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OXFORD

FIELD CORN: *Zea mays* L. (DeKalb 62–95)

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Corn (hybrid, maize, sweet) | *Zea mays*

Western bean cutworm (WBC) | *Striacosta albicosta* (Smith)

Corn earworm (CEW) | *Helicoverpa zea* (Boddie)

The objective of this field trial was to determine if application timing affects the efficacy of single applications of foliar insecticides at preventing feeding damage by the western bean cutworm (WBC), an important pest of corn and dry beans in the North American Corn Belt. This study was located at the University of Nebraska-Lincoln's Henry J. Stumpf International Wheat Center in Perkins County, NE (40.856851°N, −101.701335°W). The experimental design used was an RCB design with a total of 10 treatments (three insecticides applied at three application timings, plus an untreated check) and four replications; the treatment design was an incomplete 4 × 3 factorial in which the UTC occurred during the ideal application timing only. Seeds of DKC62-95 (Monsanto Company, St. Louis, MO), a non-Bt hybrid with RR2 herbicide tolerance, were planted on 5 May 2018 using a commercial 8-row planter at 32,000 seeds/acre at approximately 1.40–1.75 inches deep in 30-inch rows. Individual plots measured 20 ft (8 rows) wide x 35 ft long. Standard agronomic practices for the region were followed for irrigation, fertilization, and weed management inputs. No insecticide applications were made other than the experimental treatments.

A backpack sprayer with an 8.3-ft handheld boom was used to apply all foliar insecticide treatments. Insecticides were delivered at 15 gpa carrier volume through six TeeJet AIXR 11002 air induction flat fan nozzles spaced 20 inches apart; 40 psi pressure was maintained with a CO_2 propellant. Applications were made to a 10 × 30 ft area in the middle four rows of each plot with a single pass at 3 mph. Plots were scouted twice per week for the presence of WBC eggs and larvae following the onset of moth flight on 28 Jun. The recommended timing of insecticide applications for WBC is when 90–95% of the plants in a field have tasseled. To assess how application timing might affect treatment efficacy, we applied insecticides early (17 Jul at 50% tasseled), at the ideal time (24 Jul at 90% tasseled), and late (31 Jul at 100% tasseled). Scouting results indicated that 16% of plants were infested with an egg mass or larvae prior to the early application, 17% prior to the ideal application, and 18% prior to the late application.

On 20 Aug (34 days after application [DAA] for early treatments, 27 DAA for ideal treatments, and 20 DAA for late treatments), 10 ears were randomly chosen and removed along with the husks from the treated area in each plot. Ears were husked and the amount of feeding damage, measured in square centimeters, to aborted kernels at the ear tip and to harvestable kernels was determined. The presence of WBC and CEW larvae and secondary fungal infection in the ears was also recorded. To determine if treatments had a measurable impact on yield, a standardized subsample of ears (1/1000 of an acre) from each plot were hand-harvested on 1 Nov and shelled to calculate yield. Total grain weight and % moisture measurements were recorded and standardized to 56 lbs per bushel and 15.5% moisture. Damage to aborted ear tip kernels, harvestable kernels, both kernel types (total damage), and yield were analyzed separately using mixed models with insecticide treatment and application timing as fixed effects and block as a random effect in PROC GLIMMIX (SAS v. 9.4). For all analyses, mean separations were obtained using Tukey's test (α = 5%). Untransformed means are presented.

Application timing did not significantly affect the efficacy of single applications of foliar insecticides at preventing damage to aborted ear tip kernels, harvestable kernels, and both kernel types (Table 1). Similarly, application timing was not a significant effect on its own and damage to all kernel types did not differ between early, ideal, and late applications overall. However, insecticide treatment did have a significant impact on the amount of harvestable kernel and total kernel damage observed; harvestable kernel damage was lower in plots treated with Prevathon than in UTC plots, whereas total kernel damage was lower in plots treated with Prevathon than in UTC plots and plots treated with Steward (Table 2). Yield was not affected by insecticide treatment, application timing, or a combination of the two factors (Tables 1 and 2). The efficacy and residual activity of the foliar insecticide treatments tested in this study may have been negatively affected by a hail event prior to applications that damaged plants throughout the study area, and other inclement weather. Fungal infection is related to WBC infestation, and ears from the ideal and late Prevathon treatments, as well as the late Steward treatment, did not exhibit any fungal infection.

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Table 1.

Application timing	Treatment/ formulation	Rate (fl oz/ acre)	Total number of WBC larvae collected	Total number of CEW larvae collected	Mean feeding damage to aborted kernels per ear (cm^2) [a]	Mean feeding damage to harvestable kernels per ear (cm^2) [a]	Mean total feeding damage per ear (cm^2) [a]	Overall proportion of ears infested with larvae[a,b]	Overall proportion of ears with fungal infection[a,b]	Yield (bu/ acre)
	Untreated check	–	9	1	1.07a	0.85a	1.92a	0.43	0.05	185.35a
Early	Hero 1.24EC	5	1	3	0.49a	0.39a	0.88a	0.23	0.10	190.90a
	Prevathon 0.43SC	14	0	1	0.47a	0.14a	0.61a	0.13	0.05	199.54a
	Steward 1.25EC	10	4	2	1.04a	0.88a	1.93a	0.35	0.05	237.02a
Ideal	Hero 1.24EC	5	4	0	0.7a	0.26a	0.96a	0.23	0.08	209.90a
	Prevathon 0.43SC	14	0	0	0.18a	0.12a	0.30a	0.08	0.00	223.25a
	Steward 1.25EC	10	2	0	0.69a	0.43a	1.12a	0.20	0.03	210.42a
Late	Hero 1.24EC	5	4	2	1.11a	0.45a	1.56a	0.38	0.05	208.15a
	Prevathon 0.43SC	14	1	0	0.19a	0.21a	0.40a	0.18	0.00	226.20a
	Steward 1.25EC	10	2	3	0.99a	0.19a	1.18a	0.25	0.00	213.25a
	$P > F$				0.70	0.32	0.56			0.29

Means within columns followed by the same letter are not significantly different ($P > 0.05$).

[a]Data were collected 34 DAA for early treatments, 27 DAA for ideal treatments, or 20 DAA for late treatments; corn ears were at the early dent stage (R5) when collected.

[b]Data for the percent of ears infested with larvae and the percent of ears with fungal infection were not analyzed statistically.

Table 2.

Treatment/ formulation	Rate (fl oz/acre)	Mean feeding damage to aborted kernels per ear (cm^2)	Mean feeding damage to harvestable kernels per ear (cm^2)	Mean total feeding damage per ear (cm^2)	Yield (bu/ acre)
Untreated check	–	1.07a	0.85a	1.92a	185.35a
Hero 1.24EC	5	0.77a	0.37ab	1.13ab	202.98a
Prevathon 0.43SC	14	0.28a	0.16b	0.44b	216.33a
Steward 1.25EC	10	0.91a	0.50ab	1.41a	220.23a
$P > F$		0.08	0.0308	0.0124	0.13

Means within columns followed by the same letter are not significantly different ($P > 0.05$).