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TITLE: Improved Corn Production in Arkansas Through Improved Grower Selection of Corn Hybrids and Better Management of Insects and Disease

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Insect Biology, Impact and Management - 2001

Marianna

Three commonly used Bt field corn lines were planted April and May at the Cotton Plant Branch Station, Marianna. Impact of corn borers on these hybrids was compared to corn borer impact on the parent hybrids. Parent - Bt pairings include Pioneer 3394 vs. Pioneer 33V08 Bt, Pioneer 3223 vs. Pioneer 31B13 Bt, and Pioneer 3245 vs. Pioneer 33R88 Bt (Table 1). Corn borer impact was determined by splitting 10 randomly selected stalks from each plot with a bandsaw. The entire length of the stalk was then examined for presence of corn borer tunnels. Ear shanks and ears also were judged for insect damage.

In the April planting, percentage of parent (non-Bt) plants with corn borer damage ranged from 85.0 (Pioneer 3394) to 100 (Pioneer 3223). The percentage of internodes damaged by corn borer ranged from 18.3 (Pioneer 3394) to 36.4 (Pioneer 3223). In each of the corresponding Bt hybrids, the percentage of infested plants and percentage of internodes was significantly reduced when compared to the parent. Percentage of ear shanks damaged by corn borers were significantly less in the Bt hybrids compared to non-Bt parent. However, the Bt lines appeared to be slightly better at reducing ear damage from insects. Yield in bu/A ranged from 144 (Pioneer 3245) to 172 (Pioneer 31B13 Bt). Although yield for each Bt hybrid was numerically greater than that for its parent, no yield increase was significant.

Corn borer damage in the May planting at Marianna was much greater than in the April planting. The percentage of non-Bt parents infested with corn borer was 100 (Table 1). Percentage of infested internodes in the May planted parents ranged from 40.7 (Pioneer 3223) to 48.3 (Pioneer 3394). The Bt hybrids were highly effective in reducing both the percentage of infested plants and the percentage of infested internodes. These lines also were significantly superior in reducing the percentage of shanks with corn borer tunnels. Ear damage in the May planting was reduced and significant differences between the parents and the Bt hybrids were detected. Yield of all non-Bt parents were significantly less than the Bt lines. The Bt hybrids averaged 66

bu/A greater than the parents. Prior to 2001, Bt lines reported little or no tunneling. Thirty-five percent of Pioneer 33V08 stalks sampled contained tunneling with all other Bt hybrids reporting some damage. The data indicates that resistance to the Bt toxin may be developing. Continued evaluation of parent and Bt lines are essential in determining if Bt resistance has developed.

In addition to the three parent vs. Bt hybrid comparisons, nine other Bt hybrids were included in the Marianna study (Table 3). All were highly effective in reducing the percentage of plants, internodes and shanks with corn borer damage. Yields of these hybrids ranged from 157 bu/A for Pioneer 34B24Bt to 187 bu/a for DeKalb DK 68-70Bt.

Colt

Damage levels from corn borers were somewhat reduced in the April planting at the Pine Tree Station at Colt (Table 2). All of the Bt lines were infested with corn bores indicating possible resistance to the Bt toxin developing. When the percentage of damaged internodes was compared, all April planted Bt hybrids exhibited significantly less damage than in their parents. Shank damage also was significantly less in two of the Bt hybrids when compared to their parents. Some significant differences were observed in damage to ears, but the damage levels were low. Yields ranged from 124 bu/a for Pioneer 33V08Bt to 173 bu/a for Pioneer 3245. High level of variability resulted in no significant yield differences.

The data reported for the May planting showed significantly less stalk boring in the Bt lines as compared to parents. Percent internode damage to parent lines ranged from 19.3 for Pioneer 3245 to 28.7 for Pioneer 3223. All Bt lines contained significantly less boring. The Bt lines averaged over 68 bu/a better yields than the parents.

The nine other Bt lines reported similar results as those discussed from the Marianna data. DeKalb DK 68-70 reported the highest yield of 202 bu/a (Table 4). The only hybrid reporting no internode damage was DeKalb DK 69-70.

Frequency of European and southwestern corn borer adults in pheromone traps

Southwestern and European corn borer pheromone traps were again run at Marion, Arkansas during 2001. European corn borer numbers were relative low through the season. The peak collection period occurred the week of 8 August when 18 European corn borer adults were trapped. Southwestern corn borer trap collections again indicated that two strong adult activity peaks occurred in eastern Arkansas during 2001, i.e., late July and mid-August. Southwestern corn borer numbers were high (966 during the week of 15 August) but slightly less than in 2000.

State wide evaluation of corn borer occurrence.

Corn fields across the state were sampled for corn borer. The locations and recorded parameters are located in Table 5. Marianna and Pine Tree continue to be heavily infested areas.

Corn borer web page that illustrates the biology and identification of ECB and SWCB at <http://comp.uark.edu/~pjmcleod/>.

Table 1. Evaluation of field corn cultivars for resistance to insects, Marianna, Arkansas, 2001

Cultivar	% of plants with corn borer damage	% of internodes damaged	% shank damage	Ear damage rating *	Yield bu/A
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April planting

2. Pioneer 3394	85.0c	18.3b	20.0b	0.8a	152a
3. Pioneer 33V08 Bt	35.5b	5.3a	0.0a	1.2a	157a
4. Pioneer 3223	100.0c	36.4d	64.3c	1.6a	160a
5. Pioneer 31B13 Bt	20.0ab	3.3a	0.0a	0.9a	172a
1. Pioneer 3245	90.0c	25.7b	15.8ab	1.8a	144a
7. Pioneer 33R88 Bt	10.0a	2.7a	0.0a	0.9a	164a

May planting

2. Pioneer 3394	100.0b	48.3c	40.0b	2.5b	124bc
3. Pioneer 33V08 Bt	20.0a	2.7a	0.0a	1.2a	174a
4. Pioneer 3223	100.0b	40.7b	65.0c	2.4b	137b
5. Pioneer 31B13 Bt	20.0a	2.0a	0.0a	1.6a	194a
1. Pioneer 3245	100.0b	44.0bc	52.6bc	2.9b	94c
7. Pioneer 33R88 Bt	14.3a	1.9a	0.0a	1.3a	184a

* Damage ratings are 0 (none) to 5 (extensive).

Column means within a planting followed by the same letter are not significantly different (P=0.05, LSD).

Table 2. Evaluation of field corn cultivars for resistance to insects, Colt, Arkansas, 2001

Cultivar	% of plants with corn borer damage	% of internodes damaged	% shank damage	Ear damage rating *	Yield bu/A
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April planting

2. Pioneer 3394	90.0b	17.0b	5.3a	1.4c	144a
3. Pioneer 33V08 Bt	95.0b	26.3c	5.0a	0.8b	124a
4. Pioneer 3223	50.0a	11.5ab	17.6a	0.8b	154a
5. Pioneer 31B13 Bt	50.0a	7.0a	0.0a	0.6ab	151a
1. Pioneer 3245	95.0b	42.0d	21.1a	1.1bc	173a
7. Pioneer 33R88 Bt	30.0a	4.3a	0.0a	0.4a	155a

May planting

2. Pioneer 3394	90.0b	24.7b	60.0b	1.6a	102b
3. Pioneer 33V08 Bt	10.0a	3.3a	0.0a	1.2a	155a
4. Pioneer 3223	100.0b	28.7b	50.0b	1.3a	113b
5. Pioneer 31B13 Bt	0.0a	0.0a	0.0a	1.2a	175a
1. Pioneer 3245	80.0b	19.3b	50.0b	1.9a	89b
7. Pioneer 33R88 Bt	0.0a	0.0a	0.0a	1.4a	180a

* Damage ratings are 0 (none) to 5 (extensive).

Column means within a planting followed by the same letter are not significantly different (P=0.05, LSD).

Table 3. Evaluation of additional field corn cultivars for resistance to insects, Marianna, Arkansas, 2001

Cultivar	% of plants with corn borer damage	% of internodes damaged	% shank damage	Ear damage rating *	Yield bu/A
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April planting

6. Pioneer 33R87	100.0d	26.0c	40.0a	1.6b	143b
8. Pioneer 32P75	50.0bc	4.4a	0.0a	1.2ab	162ab
9. Pioneer 32P76BT	10.0a	0.7a	0.0a	0.6a	173ab
10. Pioneer 34B23	100.0d	26.0c	30.0a	1.4b	152ab
11. Pioneer 34B24BT	20.0ab	2.7a	0.0a	0.8a	157ab
12. DeKalb DK687	70.0cd	12.0bc	40.0a	1.2ab	159ab
13. DeKalb DKC68-70BT	50.0bc	5.3ab	0.0a	0.5a	187a
14. DeKalb DK697	80.0cd	19.3bc	20.0a	1.0ab	157ab
15. DeKalb DKC69-70BT	0.0a	0.0a	0.0a	1.1ab	171ab

* Damage ratings are 0 (none) to 5 (extensive).

Column means within a planting followed by the same letter are not significantly different (P=0.05, LSD).

Table 4. Evaluation of additional field corn cultivars for resistance to insects, Colt, Arkansas, 2001

Cultivar	% of plants with corn borer damage	% of internodes damaged	% shank damage	Ear damage rating *	Yield bu/A
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April planting

6. Pioneer 33R87	40.0bcd	11.3bc	0.0a	1.3cd	125cd
8. Pioneer 32P75	70.0de	14.7c	20.0a	1.1bcd	148b-d
9. Pioneer 32P76BT	30.0abc	5.3abc	0.0a	0.6ab	167a-d
10. Pioneer 34B23	100.0e	39.3e	11.1a	1.7d	120d
11. Pioneer 34B24BT	50.0c	5.3abc	0.0a	0.6ab	178a-c
12. DeKalb DK687	100.0e	25.9d	22.2a	0.8abc	189ab
13. DeKalb DKC68-70BT	80.0e	12.7c	0.0a	0.5ab	202a
14. DeKalb DK697	12.5ab	0.8ab	0.0a	0.2a	163a-d
15. DeKalb DKC69-70BT	0.0a	0.0a	0.0a	0.7abc	154cd

* Damage ratings are 0 (none) to 5 (extensive).

Column means within a planting followed by the same letter are not significantly different (P=0.05, LSD).

Table 5. Insect damage to field corn at harvest in Arkansas, 2001

Location	% of plants with corn borer damage	% of internodes damaged	% shank damage	Ear damage rating *
Arkadelphia	4.0	0.3	0.0	1.7
Gin City	0.0	0.0	0.0	0.0
Gould	0.0	0.0	0.0	0.4
Holly Grove	13.0	2.5	2.2	0.9
Kibler	0.0	0.0	0.0	0.0
Marianna	100.0	46.3	45.0	2.5
Marion	44.5	6.5	7.6	0.2
Piggott	32.0	6.5	8.0	0.6
Pine Tree	90.0	22.0	60.0	1.8

* Damage ratings are 0 (none) to 5 (extensive).