Evaluation of Bt Corn Hybrids for Protection of Ears Against Ear Feeders and Monitoring For Resistance in Southwestern Corn Borers

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Crop: Field Corn
Status: 1st Year

Value to the Grower:

High corn earworm populations in recent years have caused some to question what level of yield loss in field corn is realized as a result of heavy infestations of these pests. Making insecticide applications for these pests in field corn has never been considered to be economical or believed to significantly increase yields. Earworm moths deposit their eggs on fresh corn silks. Newly hatched larvae then move down the silk and begin feeding on the ear underneath the shuck where they are protected from insecticide applications. To keep earworms from damaging ears would require daily applications of a foliar insecticide during the silking phase. While this practice is common in commercially grown sweet corn it is not economically feasible in field corn. The recent development of corn hybrids containing dual Bt proteins have shown increasing levels of protection against ear feeding caterpillars, particularly the corn earworm. However, the level of this protection is not always 100%. The true value of these hybrids to the grower for earworm protection is difficult to ascertain. It is important that we determine the true level of any yield increase that may offset the cost of the technology to the grower.

The southwestern corn borer is one of the more destructive pests of corn in Arkansas. Corn varieties expressing the Bt toxin give excellent control and have been very useful for managing southwestern corn borer. It is important to monitor these Bt hybrids for potential insecticide resistance development in this pest.

Objectives:

1. To determine the effectiveness of new Bt corn hybrids against ear feeders (corn earworm and fall armyworm) in Arkansas.
2. To determine the yield loss caused by ear feeders in field corn in Arkansas.
3. To monitor the development of resistance in southwestern corn borer to Bt corn technologies.

Procedures:

Plots of a Bt corn hybrids containing the various Bt technologies were planted in northeast, central and southeast Arkansas. One non-Bt hybrid was also planted at each location. Ears were sampled at the end of the season from 10 of the county variety trials and from each of the research center (Keiser, Rowher, Marianna) locations. The number of damaged ears and the amount of damage per ear was evaluated. Corn stalks from each location were also collected and split to determine the level of southwestern corn borer damage to each technology. The southwestern corn borer data will kept in a database to compare to future levels of damage in order to determine any levels of resistance that may develop.

Plots of a non-Bt, a YieldGard, a Triple PRO, a Viptera and a Herculex hybrid were planted in northeast Arkansas. Each technology was treated under two spray regimes, unsprayed and weekly sprays during silking. The weekly sprays were used to keep the hybrids free of ear feeding caterpillars. At the

end of the season ears were evaluated for feeding damage using the same methods as above and yields were taken from each plot.

Research Locations:

Northeast Research and Extension Center, Keiser
Lon Mann Station, Marianna
Southeast Research and Extension Center, Rohwer

Results

The amount of damage per 10 ears in the sprayed and unsprayed treatments is reported in Figure 1. Little to no damage was detected in the Viptera and SmartStax hybrids in sprayed or unsprayed treatments. The Triple Pro hybrids did sustain some damage in the unsprayed treatment. The Yieldgard, Herculex and non-Bt hybrids sustained similar amounts of damage in the unsprayed plots. The sprayed plots had little ear feeding damage across all hybrids regardless of technology trait package indicating that the daily spray regime did successfully protect ears from earworm infestations. Although there were differences in the amount of damage in the sprayed and unsprayed treatments with Triple Pro, Herculex, Yieldgard and non-Bt hybrids (Figure 1), there was no significant increase in yield in the sprayed treatments (Figures 4, 5 & 7) with exception of the Herculex hybrids (Figure 6). In most instances the unsprayed treatments had a slight increase in yield over the sprayed plots although this was not statistically significant.

No southwestern corn borer damage was detected in any of the Bt hybrids at any locations. Damage in non-Bt hybrids was lower than normal indicating southwestern corn borer populations were low in 2011.

Discussion

There was no significant yield increase in non-Bt hybrids when protected from corn earworm feeding on ears. This indicates that there is no significant yield loss from this insect in field corn even though ears did sustain some damage from this pest. Earworms feed on predominantly on the tip of the ear. Previous research indicates that the top 25% of the tip end of the ear contributes only about 15% of the total yield. Given the fact that earworms do not usually consume the entire tip, but only a portion, it can be understood why there was no detectible yield loss from this pest. Planting a Bt corn hybrid, with either single or multiple Bt proteins, for earworm protection does not appear to be necessary. However, these data are the results from only one year of research and do not consider the potential problems associated with other secondary organisms that may infect the ear as a result of earworm feeding.

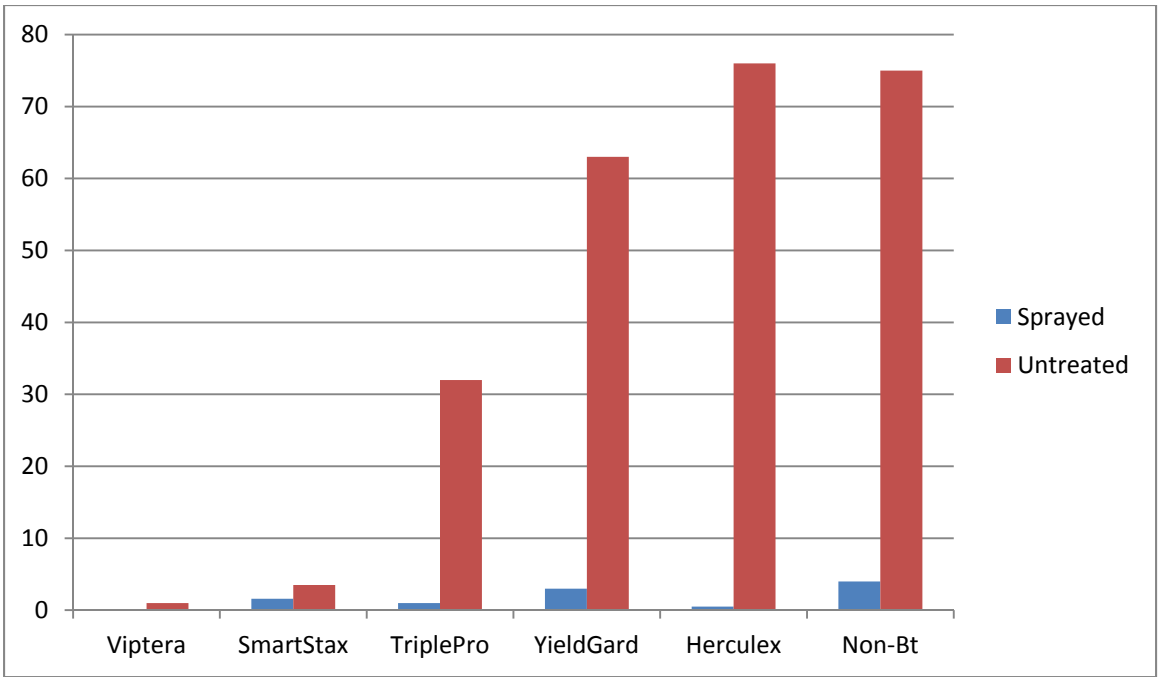

Figure 1. Square cm Feeding Damage per 10 Ears on Different Traits in Sprayed and Unsprayed Plots.

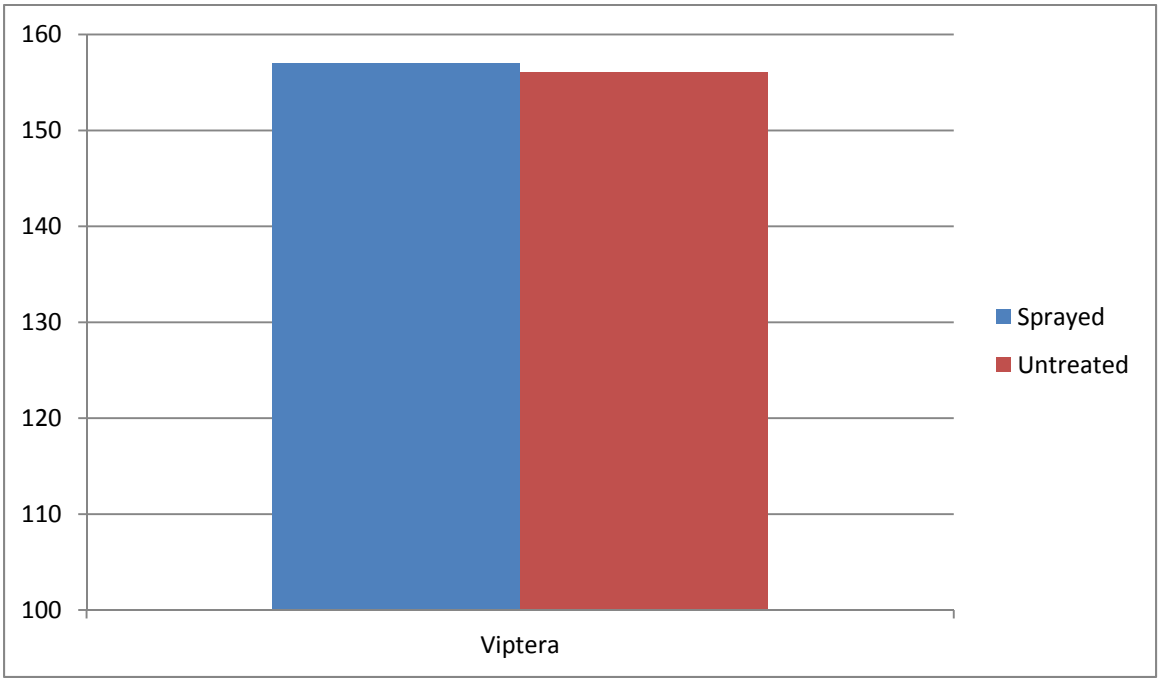

Figure 2. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders

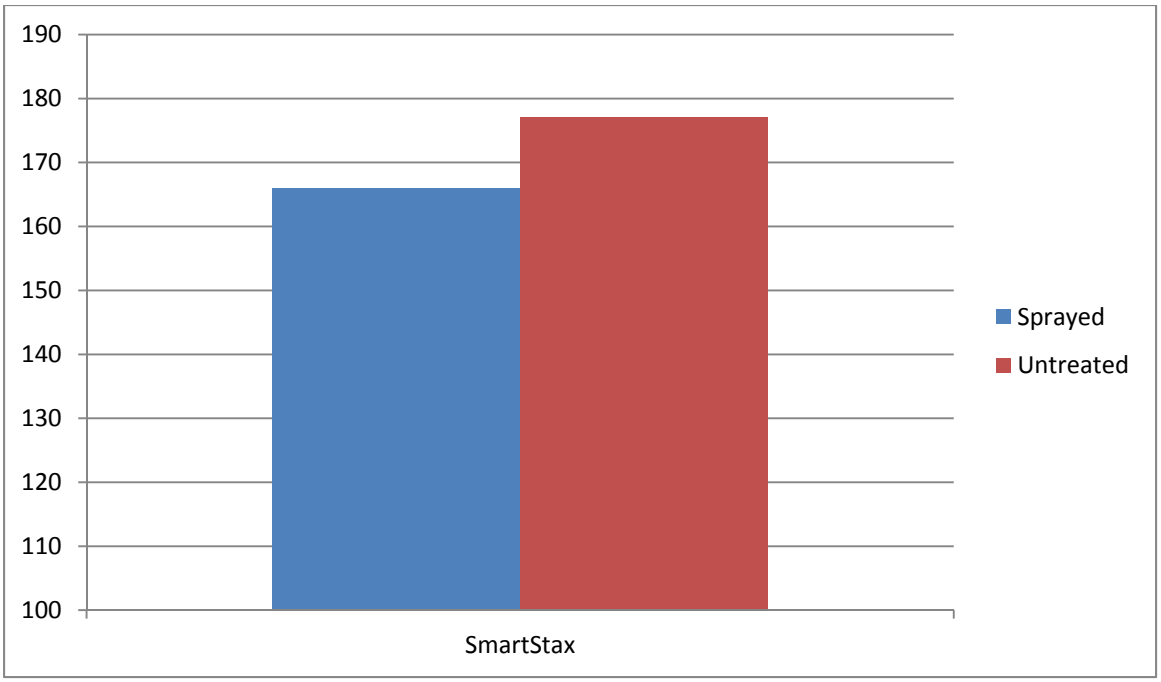

Figure 3. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders

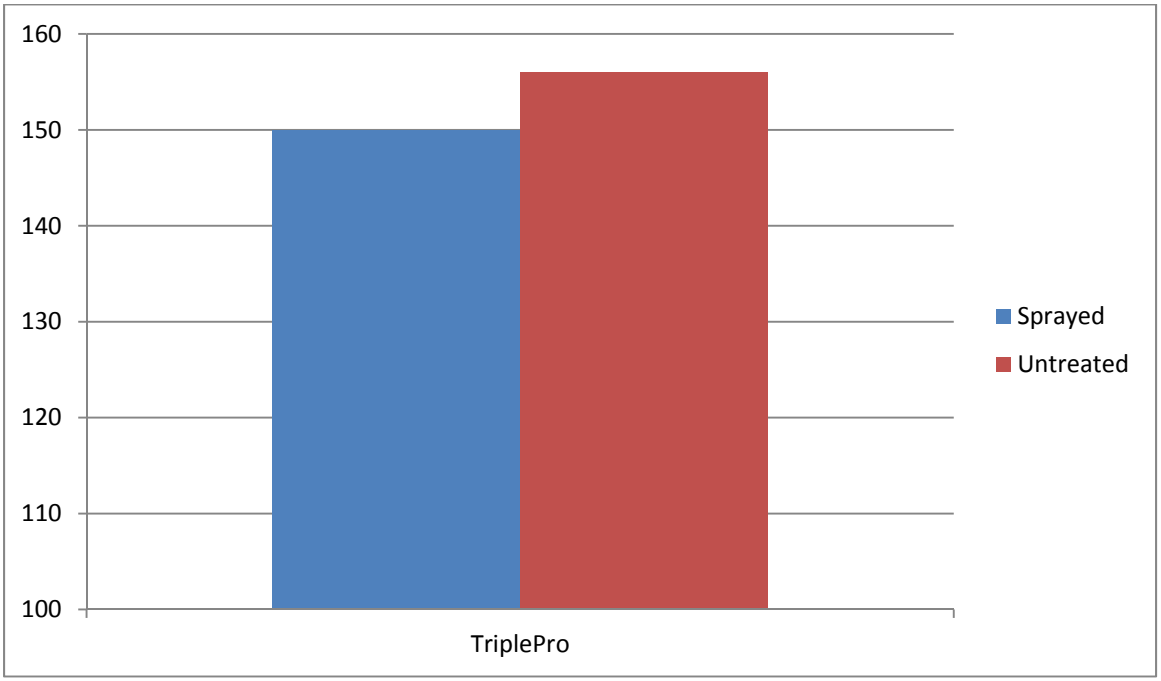

Figure 4. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders

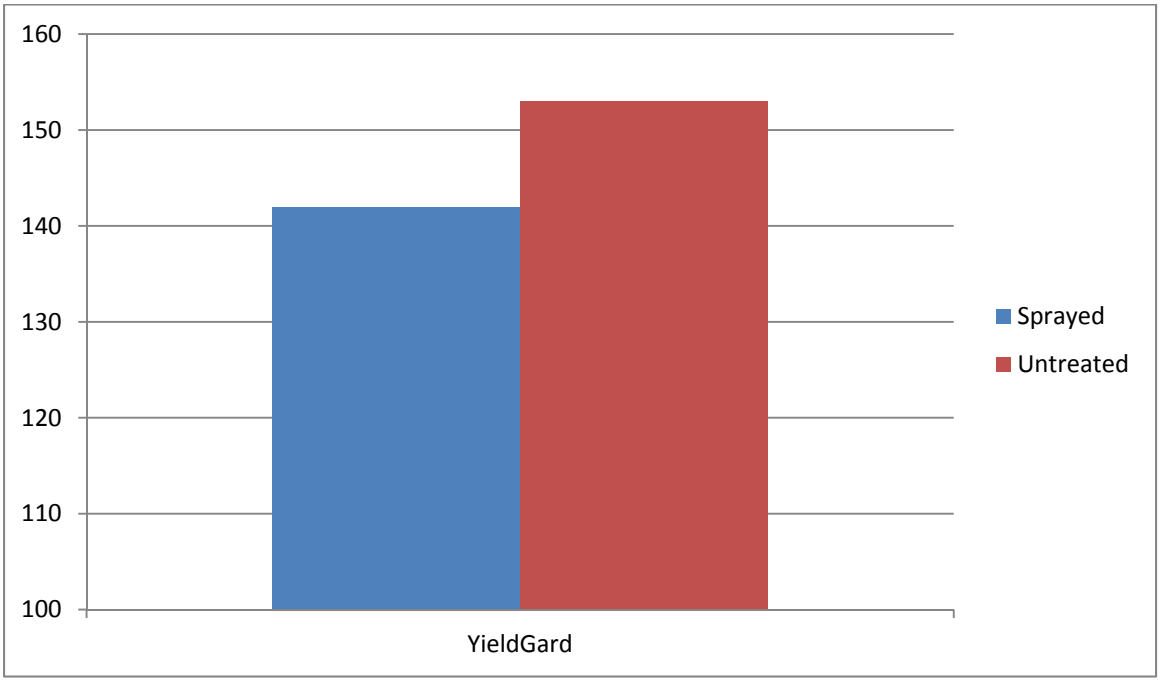

Figure 5. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders

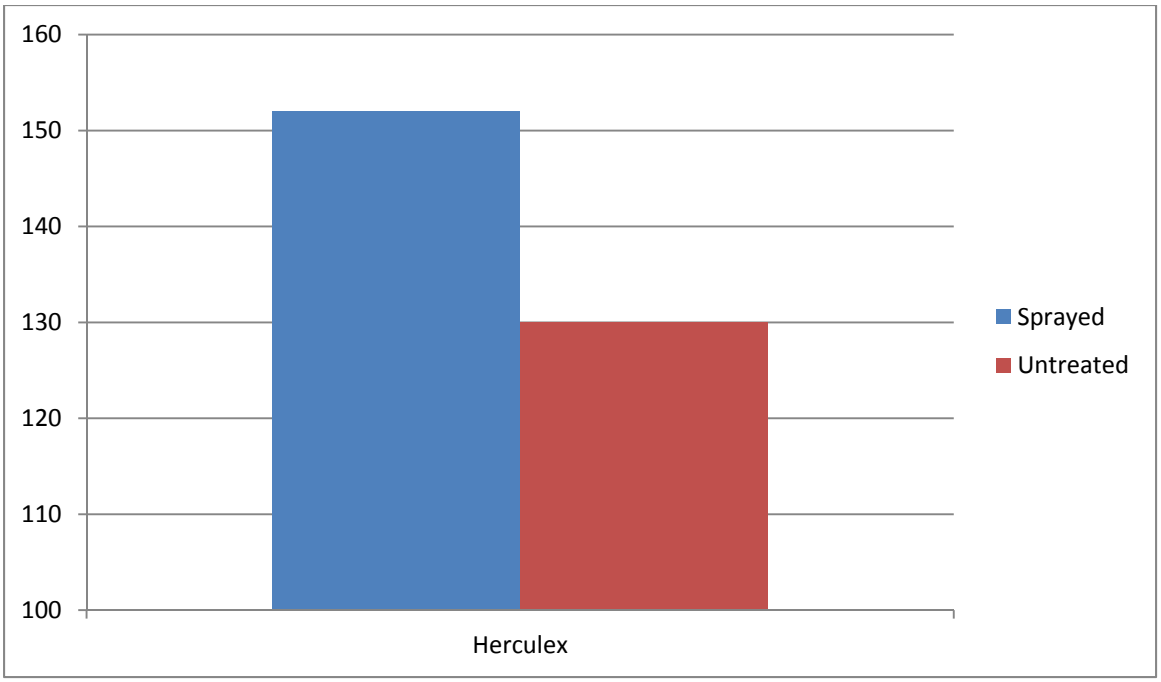

Figure 6. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders

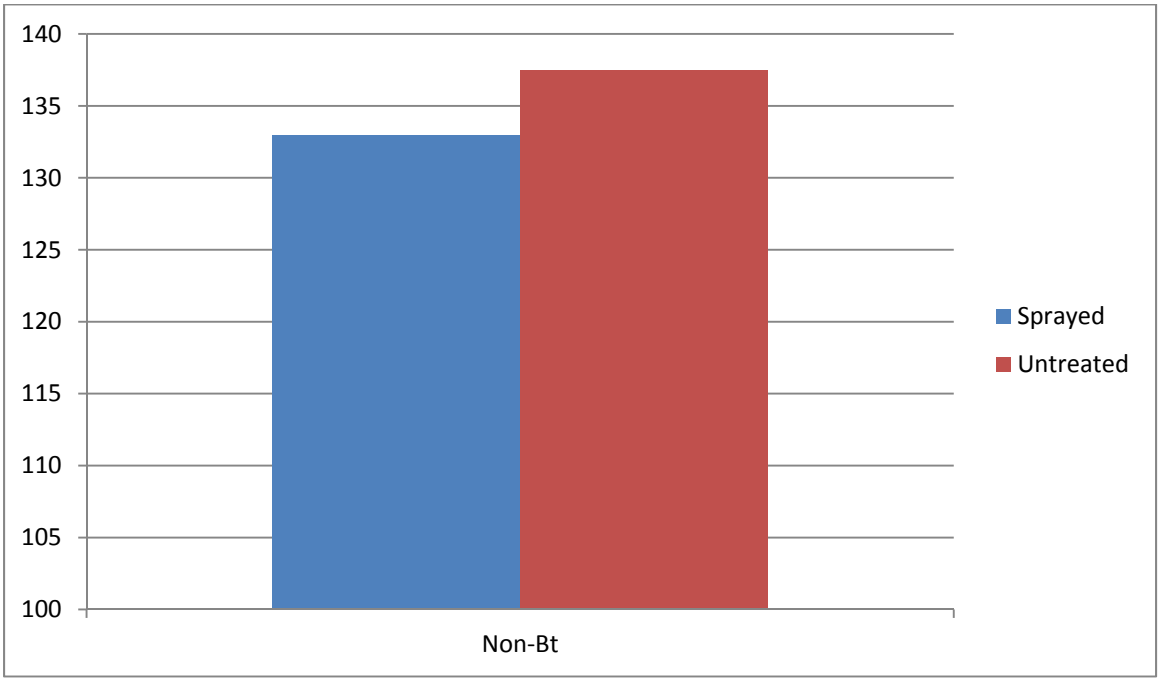

Figure 7. Yield (Bu/Acre) Sprayed Daily vs Unsprayed for Ear Feeders