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Durability of Corn Expressing Bacillus thuringiensis Insecticidal Proteins in Single and Stacked Events

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Abstract
Western corn rootworm is an important agricultural pest of corn. Transgenic corn producing toxins derived from the bacterium Bacillus thuringiensis Bt has been rapidly adopted by farmers. These Bt crops control many key agricultural pests such as corn rootworm. Thus, it is important to understand the durability of Bt crops. In order to delay pest resistance, farmers must plant a refuge (Box 1). Non-Bt corn is used with Bt corn as part of a refuge strategy (Figure 1). This study focuses on studying the durability of Bt corn as either a stacked event (SmartStax) or a single event (VTTriple Pro) in controlling the Western corn rootworm.

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Durability of Corn Expressing *Bacillus thuringiensis* Insecticidal Proteins in Single and Stacked Events

RFR-A9100

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Introduction

Western corn rootworm is an important agricultural pest of corn. Transgenic corn producing toxins derived from the bacterium *Bacillus thuringiensis* Bt has been rapidly adopted by farmers. These Bt crops control many key agricultural pests such as corn rootworm. Thus, it is important to understand the durability of Bt crops. In order to delay pest resistance, farmers must plant a refuge (Box 1). Non-Bt corn is used with Bt corn as part of a refuge strategy (Figure 1). This study focuses on studying the durability of Bt corn as either a stacked event (SmartStax) or a single event (VTTriple Pro) in controlling the Western corn rootworm.

Materials and Methods

This study started in the field, where 16 plots were established consisting of four treatments: SmartStax only, a SmartStax with a blended refuge, YieldGard VT Triple only, and isoline only (Table 1). The plots were covered by mesh tents and then were regularly checked for insects. Any rootworms found in those tents were collected and brought back to the laboratory. Field collected insects were mated and the resulting eggs collected. The larvae that hatched from those eggs were placed on SmartStax, VT Triple Pro, and isoline corn, and allowed to feed for 17 days. At that point, the larvae were extracted from the soil and collected. Observations were made based on larval survival and larval instar.

Results and Discussion

Data collection is ongoing. Our goal is to test whether Western corn rootworm emerging from Bt corn produce offspring that have higher than average survival on Bt corn, and the extent to which there are existing variants within Iowa rootworm populations that can survive on Bt corn. Such data are critical for understanding the durability of transgenic corn.

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Table 1. Explanation of genetically modified corn types.

Corn Type	Description
SmartStax	Transgenic corn developed to express two types of Bt toxins specific to corn rootworms. Smartstax was generated by crossing Herculex XTRA and YieldGard VT Triple Pro.
YieldGard Vt Triple Pro	A transgenic corn that has been in use in agriculture for several years. This variety has only a single event for controlling corn rootworms.
Isoline	This variety does not contain any genes that control rootworm pests but is genetically similar to the other hybrids.

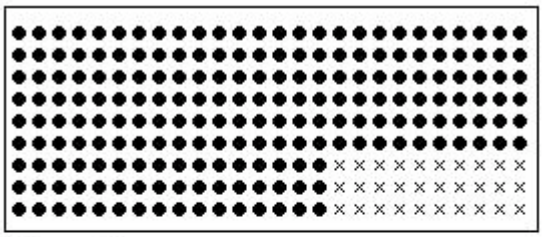

Figure 1A

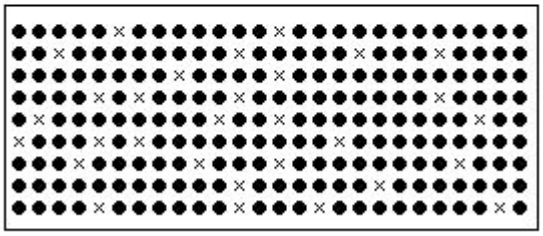

Figure 1B

Figure 1. Illustrates the difference between block (Figure 1A) and blended (Figure 1B) refuge. The dark circles represent Bt corn and the crosses represent isoline corn. A block refuge localizes the isoline corn into one specific area while a blended refuge distributes the isoline corn over the entire field. Currently, the only legal refuge configuration is a block refuge, and there are no commercialized blends. However, a blended option may soon be available to farmers.

Box 1- What is the refuge strategy? The idea behind the refuge strategy is that in a field of Bt corn, a refuge is planted to ensure that non-resistant insects survive and mate with rare, resistant individuals emerging from Bt fields. The progeny are likely to be weakly resistant and will likely die when exposed to Bt corn, thereby slowing the development of resistance.