

# WRIPM Final Report

## Grant Data

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Project Title: Yield Losses for Western Bean Cutworm and European Corn Borer Among Site-Specific Management Zones

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## Project Summary

Site-specific insect management has the potential to make pest management more efficient. One method of implementing site-specific insect management would be to make decision at the site-specific management zone level. Site-specific management zones are areas within fields that have similar yield potential and are managed in a similar manner. Site-specific management zones have been developed to define zones of high, medium and low productivity. Benefits of site-specific insect management: 1) Effective control of insects, 2) Reduction in the amount and costs of insecticides applied, 3) Reduction in environmental contamination, 4) Preservation of natural enemies, 5) Better management of insecticide resistance. Our study was conducted in a corn (*Zea mays* L.) agroecosystem with four pests: Western bean cutworm (*Striacosta albicosta* [Smith]), European corn borer (*Ostrinia nubilalis* [Hübner]) and two spider mite species (*Oligonychus pratensis* [Banks] and *Tetranychus urticae* [Koch]). The objective of our study is to develop site-specific management zone loss factors (i.e., amount of yield lost per pest) and economic injury levels for important pests of corn in Colorado. Results for European corn borer and spider mites show that site-specific management zones are an impractical way to define pest management zones for these species. However, site-specific management zones show excellent potential for managing western bean cutworm. Currently additional research is being applied to develop quality loss factors for

the western bean cutworm which would enhance our integrated pest management strategy options. **Introduction**

Site-specific insect management has the potential to make pest management more efficient. One method of implementing site-specific insect management would be to make decision at the site-specific management zone level. Site-specific management zones are areas within fields that have similar yield potential and are managed in a similar manner. Site-specific management zones have been developed in Colorado using bare soil color from aerial photographs, past management experience and the farmer's perception of topography to define zones of high, medium and low productivity.

Our study was conducted in a corn (*Zea mays* L.) agroecosystem with four pests: Western bean cutworm (*Striacosta albicosta* [Smith]) (WBC), European corn borer (*Ostrinia nubilalis* [Hübner]) (ECB) and two spider mite species (*Oligonychus pratensis* [Banks] and *Tetranychus urticae* [Koch]). Traditionally Economic Injury Levels (EILs) for pests have been established based on whole field conditions. The EIL is defined as the pest population density at which the value of actual or potential damage caused by the insect equals the cost of controlling the pest population.

Corn production for grain was estimated by USDA-NASS to produce approximately \$436 million in 2006 in Colorado alone, making corn the second highest value crop in Colorado in 2006 (behind hay production). Crop inputs to corn are significant including large inputs of water and fertilization. Pests can significantly reduce yield and therefore, a well-planned integrated pest management program is highly advised. European corn borer is an economically important pest of corn. Cavities produced by ECB larvae interfere with nutrient uptake, as well as reducing the strength of the corn stalk and ear shank, making plants susceptible to breakage and ear drop in high winds.

Spider mites can be serious corn pests in Colorado, especially during hot, dry years. They feed on the undersides of leaves, eventually killing the leaf and leaving it with a scorched or burned appearance. Commercial yield losses as high as 40 percent for silage (dry matter) have been documented in Colorado, although normal losses generally are lower.

Western bean cutworm has been recognized as a pest of corn in Colorado since the mid 1960s. Infestations can result in yield losses in excess of thirty percent. Few effective control methods exist for management of WBC in corn, with properly timed pesticide applications being the primary method.

Benefits of site-specific insect management: 1) Effective control of insects, 2) Reduction in the amount and costs of insecticides applied, 3) Reduction in environmental contamination, 4) Preservation of natural enemies, 5) Better management of insecticide resistance. 6) Reduction of pesticide exposure to agricultural users and producers.

The objective of our study was to develop site-specific management zone loss factors (i.e., amount of yield lost per pest) and EILs for economically important pests of corn in Colorado. European corn borer and spider mites do not appear to directly respond to factors influencing yield based management zones. Other management zone (e.g., management zones based on soil characteristics) approaches should be analyzed in future studies. However, control of WBC using a site-specific yield based management zone shows promise. Research is currently being conducted to develop quality loss factors for this pest.

## Methods

Research was conducted at the Agricultural Research Development and Education Center, located northeast of Fort Collins, CO. The agroecosystem is approximately 22 acres of corn. During the 2005 and 2006 field seasons, twelve sites were developed across the agroecosystem. Each site contained plots established using four different infestation levels for ECB generation 1 (i.e., first flight), ECB generation 2 (second flight) and WBC. Additionally, three infestation levels were established for spider mites (primarily Banks grass mite). All treatments were replicated four times within each site. Western bean cutworm abundance counts were collected in the early fall from the ear of each plant. European corn borers abundances were estimated by splitting 5 corn stalks per plot, then counting cavities and live worms. Spider mite abundances were estimated by removing half of the leaves on three consecutive plants per plot and calculating the number of mites under a dissecting microscope. Each plot was harvested, threshed, and weighed to determine corn yield. Yield data were regressed against pest abundance by management zone (i.e., high, medium or low) to quantify the damage per pest or loss factor per pest. The loss factor per pest was used in conjunction with the current market value of corn, and the application costs for control of the pest to determine EILs for each pest in each of the management zones.

This project is continuing to examine WBC by established 5 sites within each of the three management zones (15 sites total) for WBC during the current growing season (i.e., 2007) . Three infestation levels were developed (0 larvae per plant, ca. 2 larvae per plant and ca. 20 larvae per plant), with four replications per infestation level. Plots were successfully infested, pest numbers calculated per plot, and corn was harvested. Currently, harvested corn is in the process of drying before calculating yield. Yields will be regressed against WBC abundance by management zone to determine loss factors, as described above.

## Preliminary Results

Results from the first two years do not show a significant relationship between site-specific management zone and European corn borer or either of the spider mites. However, 2005 data showed a relationship between WBC and management zone. The 2006 infestation of WBC was largely unsuccessful but showed similar trends to results from the 2005 field season. The 2007 WBC infestation data have been collected and infestation levels appear to be highly successful. Plot level yield data has not been calculated for the 2007 season. We anticipate development of loss factors and EILs for WBC based on data collected from 2005 through the present season.

## Conclusions and Ongoing Research

Unfortunately, site-specific management zones based on corn yield appear to be ill-suited for control of European corn borer and spider mite populations. However, management zones based on other factors, such as soil characteristics, may still be of value. If management zones could be developed for these pests the economic and social benefits would be significant. Site-specific management zones appear to have exceptional promise for control of western bean cutworm. If loss factors for WBC can be developed substantial benefits, both directly to the producer and indirectly to the community will be

observed. Site-specific insect management shows exceptional promise for greatly enhancing pest management efficiency.