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

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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 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 16 rows (30 in. spacing) by 70 ft. There were four replicate blocks. ECB infestation was due to natural populations, but in subplots of 10 plants within each plot, 50 neonatal larvae were placed into the ear axil on August 15. Fungal infection was 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 26, 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. The Student-Newman-Keuls Test ($\alpha = 0.05$) was used to conduct mean separation.

Results and Discussion

In the naturally infested plants, there were low levels of ECB stalk injury in the non-Bt hybrids (Table 1), but the Bt hybrids had almost no stalk injury by ECB. Most plants had some internal stalk rot, and it differed among hybrids. DeKalb and Garst Bt hybrids had less stalk rot than their non-Bt counterparts. Most of the plants had external symptoms of anthracnose stalk rot, and only the Garst Bt hybrid had fewer stalks with anthracnose symptoms, compared with the other hybrids. Bt hybrids suffered significantly less lodging than non-Bt hybrids. In the plants that were manually infested with ECB, trends were similar to those in the naturally infested plants, but ECB injury was somewhat higher in the manually infested plants. Stalk rot levels were similar in naturally and manually infested plants (Table 2).

ECB injury to the kernels and Fusarium ear rot were not severe in the naturally infested plants. Bt hybrids had significantly less ECB injury to kernels than non-Bt hybrids (Table 3). The Bt hybrids with YieldGard also had significantly less Fusarium ear rot than their non-Bt counterparts. The trend was similar in the manually infested plants, but kernel injury and ear rot were more severe than in the naturally infested plants (Table 4). Yields were not significantly different between Bt and non-Bt hybrids. (Table 3). Analysis for mycotoxins associated with Fusarium ear rot has not yet been completed.

These results confirm earlier findings that Bt hybrids experience less damage from Fusarium ear rot and, under some conditions, less damage from stalk rots than non-Bt hybrids.

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

	ECB injury		Internal stalk rot		External anthracnose	Lodging
Hybrid	(% of plants)	(in.)	(% of plants)	(in.)	(% of plants)	(% of plants)
DK 525 Bt	0 b	0.0 c	90 a	11.6 b	70 a	1.5 c
DK 525	65 a	1.4 a	95 a	15.6 a	80 a	18.7 a
Garst 8600 Bt, It, LL	0 b	0.0 c	35 b	2.1 d	15 b	1.0 c
Garst 8600 It	55 a	0.7 b	95 a	6.7 c	60 a	14.8 ab
N 4640 Bt	5 b	0.0 c	100 a	10.5 bc	95 a	3.2 c
N 4640	45 a	0.6 bc	100 a	10.3 bc	100 a	9.8 b

Table 2. European corn borer injury to stalks, and stalk rot. (ECB infested)

	ECB injury		Internal stalk rot		External anthracnose
Hybrid	(% of plants)	(in.)	(% of plants)	(in.)	(% of plants)
DK 525 Bt	0 c	0.0 b	75 b	7.7 bc	60 ab
DK 525	95 a	1.6 a	100 a	13.5 a	84 a
Garst 8600 Bt, It, LL	0 c	0.0 b	65 c	2.2 d	5 c
Garst 8600 It	75 ab	1.8 a	95 ab	5.7 c	35 bc
N 4640 Bt	0 c	0.0 b	92 ab	9.9 ab	94 a
N 4640	65 b	1.5 a	100 a	12.9 a	84 a

Table 3. Insect injury to ears, Fusarium ear rot, and yield.

	Insect injury		Fusarium ear rot		Yield
Hybrid	(% of plants)	(kernels/ear)	(% of plants)	(kernels/ear)	Bu/acre
DK 525 Bt	0 c	0.0 c	15 b	0.2 b	151.2 ab
DK 525	70 a	6.1 b	60 a	5.5 a	145.5 b
Garst 8600 Bt, It, LL	10 c	0.3 c	5 b	0.4 b	155.0 a
Garst 8600 It	40 b	2.6 bc	15 b	0.5 b	156.8 a
N 4640 Bt	5 c	1.0 c	15 b	0.7 b	149.2 ab
N 4640	85 a	14.3 a	55 a	6.1 a	145.6 b

Table 4. Insect injury to ears and Fusarium ear rot. (ECB infested)

	Insect injury		Fusarium ear rot	
Hybrid	(% of plants)	(kernels/ear)	(% of plants)	(kernels/ear)
DK 525 Bt	10 b	1.9 cd	15 c	0.3 b
DK 525	100 a	17.4 b	100 a	27.9 a
Garst 8600 Bt, It, LL	0 b	0.0 d	10 c	0.9 b
Garst 8600 It	80 a	6.5 c	65 b	5.1 b
N 4640 Bt	5 b	0.1 d	10 c	0.5 b
N 4640	100 a	26.3 a	100 a	26.9 a