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Bt/NonBt Corn Variety Evaluation Study

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Abstract
The 2003 growing season marks the eighth year that Bt corn varieties were commercially grown and evaluated at the Northeast Research and Demonstration Farm. *Bacillus thuringiensis*, commonly known as Bt, is a naturally occurring soil bacterium toxic to European corn bores (ECB) that has been genetically modified and inserted into corn hybrids. Different Bt genes and different promoters called events vary in their expression and subsequent level of ECB protection.

Disciplines
Agricultural Science | Agriculture

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Introduction

The 2003 growing season marks the eighth year that Bt corn varieties were commercially grown and evaluated at the Northeast Research and Demonstration Farm. *Bacillus thuringiensis*, commonly known as Bt, is a naturally occurring soil bacterium toxic to European corn bores (ECB) that has been genetically modified and inserted into corn hybrids. Different Bt genes and different promoters called events vary in their expression and subsequent level of ECB protection.

European corn borer incidence is highly variable by year and location. In the past, crop scouting was used to see if economic thresholds of ECB existed to justify use of insecticide applications. Bt corn and insecticide applications are not always warranted each year because of low corn borer populations, environmental conditions, several fungal diseases, natural enemies/predators, and parasites. Bt hybrids offer a management option for control of ECB, in which the increased cost of the seed corn will have to be compared with the cost and effectiveness of insecticide use after crop scouting to verify if economically damaging ECB populations are present.

Materials and Methods

The 2002 plot area consisted of a Readlyn loam, with a 2003 soil test report of pH 6.9, 4.8% organic matter, 27.5 ppm P_20_5 (Bray 1), and 132.0 ppm K_20. The 2003 plot area consisted of a Kenyon and Readlyn loam, with a 2002 soil test report of pH 7.1, 3.6% organic matter, 26.5 ppm P_20_5 (Bray 1), and 107.5 ppm K_20. A fertilizer mix consisting of 50.4 lbs P_20_5/acre and 179.8 lbs K_20/acre was spread on the 2003 site after soil testing in the fall of 2002. The experimental design was a randomized complete block with three replications, and plots were 15 × 87 ft (2002) and 15 × 66 ft (2003). The previous crops were soybeans. Fertilization prior to planting included 140 lb N/acre as anhydrous ammonia. Tillage included a spring field cultivation. Corn varieties were planted two inches deep on May 9 (2002) and May 17 (2003) at 33,674 seeds/acre in 30-inch rows. Surpass EC was applied preemergently at planting at a 3 pt/ac (2.4 lb ai/a) rate. Marksman 3.2FL was applied postemergently on June 6 (2002) and June 4 (2003) at a 2.5 pt/a (1.0 lb ai/a) rate. Four corn plants were collected on September 18 (2002) and September 12 (2003) from the center 2 rows of each corn plot and dissected for corn borer counts and inches of tunneling. Stand counts were taken prior to harvest, and plots were machine harvested for yield on October 6 (2002) and October 4 (2003).

Results and Discussion

Harvest moisture, yield at 15% moisture, total borers/plant, borer tunneling (inches)/plant, and final populations for the 2002 and 2003 variety plots are shown in Table 1. Yearly ECB infestation levels are shown in Table 2. Lodging to varying degrees occurred from windstorms on July 10 and August 17, 2002. An average of a 5.7 bushel/acre Bt corn advantage was shown when comparing the hybrids in these studies that were the same isoline, with and without the Bt gene, from 1996 through 2003.

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Table 1. Evaluation of Bt/nonBt hybrids on growth parameters and ECB insect damage, Nashua (2002–2003).

2002						2003					
Brand-Hybrid	ECB/ plant	Tunneling (inches)	H_20	Bu/Ac	Bt Adv.	Brand-Hybrid	ECB/ plant	Tunneling (inches)	H_20	Bu/ac	Bt Adv.
Crows 213	2.5	3.13	20.5	189.5		Crows 1702	0.92	1.13	16.2	152.1	
Crows 215Bt	0	0	21.1	188.2	(-1.3)	Crows 1703Bt	0	0	16.0	148.0	(-4.1)
Dekalb 44-0	1.33	1.23	19.2	182.1		Dekalb 51-43	1.08	1.71	15.4	145.7	
Dekalb 44-42Bt	0	0	18.6	184.5	(+2.4)	Dekalb 50-18Bt	0	0	15.8	152.2	(+6.5)
Dekalb 537	2.08	2.08	21.6	191.5		Dekalb 537	2.25	3.15	17.5	148.5	
Dekalb 53-32Bt	0	0	23.3	203.3	(+11.8)	Dekalb 53-32Bt	0	0	17.1	152.4	(+3.9)
Dekalb 57-01	2.5	2.56	21.9	217.6		Dekalb 57-01	0.42	0.58	18.1	153.4	
Dekalb 58-78Bt	0	0	22.2	232.6	(+15.0)	Dekalb 58-78Bt	0	0	19.1	153.2	(-0.2)
Fontanelle 4402	2.58	3.02	21.1	211.4		Dekalb 60-15	0.58	0.73	19.3	127.2	
Font. HC7636Bt	0	0	21.0	206.0	(-5.4)	Dekalb 60-16Bt	0	0	19.7	124.3	(-2.9)
G. Harvest 2390	1.67	2.02	21.1	191.9		G. Harvest 2398	1.50	2.71	18.6	135.6	
G. Harv. 8065Bt	0	0	22.4	193.2	(+1.3)	G. Harv. 8067Bt	0	0	18.6	139.2	(+3.5)
G. Harvest 8250	2.42	3.15	21.0	176.4		G. Harvest 8250	1.17	1.77	20.3	150.1	
G. Harv. 8350Bt	0	0	22.0	186.2	(+9.8)	G. Harv. 8350Bt	0	0	20.4	151.5	(+1.4)
G. Harvest 7895	1.75	1.98	21.4	178.7		G. Harvest 8562	1.17	1.27	17.8	162.4	
G. Harv. 7995Bt	0	0	21.5	194.4	(+15.7	G. Harv 8662Bt	0	0	17.0	156.5	(-5.9)
Pioneer 36B08	1.92	2.29	22.9	216.1		G. Harvest 17040	0.83	1.27	18.0	123.1	
Pioneer 36B09Bt	0	0	23.0	228.8	(+12.7)	G. Harv. 7140 Bt	0	0	17.5	124.1	(+1.0)
Pioneer 38A24	1.42	2.06	21.0	191.6		Pioneer 36B08	1.25	2.75	19.6	163.6	
Pioneer 38A25Bt	0	0	21.3	194.7	(+3.1)	Pioneer 36B09Bt	0	0	19.7	165.0	(+1.5)
Pioneer 34M94	2.08	1.44	26.5	220.3		Pioneer 34M94	0.75	0.75	20.6	160.6	
Pioneer34M95Bt	0	0	27.3	220.7	(+0.4)	Pioneer 34M95Bt	0	0	20.7	169.9	(+9.3)
Pioneer 34B23	2.17	1.69	23.3	216.4		Pioneer 34N43	0.75	1.10	21.4	161.8	
Pioneer 34B24Bt	0	0	23.6	218.0	(+1.6)	Pioneer 34N44Bt	0	0	22.6	167.1	(+5.2)
Syngenta. NK45T5	1.67	1.19	20.2	201.4		Syn, NK 45-T5	1.25	1.67	14.8	133.2	
Syn, NK45-A6Bt	0	0	20.5	206.2	(+4.8)	Syn. NK 45-A6Bt	0	0	14.7	142.7	(+9.5)
						Syn. NK 60-N2	1.83	2.98	19.9	158.1	
						Syn. NK 60B6Bt	0	0	20.5	172.1	(+14.1)
AVG.- LSD(Var)	**0.87**	**1.16**	**1.15**	**11.75**			**0.67**	**1.08**	**1.28**	**18.34**	
AVG. (NonBt)	**2.01 a**	**2.14 a**	**21.7 a**	**198.8 a**			**1.13a**	**1.68a**	**18.4a**	**148.2a**	
AVG. (Bt)	**0 b**	**0 b**	**22.1 b**	**204.4 b**			**0 b**	**0 b**	**18.5a**	**151.3a**	
Bt/NonBt-LSD	**0.24**	**0.32**	**0.32**	**3.26**			**0.18**	**0.29**	**0.34**	**4.9**	**(P=0.05)**

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

Year	Variety*	Bu/ac	ECB /plant	Tunneling (in.)	Variety	Bu/ac	ECB /plant	Tunneling (in.)	Bt advantage (Bu/ac)	Isolines
2003	Bt*	151.3	0	0	Non-Bt	148.2	1.13	1.68	(+3.1)	14
2002	Bt*	204.4	0	0	Non-Bt	198.8	2.01	2.14	(+5.6)	13
2001	Bt*	186.1	0	0	Non-Bt	176.6	1.75	2.31	(+9.5)	11
2000	Bt*	160.4	0	0	Non-Bt	153.2	1.53	1.71	(+7.2)	11
1999	Bt*	166.3	0	0	Non-Bt	154.1	1.87	2.75	(+12.2)	8
1998	Bt	164.8	0.03	0.04	Non-Bt	158.3	0.44	0.50	(+6.5)	13
1997	Bt	162.8	0.24	0.22	Non-Bt	160.0	1.53	1.52	(+2.8)	12
1996	Bt	167.1	0.03	0.01	Non-Bt	166.7	1.56	1.21	(+0.4)	2
Avg	Bt	170.4	0.04	0.03	Non-Bt	164.5	1.48	1.73	(+5.9)	

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