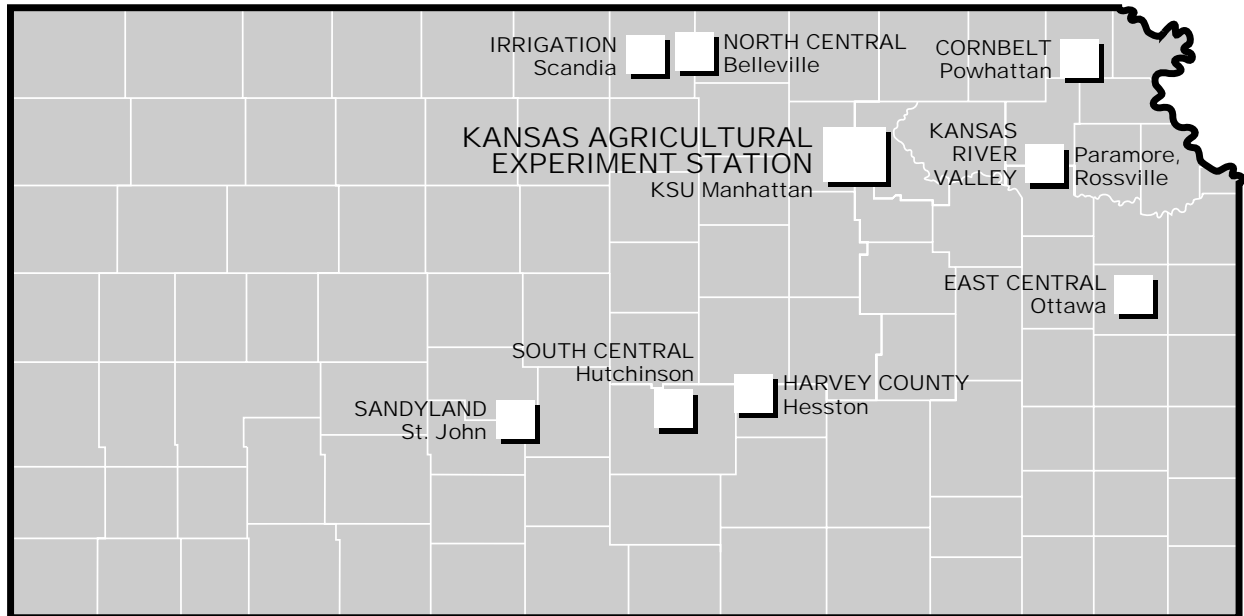


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FIELD RESEARCH 2000



Agronomy Experiment Fields

EVALUATION OF CORN BORER RESISTANCE AND GRAIN YIELD FOR BT AND NON-BT CORN HYBRIDS

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Summary

Fifteen corn hybrids (9 Bt and 6 non-Bt) were evaluated for corn borer resistance and grain yield performance at the Sandyland Experiment Field in St. John, Kansas. Second generation European and southwestern corn borer pressures averaged 0.05 and 0.53 larvae per plant, respectively, in the non-Bt plots. Corn borer tunneling averaged 15 cm per plant in the non-Bt corn hybrids. No tunneling was recorded in hybrids containing Bt events Bt11, MON810 and CBH351; however, both hybrids with event 176 suffered noticeable tunneling. The yield loss from lodging caused by corn borers averaged 29.9 bu/a for the non-Bt hybrids. Hybrids with events Bt11, MON810, and CBH351 generally had no lodged plants at harvest time. Standing corn yields averaged 81.4 bu/a for the six non-Bt hybrids and 102.0, 133.8, 121.0, and 115.3 for hybrids with events 176, Bt11, MON810, and CBH351, respectively. The best non-Bt hybrid (Pioneer 3162IR) had a standing yield of 101.2 bu/a, whereas the best Bt hybrid (Novartis 7590Bt) had a standing yield of 142.1 bu/a.

Procedures

Corn plots were machine-planted on 5 May at 26,000 seeds/a at the Sandyland Experiment Field in St. John, Kansas. Pre-emergence herbicides were atrazine (1 qt/a) and Dual (1 qt/a). Postemergence herbicide application was made on 20 May using 1 qt/a of Marksman. No insecticides were applied. The soil was a Carwile sandy loam. The field was sprinkler-irrigated with 1.0, 5.1 and 1.8 inches of water in June, July, and August, respectively. Monthly rainfalls are shown in Table 1. The plots were four rows wide (10 ft) by 30 ft

long. Two rows (5 ft) of Bt corn were planted between the plots as border rows, and 10-ft alleyways at the end of each plot were left bare. The border rows and alleyways were included to reduce larval migration between plots. The experimental design was a randomized block design with four replications. The 15 hybrids had a relative maturity ratings of 110 to 118 days.

Second generation corn borer infestations were entirely native. Data for second-generation corn borers were taken on 21 September from five plants selected at random from one of the center rows of each plot. The plants were dissected to record corn borers larvae and tunneling. Yield was determined by hand harvesting the ears from the other center row (30 row-ft) in late September. The ears from standing plants and from plants lodged because of corn borer damage were harvested separately. Grain yield was calculated for standing and fallen corn and corrected to 15.5% moisture.

The data were analyzed by an analysis of variance, and means were separated using the least significant difference test. To simplify discussion, results are averaged across non-Bt hybrids and the hybrids with the four Bt events.

Results

First generation corn borer pressure was light, and no data were collected. Second generation European (ECB) and southwestern corn borer (SWCB) pressures averaged 0.05 and 0.53 larvae per plant, respectively, in the non-Bt plots (Table 12). Corn borer tunneling averaged 15 cm per plant in the non-Bt corn hybrids. No tunneling was recorded in hybrids containing Bt events Bt11, MON810, and CBH351; however, both hybrids with

event 176 suffered noticeable tunneling. In hybrids with events 176, Bt11, MON810, and CBH351, second generation ECB larvae were reduced by 50, 100, 100, and 100%, respectively (Figure 21); second generation SWCB larvae were reduced by 77, 100, 100, and 100% (Figure 22); and corn borer tunneling was reduced by 66, 100, 100, and 100% (Figure 23).

Standing corn yields averaged 81.4 bu/a for the six non-Bt hybrids and 102.0, 133.8, 121.0, and 115.3 for hybrids with events 176, Bt11, MON810, and CBH351, respectively. (Table 13). The best non-Bt hybrid (Pioneer 3162IR) had a standing yield of 101.2, whereas the best Bt hybrid (Novartis 7590Bt) had a standing yield of

142.1 bu/a. These were two of the longest maturity hybrids in the trial. The yield losses from lodging because of corn borers averaged 29.9 bu/a for the non-Bt hybrids and 27.7 for the two hybrids with event 176. Hybrids with Bt11, MON810, and CBH351 had no yield losses from lodging (Table 13). Yield losses from corn borer lodged plants were reduced by 7, 100, 100, and 100% for events 176, Bt11, MON810, and CBH351, respectively (Figure 24).

Acknowledgements

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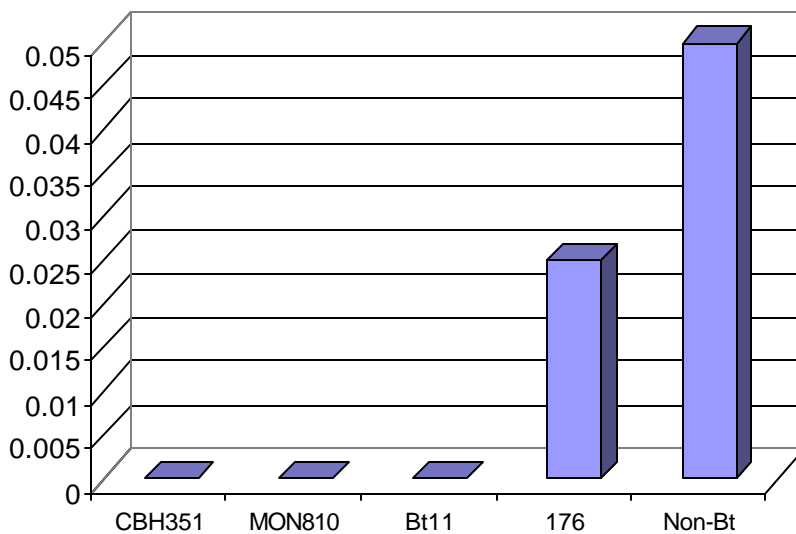


Figure 21. Second-generation European corn borer larvae per plant, St. John, KS, 1999.

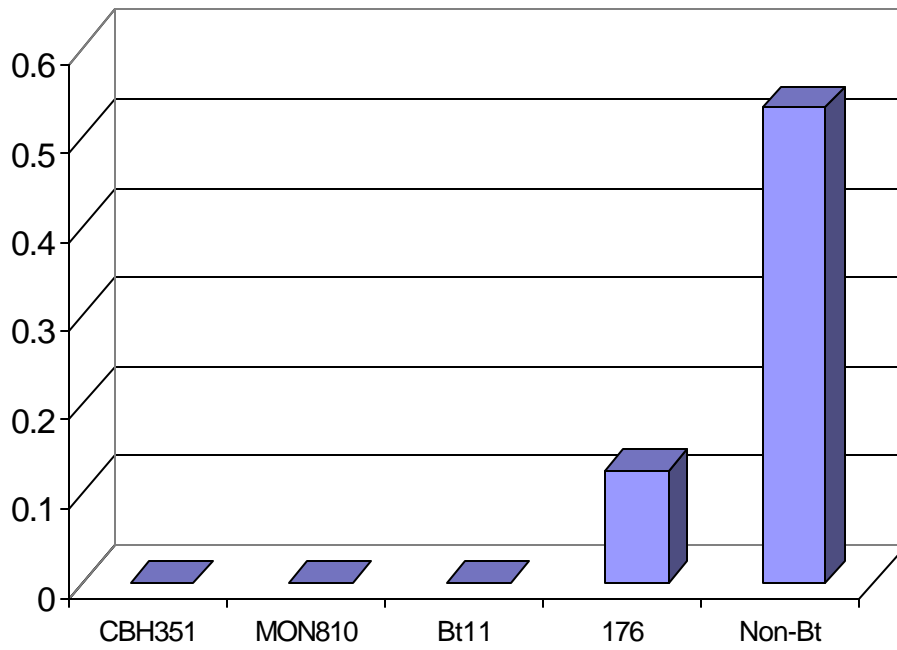


Figure 22. Second generation Southwestern corn borer larvae per plant, St. John, KS, 1999.

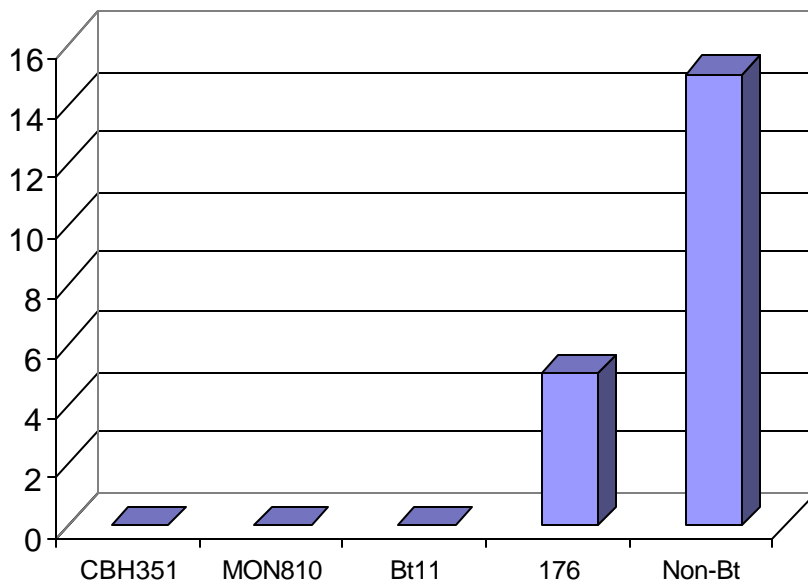


Figure 23. Corn borer tunneling in cm per plant, St. John, KS, 1999.

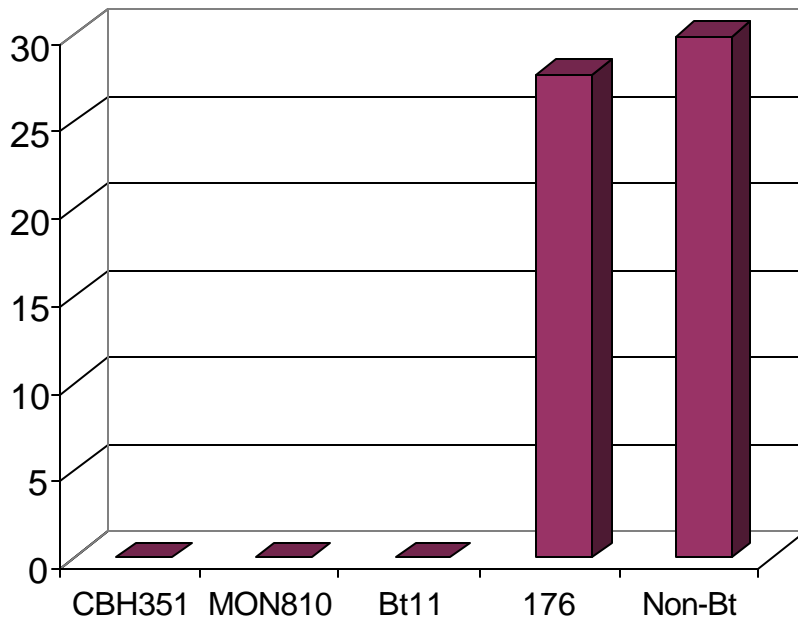


Figure 24. Fall grain yields of corn, St. John, KS, 1999.

Table 12. Corn borer damage to Bt and non-Bt corn hybrids, Sandyland Experiment Field, St. John, KS, 1999.

Hybrid	Bt Event	Company	Relative Maturity Rating	2nd Gen. Corn Borer			
				ECB Larvae per Plant	SWCB Larvae per Plant	# of Tunnels per Plant	Cm of Tunneling per Plant
4494		Novartis Seeds	110	0.15 a	0.65 a	2.30 ab	19.15 ab
MAX454	176	Novartis Seeds	111	0.05 b	0.05 c	0.45 d	4.40 de
2787	176	Mycogen	113	0.00 b	0.20 bc	0.65 d	5.70 cde
7590		Novartis Seeds	114	0.00 b	0.45 ab	1.50 c	11.00 cd
7590Bt	Bt11	Novartis Seeds	115	0.00 b	0.00 c	0.00 d	0.00 e
7639Bt	Bt11	Novartis Seeds	115	0.00 b	0.00 c	0.00 d	0.00 e
3162IR		Pioneer	118	0.00 b	0.65 a	2.85 a	22.80 a
32J55		Pioneer	116	0.05 b	0.50 a	1.70 bc	12.45 bc
33A14	MON81	Pioneer	113	0.00 b	0.00 c	0.00 d	0.00 e
7821BT	MON81	Cargill	115	0.00 b	0.00 c	0.00 d	0.00 e
H-2547		Golden Harvest	112	0.05 b	0.40 ab	1.45 c	12.20 bc
H-9230Bt	MON81	Golden Harvest	113	0.00 b	0.00 c	0.00 d	0.00 e
8481		Garst	112	0.05 b	0.55 a	1.45 c	12.50 bc
8481Bt/LL	CBH35	Garst	112	0.00 b	0.00 c	0.00 d	0.00 e
8366Bt/LL	CBH35	Garst	113	0.00 b	0.00 c	0.00 d	0.00 e
LSD value p=0.05				0.08	0.26	0.69	7.09
F-test Prob.				0.0372	<0.0001	<0.0001	<0.0001

Table 13. Effects of corn borers on yield of Bt and non-Bt corn hybrids, Sandyland Experiment Field, St John, KS, 1999.

Hybrid	Bt Event	Company	Relative Maturity Rating	Yield Standing Plts. bu/a	Yield Fallen Plts. bu/a	Total Yield bu/a
4494		Novartis Seeds	110	63.6 f	26.5 bc	90.1 c
MAX454	176	Novartis Seeds	111	76.3 def	42.1 a	118.4 abc
2787	176	Mycogen	113	127.8 ab	13.3 d	141.1a
7590		Novartis Seeds	114	64.9 f	41.4 a	106.3 bc
7590Bt	Bt11	Novartis Seeds	115	142.1 a	0.0 e	142.1 a
7639Bt	Bt11	Novartis Seeds	115	125.5 ab	0.0 e	125.5 ab
3162IR		Pioneer	118	101.2 b-e	40.3 a	141.6 a
32J55		Pioneer	116	74.6 ef	15.4 cd	90.0 c
33A14	MON81	Pioneer	113	139.3 a	0.0 e	139.3 ab
7821BT	MON81	Cargill	115	112.7 abc	0.0 e	112.7 abc
H-2547		Golden Harvest	112	87.7 c-f	36.9 ab	124.6 ab
H-9230Bt	MON81	Golden Harvest	113	111.0 a-d	0.0 e	111.0 abc
8481		Garst	112	96.4 b-f	18.7 cd	115.2 abc
8481Bt/LL	CBH351	Garst	112	122.4 abc	0.0 e	122.4 abc
8366Bt/LL	CBH351	Garst	113	108.1 a-e	0.0 e	108.1 abc
LSD value p=0.05				35.27	12.88	34.34
F-test Prob.				0.0001	<0.0001	0.0395