0 ± 0	B
	Mustang Max + Lorsban 4E	0 ± 0	B
	F-6113	0 ± 0	B
	GF-1846	0 ± 0	B

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 14. Aphids per plant 17 days post-insecticide application at O'Brien County, IA

Date 8/31/2006	Treatment	Aphids per plant ± SEM	Statistical Grouping[1]
Checks			
	Untreated	4 ± 1	A
	Zero aphid check	0 ± 0	B
Foliar insecticides			
	Warrior	0 ± 0	B
	Baythroid XL	0 ± 0	B
	Orthene 96	0 ± 0	B
	V-10191	0 ± 0	B
	Orthene 97 +Lorsban 4E	0 ± 0	B
	Danitol	0 ± 0	B
	Lorsban 4E	0 ± 0	B
	Lorsban 4E + Proaxis	0 ± 0	B
	Proaxis	0 ± 0	B
	Mustang Max + Lorsban 4E	0 ± 0	B
	F-6113	0 ± 0	B
	GF-1846	0 ± 0	B

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 14. Cumulative aphid days post-insecticide application at O'Brien County, IA

Date 8/31/2006	Treatment	Cumulative aphid days ± SEM	Statistical Grouping[1]
Checks			
	Check	244 ± 78	A
	Zero aphid check	8 ± 5	C
Foliar insecticides			
	Warrior	42 ± 14	BC
	Baythroid XL	36 ± 15	BC
	Orthene 96	34 ± 11	B
	V-10191	18 ± 5	B
	Orthene 97 +Lorsban 4E	52 ± 7	BC
	Danitol	36 ± 22	BC
	Lorsban 4E	31 ± 10	BC
	Lorsban 4E + Proaxis	25 ± 10	BC
	Proaxis	31 ± 13	BC
	Mustang Max + Lorsban 4E	37 ± 12	BC
	F-6113	51 ± 18	B
	GF-1846	36 ± 12	BC

[1]Treatments labeled with a unique letter are significantly different $P \leq 0.05$

Table 15. Yield and quality component analysis, Northwest Research Farm O'Brien County, IA.

Product [1,6]	Yield [2]	Protein [8]	Oil [4]
Check	35.7 ± 1.4	34.1 ± 0.1	19.7 ± 0.2
Zero aphid check	36.8 ± 0.9	34.2 ± 0.3	19.4 ± 0.1
Warrior	34.8 ± 1.6	34.2 ± 0.1	19.2 ± 0.2
Baythroid XL	35.8 ± 1.6	34.3 ± 0.2	19.5 ± 0.1
Orthene 97	37.1 ± 1.0	34.2 ± 0.2	19.5 ± 0.1
V-10191	36.7 ± 1.2	34.1 ± 0.3	19.4 ± 0.1
Orthene 97 + Lorsban 4E	37.5 ± 0.8	34.0 ± 0.2	19.3 ± 0.1
Danitol	36.8 ± 0.9	34.1 ± 0.2	19.3 ± 0.1
Lorsban 4E	36.8 ± 1.3	34.2 ± 0.2	19.2 ± 0.1
Loesban 4E + Proaxis	35.0 ± 0.4	34.2 ± 0.2	19.5 ± 0.1
Proaxis	37.3 ± 0.3	34.3 ± 0.1	19.4 ± 0.2
Mustang Max + Lorsban 4E	34.8 ± 0.6	34.2 ± 0.2	19.6 ± 0.1
F-6113	36.6 ±1.0	34.4 ± 0.2	19.4 ± 0.1
GF-1846	35.0 ± 1.5	34.2 ± 0.2	19.7 ± 0.2

[1] All foliar treatments were applied on 1 August.
[2] Yield reported as average bu/ac at 13% moisture.
[3] Protein reported as average % weight at 13% moisture.
[4] Oil reported as average % weight at 13% moisture.
[6] There were no significant differences between treatments ($P \leq 0.05$).

Table 16. Beneficial insects and spiders collected by sweep-nets in treatments at the Northeast Research Farm Floyd County, IA. [1]

Order [2]	Family [3]	Species [4]
Coleoptera	Coccinellidae	*Coleomeguila maculata* *Harmonia axyridis* *Coccinella septempunctata* *Hippodamia convergens* *Hippodamia parenthesis*
Hemiptera	Anthocoridae Nabidae Pentatomidae	*Orius insidiosus*
Neuroptera	Chrysopidae Hemerobiidae	
Diptera	Dolichopodidae Syrphidae	
Hymenoptrea	Aphelinidae Braconidae	
Araneae		
Opiliones		

[1] Only beneficial insects collected were recorded.
[2] All beneficial insects were identified to the family level
[3] Spiders were only identified to order level
[4] Coccinellidae and Anthocoridae were the only families taken to species

Table 17. Total beneficial insect population from visual counts, Northeast Research Farm Floyd County, IA

	Total beneficial insect populations [1]					
Product[2]	4 August [5, 9]		7 August [6, 9]		14 August [6, 9]	
Check	3.17 ± 0.98	AB	5.83 ± 1.17	A	6.38 ± 1.37	AB
Cruiser 100	2.33 ± 0.56	AB	1.67 ± 0.61	BC	9.00 ± 1.95	A
Gaucho	4.67 ± 0.95	A	3.67 ± 1.02	AB	6.83 ± 1.97	AB
Trimax	1.50 ± 0.56	B	3.83 ± 1.40	AB	5.50 ± 2.19	AB
Fufill	1.00 ± 0.45	B	1.83 ± 0.54	B	2.83 ± 0.70	B
Warrior	0.67 ± 0.33	B	0.17 ± 0.17	C	0.33 ± 0.33	C

[1] Beneficial insects collected in the plots listed in table 16
[2] All foliar treatments were applied on 1 August.
[3] Seed treatments were applied at planting.
[4] Fufill, and Trimax are not labeled for use on soybeans in Iowa.
[5] There were no significant differences between treatments ($P \leq 0.05$).
[6] Means labeled with a unique letter were significantly different ($P \leq 0.05$).
[7] Means based on 6 reps.
[9] Beneficial insect population data should be considered observational due to confounding variables including food availability (aphids), and insecticide treatment.

Table 18. Total beneficial insect population from sweep-net sampling, Northeast Research Farm Floyd County, IA

	Total beneficial insect populations [1]					
Product[2]	4 August [5, 9]		7 August [6, 9]		14 August [6, 9]	
Check	1.36 ± 0.58	ABC	2.80 ± 0.47	AB	3.67 ± 1.04	A
Cruiser 100	1.50 ± 0.56	AB	1.33 ± 0.81	BC	1.67 ± 0.56	A
Gaucho	2.50 ± 0.43	A	3.17 ± 1.01	A	3.33 ± 0.71	A
Trimax	1.67 ± 0.67	AB	3.00 ± 1.06	A	2.00 ± 1.4	A
Fufill	0.83 ± 0.48	BC	1.50 ± 0.81	BC	2.00 ± 0.82	A
Warrior	0.33 ± 0.33	C	0.17 ± 0.17	C	0.20 ± 0.20	B

[1] Beneficial insects collected in the plots listed in table 16
[2] All foliar treatments were applied on 1 August.
[3] Seed treatments were applied at planting.
[4] Fufill, and Trimax are not labeled for use on soybeans in Iowa.
[5] There were no significant differences between treatments ($P \leq 0.05$).
[6] Means labeled with a unique letter were significantly different ($P \leq 0.05$).
[7] Means based on 6 reps.
[9] Beneficial insect population data should be considered observational due to confounding variables including food availability (aphids), and insecticide treatment.

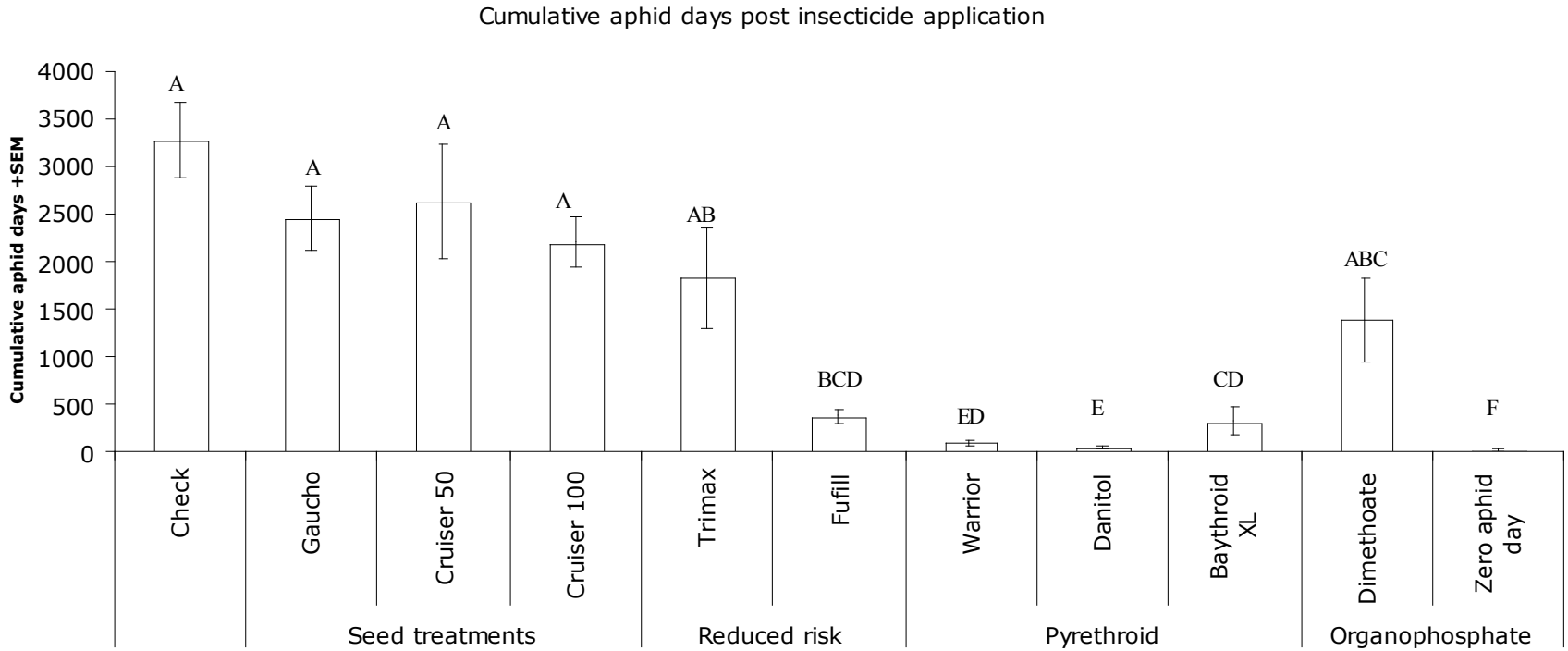

Figure 1. Cumulative aphid days post-insecticide application at Floyd County, IA. Foliar treatments were applied 1 August. Aphid populations in untreated plots averaged 85 aphids per plant at the time of application. "Zero aphid day" treatment (Warrior + Lorsban 4E) is included to show the maximum yield possible in the absence of aphid exposure. Treatments labeled with a unique letter are significantly different $P \leq 0.05$

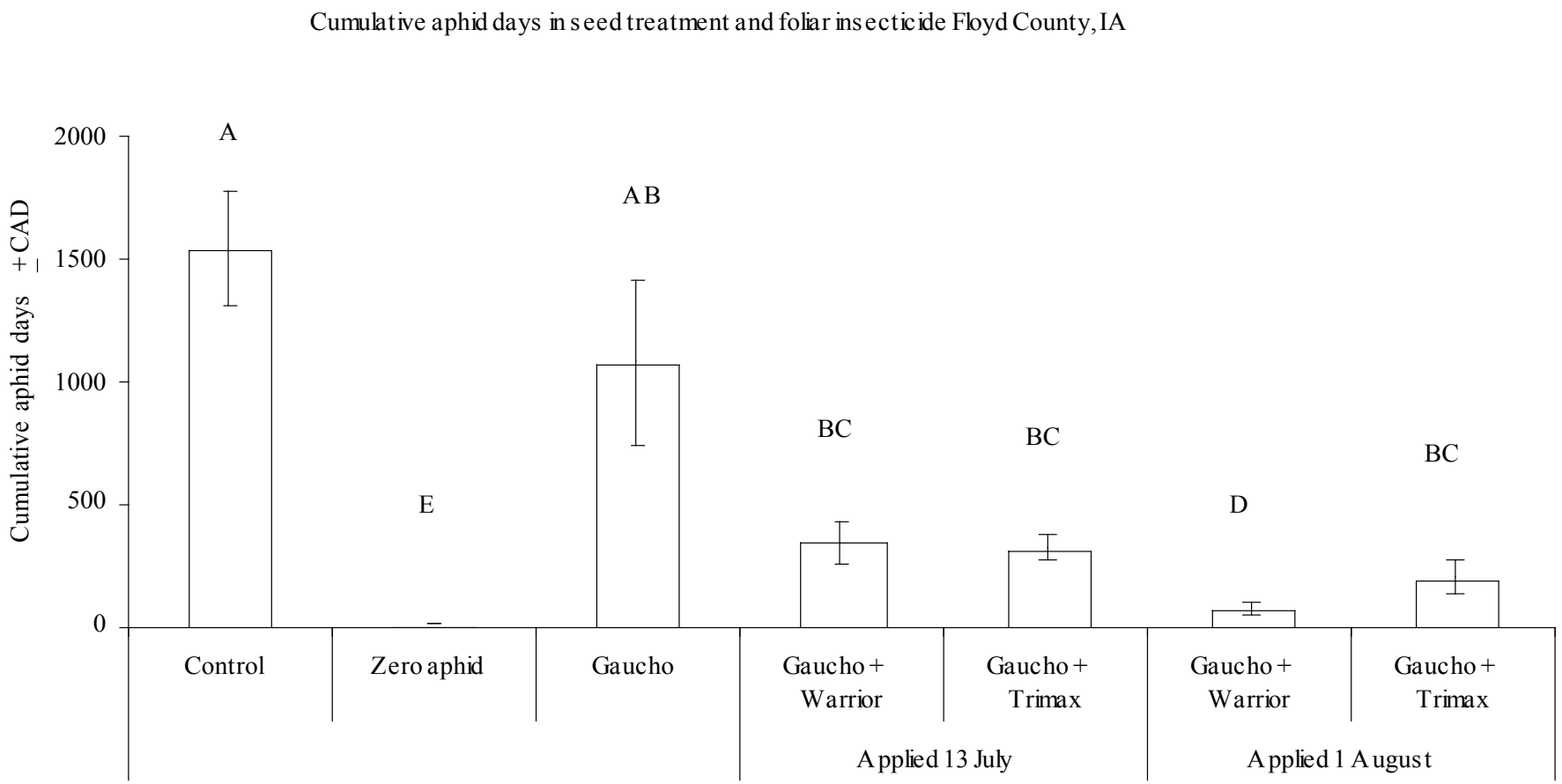

Figure 2. Season long cumulative aphid days at Floyd County, IA. "Zero aphid day" treatment (Warrior + Lorsban 4E) is included to show the maximum yield possible in the absence of aphid exposure. Treatments labeled with a unique letter are significantly different $P \leq 0.05$

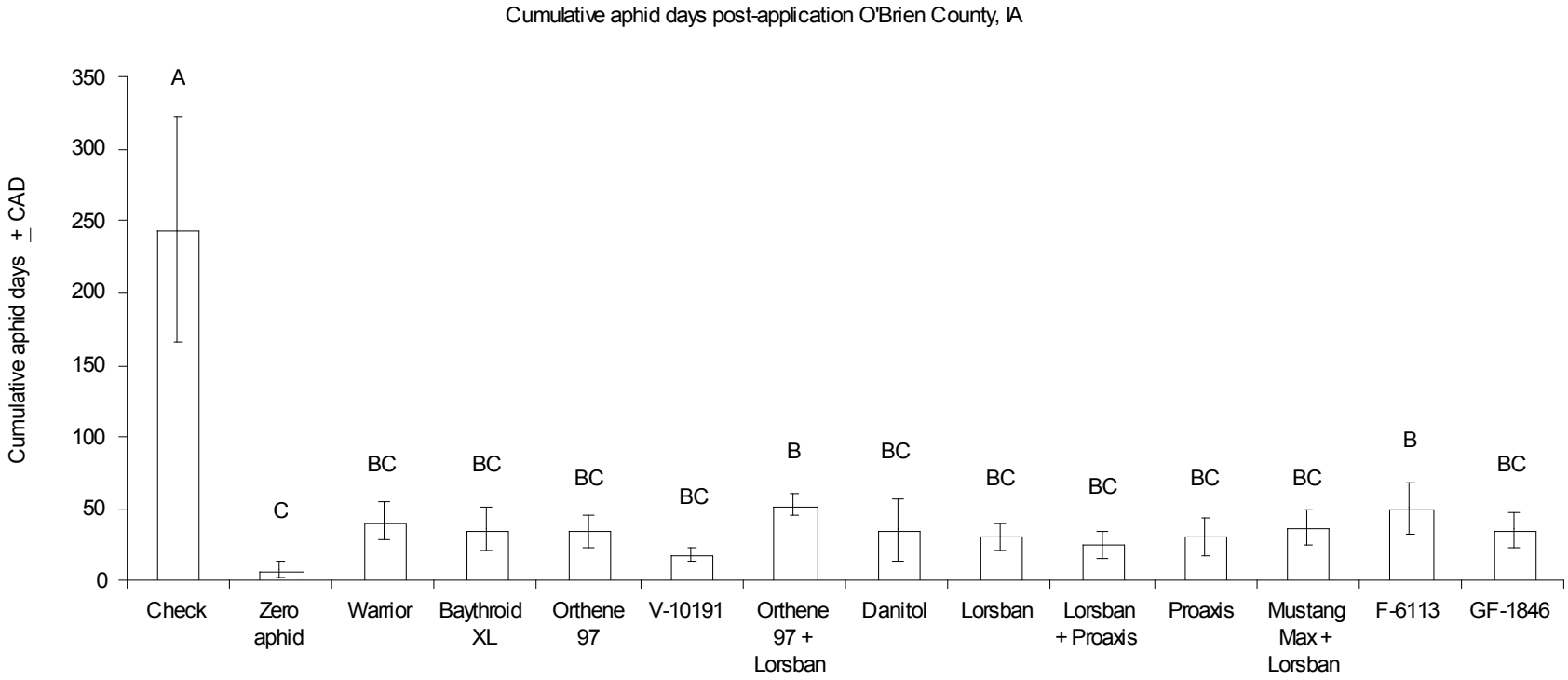

Figure 3. Cumulative aphid days post-insecticide application at O'Brien County, IA. Foliar treatments were applied 1 August. Aphid populations in untreated plots averaged 85 aphids per plant at the time of application. "Zero aphid day" treatment (Warrior + Lorsban 4E) is included to show the maximum yield possible in the absence of aphid exposure. Treatments labeled with a unique letter are significantly different $P \leq 0.05$