2018

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*Arthropod Management Tests,* XX(X), 2018, 1–2
doi: 10.1093/amt/tsy095
Section F: Field & Cereal Crops

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

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Subject Editor: Clyde Sorenson

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 evaluate the efficacy of a single application of foliar insecticides at preventing feeding damage by the western bean cutworm (WBC), an important pest of corn and dry beans. Direct feeding by WBC larvae on developing kernels in the ear can result in yield loss, whereas WBC infestation can also lead to secondary fungal infections. WBC has undergone a rapid range expansion into the eastern Corn Belt within the last 16 yr. This study was conducted within the historic range of WBC, at the University of Nebraska-Lincoln's Henry J. Stumpf International Wheat Center in Perkins County, NE (40.856772° N, –101.701281° W). An RCB design with 14 treatments (including an untreated check) and 4 replications was used. Each plot was 20 × 35 ft and consisted of eight rows. The trial was planted on 12 May 2017 using a commercial 8-row planter at 32,000 seeds/acre at an approximate depth of 1.40–1.75 inches in 30-inch rows. The seeds planted were DKC62-95 (Monsanto Company, St. Louis, MO), a non-Bt hybrid with RR2 herbicide tolerance. Irrigation, fertilization, and weed management inputs in plots followed standard agronomic practices for the region, with no insecticide applications other than the experimental treatments.

Plots were scouted weekly for the presence of WBC eggs and larvae following the onset of moth flight on 28 Jun. Prior to application, 21% of plants on average were infested with egg masses or early instar larvae, whereas ~80% of the plants had tasseled. Foliar insecticide treatments were applied on 24 Jul using a backpack sprayer with an 8.3-ft handheld boom. Insecticides were delivered at 15 gpa carrier volume through six TeeJet AIXR 11002 Yellow nozzles spaced 20 inches apart with 30 psi pressure 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.

Beginning on 1 Aug (7 d after application; DAA), five plants in the center of each plot were scouted and the numbers of hatched and unhatched WBC egg masses and live and dead larvae were recorded. Corn earworm (CEW) and other non-WBC larvae were noted at the time of observation. Scouted plants were located in the middle third of the two middle rows in each plot and were selected using randomly generated sampling sequences and marked with flagging tape. New plants were scouted using the same methods on 8 Aug (14 DAA) and 15 Aug (21 DAA).

On 23 Aug (29 DAA), 10 ears were randomly chosen and removed along with the husks from the two rows adjacent to the scouted area in each plot. The ears were husked and examined in the laboratory to determine the amount of feeding damage, measured in square centimeters, to aborted kernels at the ear tip and to harvestable kernels. The presence of WBC and CEW larvae and secondary fungal infection in the ears were also recorded. On 29 Nov, a standardized subsample of ears (1/1,000 of an acre) from each plot were hand-harvested 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 kernels, harvestable kernels, and both kernel types (total damage) were analyzed using mixed-model ANOVA (PROC MIXED, SAS v. 9.4) with treatment as a fixed effect and block as a random effect. Yield data were analyzed using a mixed-model ANOVA with treatment as a fixed effect and replicate as a random effect. In all analyses, mean separations were obtained using Tukey's test ($\alpha$ = 5%). Damage data were square root-transformed to meet the assumptions of normality, whereas the Satterthwaite approximation was used to determine degrees of freedom due to heteroscedasticity. Untransformed means are presented.

A total of 140 larvae were counted during scouting efforts conducted 7, 14, and 21 DAA. Over half (52.9%) of larvae encountered on plants at 7 DAA were dead, whereas only 16.1 and 0.0% larvae encountered at 14 and 21 DAA, respectively, were dead (Table 1). A total of 25 larvae were counted across the three scouting dates in UTC plots; only the plots treated with the lowest rate of Mustang Maxx had more larvae than the UTC. Plots treated with the highest rate of Besiege and the lowest rate of Brigade had the lowest numbers of larvae present overall (1 each).

Feeding damage from WBC and CEW larvae were combined in these analyses; however, 93.9% of the 66 larvae encountered during

ear assessments were WBC and 6.1% were CEW. At 29 DAA, 40.0% of corn ears in the UTC were infested with larvae. Mean feeding damage in UTC plots ranged from 0.33 to 2.05 $cm^2$ with a mean of 0.88 $cm^2$ for aborted ear tip kernels, from 0.00 to 4.58 $cm^2$ with a mean of 1.76 $cm^2$ for harvestable kernels, and from 0.40 to 6.63 $cm^2$ with a mean of 2.64 $cm^2$ for total kernel damage. All foliar insecticide treatments failed to significantly reduce ear feeding damage to aborted ear tip kernels ($F = 1.50$, df = 13, 39, $P = 0.16$), harvestable kernels ($F = 1.86$, df = 13, 39, $P = 0.07$), and both kernel types ($F = 1.84$, df = 13, 39, $P = 0.07$) compared with the UTC (Table 2). Although damage to aborted ear tip kernels was numerically higher in plots treated with Steward + Comite II than in UTC plots, damage to harvestable kernels and total kernel damage was numerically higher in UTC plots than in all other treatment plots. Yield in plots treated with Warrior II was higher than in plots treated with both rates of Besiege. Plots treated with the lower rate of Brigade were the only plots where fungal infection was observed. The efficacy and residual activity of the foliar insecticide treatments tested in this study may have been negatively affected by inclement weather. Although results from past trials conducted at this site have shown that fungal infection is related to WBC infestation, very few ears in this trial had fungal infection.

This research was supported by industry gifts of products and research funding.

**Table 1.**

| Treatment/formulation (AI) | Rate (fl oz/acre) | 7 DAA[a] | | 14 DAA | | 21 DAA | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | No. of dead | No. of live | No. of dead | No. of live | No. of dead | No. of live | No. of dead | No. of live |
| Untreated check | – | 3 | 1 | 0 | 7 | 0 | 14 | 3 | 22 |
| Asana XL EC (Esfenvalerate) | 5.8 | 1 | 1 | 0 | 3 | 0 | 4 | 1 | 8 |
| Besiege ZC (Chlorantraniliprole + Lambda-Cyhalothrin) | 5.0 | 14 | 0 | 0 | 0 | 0 | 0 | 14 | 0 |
| | 9.0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Brigade 2EC (Bifenthrin) | 3.0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 6.4 | 0 | 1 | 4 | 0 | 0 | 3 | 4 | 4 |
| Mustang Maxx EC (Zeta-Cypermethrin) | 1.76 | 9 | 15 | 0 | 3 | 0 | 2 | 9 | 20 |
| | 4.0 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| Prevathon SC (Chlorantraniliprole) | 14.0 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 3 |
| | 20.0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Steward EC (Indoxacarb) | 6.0 | 0 | 14 | 0 | 4 | 0 | 1 | 0 | 19 |
| | 9.2 | 0 | 0 | 0 | 4 | 0 | 6 | 0 | 10 |
| Steward EC (Indoxacarb) + Comite II (Propargite) | 9.2 + 54 | 0 | 0 | 1 | 3 | 0 | 4 | 1 | 7 |
| Warrior II CS (Lambda-Cyhalothrin) | 1.6 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 4 |
| Total | – | 36 | 32 | 5 | 26 | 0 | 41 | 41 | 99 |

[a]Days after application.
Data were not analyzed statistically.

**Table 2.**

| Treatment/formulation (AI) | Rate (fl oz/acre) | Mean feeding damage to aborted kernels ($cm^2$) | Mean feeding damage to harvestable kernels ($cm^2$) | Mean total feeding damage ($cm^2$) | % of ears infested with WBC larvae | % of ears with fungal infection | Mean yield per plot (bu/acre) |
|---|---|---|---|---|---|---|---|
| Untreated check | – | 0.88a | 1.76a | 2.64a | 40.0 | 0.0 | 164.9ab |
| Asana XL EC (Esfenvalerate) | 5.8 | 0.22a | 0.00a | 0.22a | 10.0 | 0.0 | 133.6ab |
| Besiege ZC (Chlorantraniliprole + Lambda-Cyhalothrin) | 5.0 | 0.34a | 0.73a | 1.07a | 12.5 | 0.0 | 92.6b |
| | 9.0 | 0.08a | 0.01a | 0.09a | 10.0 | 0.0 | 97.7b |
| Brigade 2EC (Bifenthrin) | 3.0 | 0.09a | 0.00a | 0.09a | 2.5 | 2.5 | 143.6ab |
| | 6.4 | 0.77a | 0.00a | 0.77a | 25.0 | 0.0 | 138.6ab |
| Mustang Maxx EC (Zeta-Cypermethrin) | 1.76 | 0.33a | 0.09a | 0.41a | 10.0 | 0.0 | 133.9ab |
| | 4.0 | 0.15a | 0.00a | 0.15a | 5.0 | 0.0 | 167.6ab |
| Prevathon SC (Chlorantraniliprole) | 14.0 | 0.13a | 0.13a | 0.26a | 7.5 | 0.0 | 151.3ab |
| | 20.0 | 0.05a | 0.00a | 0.05a | 7.5 | 0.0 | 161.9ab |
| Steward EC (Indoxacarb) | 6.0 | 0.24a | 0.00a | 0.24a | 7.5 | 0.0 | 137.3ab |
| | 9.2 | 0.36a | 0.03a | 0.39a | 17.5 | 0.0 | 169.2ab |
| Steward EC (Indoxacarb) + Comite II (Propargite) | 9.2 + 54 | 1.28a | 0.21a | 1.49a | 22.5 | 0.0 | 137.0ab |
| Warrior II CS (Lambda-Cyhalothrin) | 1.6 | 0.12a | 0.01a | 0.13a | 7.5 | 0.0 | 180.1a |
| *P* value | – | 0.16 | 0.07 | 0.07 | – | – | 0.0141 |

Means within columns followed by the same letter are not significantly different ($P > 0.05$).
Data for the percent of ears infested with WBC and the percent of ears with fungal infection were not analyzed statistically.