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Stalk and Ear Diseases in Bt and Non-Bt Corn Hybrids, 2000

Gary P. Munkvold
Iowa State University, munkvold@iastate.edu

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Abstract
Ear rot and stalk rot diseases are not under adequate control by direct genetic resistance in corn hybrids, and cultural or chemical control methods do not exist or are not effective. Because infection by ear- and stalk-rotting fungi sometimes occurs through European corn borer (ECB) injury, there is a potential to reduce infection through the use of Bt hybrids, which are resistant to ECB. In previous research, we have shown that Fusarium ear rot, caused by *Fusarium moniliforme* and *Fusarium proliferatum*, is reduced in Bt hybrids with the YieldGard genes. We also found that the primary mycotoxins produced by these fungi, fumonisins, were significantly lower in the Bt hybrids. In 2000, we sought to add to our data on the potential benefits of using Bt hybrids for management of Fusarium ear rot and corn stalk rots.

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Gary Munkvold, associate professor
Department of Plant Pathology

Introduction

Ear rot and stalk rot diseases are not under adequate control by direct genetic resistance in corn hybrids, and cultural or chemical control methods do not exist or are not effective. Because infection by ear- and stalk-rotting fungi sometimes occurs through European corn borer (ECB) injury, there is a potential to reduce infection through the use of Bt hybrids, which are resistant to ECB. In previous research, we have shown that Fusarium ear rot, caused by *Fusarium moniliforme* and *Fusarium proliferatum*, is reduced in Bt hybrids with the YieldGard genes. We also found that the primary mycotoxins produced by these fungi, fumonisins, were significantly lower in the Bt hybrids. In 2000, we sought to add to our data on the potential benefits of using Bt hybrids for management of Fusarium ear rot and corn stalk rots.

Materials and Methods

Six hybrids were planted in Field 14 at the Southeast Research Farm (SERF) in a nonrandom complete block design. The six hybrids were three pairs consisting of a Bt and near-isogenic, non-Bt hybrid. Paired Bt and non-Bt hybrids were planted adjacent to each other in each block. The hybrids are shown in Table 1. Plot sizes were 8 rows (30 in. spacing) by 163 ft. There were four replicate blocks. ECB infestation and fungal infection were due to natural populations.

Stalks were evaluated for ECB injury and stalk rot by collecting five stalks per replicate plot in mid-September and splitting them. ECB injury and the stalk were measured and the occurrence of external symptoms of anthracnose stalk rot was noted. Ears from these plants also were evaluated for ECB injury and Fusarium ear rot symptoms. On September 27, the percentage of lodged stalks was recorded for each replicate plot. The plots were mechanically harvested, and yields were calculated based on 15.5% moisture content. Analysis of variance was conducted to assess differences in ECB injury, stalk rot, and ear rot among the hybrids. Mean separation was conducted by the Student-Newman-Keuls Test ($\alpha = 0.05$).

Results and Discussion

There were moderate levels of stalk injury by ECB in the non-Bt hybrids, but stalk rots and lodging were severe in all the hybrids (Table 1). Bt hybrids with the YieldGard gene did not have any stalk injury by ECB, but the StarLink hybrid had a small amount of injury. Most of the plants had internal stalk rot, although many of these did not have external symptoms of anthracnose. There was little difference in stalk rot among hybrids and lodging did not differ between Bt and non-Bt hybrids.

ECB injury to the kernels and Fusarium ear rot were slight and did not differ between Bt and non-Bt hybrids except that the DeKalb Bt hybrid had significantly less injury than its non-Bt counterpart (Table 2). Yield did not differ significantly among hybrids except that the Novartis Bt hybrid yielded significantly more than its non-Bt counterpart (Table 2).

In this trial, little disease-management benefit was demonstrated through the use of Bt hybrids. Conditions were very favorable (dry late-season soil conditions) for stalk rot development unrelated to ECB injury; therefore, Bt hybrids generally suffered as much stalk rot as non-Bt hybrids. Fusarium ear rot levels were too low to see meaningful differences among hybrids.

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Table 1. European corn borer injury to stalks, stalk rot, and lodging.

Hybrid	ECB injury (% of plants)	ECB injury (in.)	Internal stalk rot (% of plants)	Internal stalk rot (in.)	External anthracnose (% of plants)	Lodging (% of plants)
DK 647 BtY	0.0 c	0.0 c	80.0 a	7.6 b	25.0 a	70.6 a
DK 647	95.0 a	3.1 b	85.0 a	4.5 b	25.0 a	63.6 a
Garst 8539 BLt	15.0 c	0.8 c	80.0 a	4.8 b	25.0 a	40.1 b
Garst 8539	70.0 b	3.4 b	85.0 a	8.6 b	45.0 a	35.0 b
NK 7070 Bt	0.0 c	0.0 c	85.0 a	10.8 b	35.0 a	24.9 b
NK 7070	90.0 a	5.9 a	100.0 a	16.6 a	55.0 a	35.0 b

Table 2. Insect injury to ears, Fusarium ear rot, and yield.

Hybrid	Insect injury (% of plants)	Insect injury (kernels/ear)	Fusarium ear rot (% of plants)	Fusarium ear rot (kernels/ear)	Yield Bu/acre
DK 647 BtY	5 b	1.3 bc	0 b	0.0 b	124.4 b
DK 647	60 a	12.5 a	20 ab	0.4 b	133.6 b
Garst 8539 BLt	15 b	0.6 c	10 b	0.4 b	148.9 a
Garst 8539	45 a	2.3 bc	15 b	0.4 b	151.6 a
NK 7070 Bt	40 a	4.1 b	35 a	2.0 ab	145.5 a
NK 7070	65 a	7.3 b	55 a	5.2 a	129.7 b