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Aphids in Corn Research

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Abstract
Corn, *Zea mays* L., is the most abundant field crop in Iowa, and there are many insect pests associated with this field crop. Although aphids are not typically economically important in corn, recent observations have indicated several aphid species developing heavy populations in northwest Iowa and southwest Minnesota. Historically, the corn leaf aphid, *Rhopalosiphum maidis* (Hemiptera: Aphididae), has been the most abundant aphid species in corn. However, the bird cherry oat aphid, *R. padi* (Hemiptera: Aphididae) and several other species also have been detected. Recent observations show a shift to populations peaking later in the summer. Damage to potential and management guidelines for aphids in corn are not well defined and this research is aimed at developing economic threshold and sampling protocols.

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Aphids in Corn Research

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Introduction

Corn, *Zea mays* L., is the most abundant field crop in Iowa, and there are many insect pests associated with this field crop. Although aphids are not typically economically important in corn, recent observations have indicated several aphid species developing heavy populations in northwest Iowa and southwest Minnesota. Historically, the corn leaf aphid, *Rhopalosiphum maidis* (Hemiptera: Aphididae), has been the most abundant aphid species in corn. However, the bird cherry oat aphid, *R. padi* (Hemiptera: Aphididae) and several other species also have been detected. Recent observations show a shift to populations peaking later in the summer. Damage to potential and management guidelines for aphids in corn are not well defined and this research is aimed at developing economic threshold and sampling protocols.

Materials and Methods

We established plots at the Iowa State University Northwest Research Farm, Sutherland, O'Brien County, Iowa. The treatments were arranged in a randomized complete block design with four replications of Roundup Ready corn (Pioneer PO115XR). Plots were planted in 30-in. rows at a seeding rate of 35,600/acre on April 25. Each plot was 8 rows wide and 44 ft long. In 2012, 15 treatments were evaluated (Table 1). Foliar treatments were made using a backpack sprayer and TeeJet flat fan nozzles (TJ 8002VS) with 20 gallons of water/acre at 40 pounds of pressure per square inch. The tassel and R1 treatment applications were made on July 12; the R3 and threshold treatment applications were made on August 17.

Estimation of aphid populations and cumulative aphid days. Plots were sampled weekly from June through August. Plots were sampled for all aphid stages (i.e., adults, nymphs, and winged aphids). The number of plants sampled in each plot started at 20 and decreased to ten plants/plot by the end of the August. Cumulative aphid days (CAD) were calculated for each plot to estimate seasonal aphid exposure with the following equation:

$$\sum_{n=1}^{\infty} = \left(\frac{x_{i-1} + x_i}{2} \right) \times t$$

where x is the mean number of aphids on sample day i, x_{i-1} is the mean number of aphids on the previous sample day, and t is the number of days between samples i - 1 and i.

Yield and statistical analysis. Yields were determined by weighing grain with a grain hopper mounted inside the combine grain tank. Yields were corrected to 15.5 percent moisture and reported as bushels/acre. One way analysis of variance (ANOVA) was used to determine treatment effects within each experiment. Means separation for CAD and yield was achieved using a least significant difference test ($P \leq 0.10$). All analyses were performed with SAS® software.

Results and Discussion

During the 2012 growing season, aphid populations were very low until August 14, shortly before all the foliar applications were made. Aphid populations peaked in the untreated control on August 26. The two most abundant species were the bird cherry oat aphid followed by the corn leaf aphid. Other corn insects were patchy and not considered to contribute to yield loss. In addition, corn foliar diseases were not evident.

In 2012, seasonal pressure of aphids in corn was highly variable between treatments and ranged from 384 to 2,712 CAD (Table 1). There were significant differences in CAD among treatments ($P = 0.0258$; $F = 2.10$; df = 14, 3). The treatments with the highest CAD were the untreated control and Quadris applied at tassel. There were also yield differences among treatments ($P = 0.1245$; $F = 1.55$; df = 14, 3) (Table 1). Yield was highest in the Cobalt Advanced + Quadris treatment (225.8 bushels/acre).

Our recommendation for managing aphids in corn is to monitor populations just prior to tasseling through the end of August. Since an economic threshold has not been developed for populations after tasseling, foliar insecticides may be justified if aphid feeding and honeydew production are interfering with pollination or grain fill.

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Table 1. List of treatments for the aphids in corn study at ISU Northwest Research Farm.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
1. Untreated Control	-----	2,712.38 ± 1,328.86	A	204.7 ± 10.5	BCDE
2. Cobalt Advanced EC[f]	16	384.00 ± 149.21	B	205.4 ± 12.6	BCDE
3. Cobalt Advanced EC[f]	16	830.00 ± 446.15	B	202.1 ± 7.4	BCDE
4. Quadris SC[f]	12	2,660.00 ± 2,409.94	A	217.5 ± 7.7	AB
5. Cobalt Advanced EC + Quadris SC[f]	16 12	845.50 ± 405.00	B	205.4 ± 7.9	BCDE
6. Cobalt Advanced EC[f]	16	620.25 ± 576.20	B	206.9 ± 11.3	BCD
7. Quadris SC[f]	12	695.50 ± 228.58	B	216.1 ± 6.3	AB
8. Cobalt Advanced EC + Quadris SC[f]	16 12	813.50 ± 584.90	B	225.8 ± 4.0	A
9. Quadris SC[g]	12	1,132.00 ± 585.11	AB	139.9 ± 56.0	DE
10. Cobalt Advanced EC[g]	16	997.50 ± 309.70	AB	211.5 ± 7.9	ABC
11. Cobalt Advanced EC + Quadris SC[g]	16 12	620.50 ± 259.93	B	211.9 ± 7.4	ABC
12. Cobalt Advanced EC[g]	16	721.13 ± 473.35	B	190.8 ± 6.7	DE
13. Cobalt Advanced EC[g]	16	789.25 ± 457.81	B	196.7 ± 3.6	CDE
14. Cobalt Advanced EC[g]	16	2,002.75 ± 1,524.86	AB	207.9 ± 3.6	ABCD
15. Cobalt Advanced EC[g]	16	626.25 ± 365.80	B	187.8 ± 3.2	E

[a]Foliar product rates are given as formulated product per acre.
[b]CAD ± SEM; cumulative aphid days ± standard error of the mean.
[c]CAD-LSD; least significant different mean separation test for cumulative aphid days.
[d]Yield ± SEM; yield in bushels per acre ± standard error of the mean.
[e]Yield-LSD; least significant different mean separation test for yield.
[f]Foliar applications were made on July 12, 2012.
[g]Foliar applications were made on August 17, 2012.