

2001

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Recommended Citation

Pecinovsky, Kenneth T., "2000 Bt/Non-Bt Corn Variety Evaluation Study" (2001). *Iowa State Research Farm Progress Reports*. 1778.
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Abstract

The 2000 growing season marks the fifth year that Bt corn varieties were commercially grown in Iowa. This is the fifth year that the Northeast Research and Demonstration Farm has been field testing Bt and non-Bt hybrids for yield and related parameters. *Bacillus thuringiensis*, commonly known as Bt, is a naturally occurring soil bacterium toxic to European corn borers (ECB). The Bt gene is genetically modified and inserted into the corn hybrids, whereby the protein that occurs in the corn plant kills the European corn borers (ECB). Different Bt genes and different promoters, which are commonly called events, are used by different companies. These genes and promoters vary in their expression and subsequent level of ECB protection. The recent decisions by several countries and major grain buyers to not purchase certain genetically modified (GMO) corn hybrids or certain Bt events in several companies' hybrids has captured the attention of farmers and grain purchasers. In a time of low commodity prices, the decision by producers to grow and sell GMO crops will become more difficult because the future prices or premiums for such crops are in question. The decision will primarily be made on economics of the total costs to produce the crop and the ability to segregate grains at harvest.

Disciplines

Agricultural Science | Agriculture

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Ken Pecinovsky, farm superintendent

estimated annual insect damage on yield at harvest.

Introduction

The 2000 growing season marks the fifth year that Bt corn varieties were commercially grown in Iowa. This is the fifth year that the Northeast Research and Demonstration Farm has been field testing Bt and non-Bt hybrids for yield and related parameters. *Bacillus thuringiensis*, commonly known as Bt, is a naturally occurring soil bacterium toxic to European corn borers (ECB). The Bt gene is genetically modified and inserted into the corn hybrids, whereby the protein that occurs in the corn plant kills the European corn borers (ECB). Different Bt genes and different promoters, which are commonly called events, are used by different companies. These genes and promoters vary in their expression and subsequent level of ECB protection. The recent decisions by several countries and major grain buyers to not purchase certain genetically modified (GMO) corn hybrids or certain Bt events in several companies' hybrids has captured the attention of farmers and grain purchasers. In a time of low commodity prices, the decision by producers to grow and sell GMO crops will become more difficult because the future prices or premiums for such crops are in question. The decision will primarily be made on economics of the total costs to produce the crop and the ability to segregate grains at harvest. In the past, crop scouting was used to see if economic thresholds of European corn borers existed to justify the use of insecticide applications. Bt corn and insecticide applications are not always warranted each year because of low corn borer counts due to environmental conditions, several fungal diseases, natural enemies/predators and parasites. Bt hybrids offer a management option for control of European corn borers in which the increased cost of the seed corn will have to be compared with the annual average cost and effectiveness of insecticide use or the cost of the

Materials and Methods

The soil consisted of a Kenyon and Readlyn loam, with a pH of 7.0 and 3.5% organic matter. 1999 soil tests reported 47 ppm P₂O₅ and 161 ppm K₂O. The experimental design was a randomized complete block with three replications, and plots were 15 by 50 ft. The 1999 crop was soybeans. Fertilization included 140 lb N/acre as anhydrous ammonia. Tillage included a spring field cultivation. Corn varieties were planted 2" deep on April 29 at 32,271 seeds/acre in 30 inch rows. Frontier 6.0 SL was applied preemergently on April 30 at a 32 oz/a (1.5 lb ai/a) rate. Marksman 3.2FL was applied postemergently on May 25 at a 2.85 pt/a (1.14 lb ai/a) rate. Stand counts were taken on September 14. Three corn plants were collected on September 15 from the center two rows of each corn plot and dissected for corn borer counts and inches of tunneling. Plots were machine harvested for yield on September 26.

Results and Discussion

Corn variety harvest moisture, yield at 15% moisture, total borers/plant, borer tunneling (inches)/plant, and final population for the 2000 variety plot are shown in Table 1. European corn borer pressure is highly variable each year and by location (Table 2). ECB populations were fairly low for first generation, but somewhat higher for second generation ECB populations. A seven bushel per acre Bt corn advantage was shown when comparing the hybrids in this study that were of the same isolate, with and without the Bt gene.

Acknowledgments

We would like to thank the following companies for their cooperation on this research project—Golden Harvest Seed Company, DeKalb Seed Company, Pioneer Hi-Bred

International, Novartis Seed Company, Wyffels Seed Company and Fontanelle Hybrids.

Table 1. Evaluation of Bt/nonBt hybrids on growth parameters and ECB insect damage.

Brand-Hybrid	Bt/non	%H ₂ O	Bu/A@15%	ECB/plant	Tunneling/plant (in.)	Population
GH2377	Non	17.8	166.5	1.11	1.33	28395
GH8250	Non	17.1	161.3	1.45	1.50	29040
GH7895	Non	17.6	159.2	1.67	2.31	27588
DK477	Non	15.2	132.8	1.22	1.14	29242
DK537	Non	16.8	153.6	1.44	1.86	29322
P34G81	Non	18.6	149.6	1.56	2.56	25975
P36R10	Non	18.4	156.3	1.55	1.92	27104
P3489	Non	18.6	161.0	1.44	1.86	26338
NK4528	Non	16.1	151.2	1.56	1.44	26176
NK4640	Non	16.2	149.9	2.11	1.95	29000
FTL4193	Non	16.9	144.0	1.67	0.97	27507
GH7773	Bt	17.5	170.0	0	0	29363
GH08350	Bt	17.1	168.5	0	0	31016
GH98273	Bt	18.0	159.6	0	0	27709
P34G82	Bt	17.3	172.7	0	0	28153
P36R11	Bt	18.3	170.3	0	0	26580
P34R07	Bt	18.8	163.2	0	0	26660
DK477-2	Bt	15.5	129.9	0	0	27870
DK533-2	Bt	16.7	151.4	0	0	26055
NK4529	Bt	15.1	168.2	0	0	28959
NK4640	Bt	16.3	169.9	0	0	29564
HC7529	Bt	15.3	141.0	0	0	28314
AVE.- LSD(Variety)		1.6	14.6	0.87	0.88	1778 (P<0.05)
AVE. (Non-Bt)	17.2a	153.2a	1.53a	1.71a	27789a	
AVE. (Bt)		16.9a	160.4b	0.00b	0.00b	28204a
Bt/Non Bt-LSD		NS*	4.4	0.26	0.27	NS (P<0.05)

* = not significant

Table 2. Yearly ECB pressures and ECB insect damage, Nashua.

Year	Var.	Bu/Ac	ECB/plant*	Tunneling (in.)	Variety	Bu/ac	ECB/plant	Tunneling
2000	Bt	161	0	0	Non-Bt	153	1.53	1.71
1999	Bt	166	0	0	Non-Bt	152	2.09	3.11
1998	Bt	162	0.05	0.07	Non-Bt	157	0.46	0.51
1997	Bt	163	0.24	0.22	Non-Bt	160	1.53	1.52
1996	Bt	172	0.15	0.16	Non-Bt	166	1.44	1.11
Avg	Bt	165	0.09	0.09	Non-Bt	158	1.41	1.59

* = Several Bt events used in previous years, not expressed in entire plant for season-long control.