PERFORMANCE OF BIO-ENGINEERED CORN HYBRIDS

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ABSTRACT: Bio-engineered corn hybrids which should improve crop productivity are rapidly being introduced for commercial use in the United States. These bio-engineered hybrids contain various types of herbicide and/or insect resistance. However, producer reports and limited research results indicate performance deficiencies can occur when comparing bio-engineered crops to conventional hybrids. Our objective was to compare bio-engineered corn hybrid performance to their closely related conventional isolines in identical cropping systems grown in various Mississippi environments. Ten hybrids containing bio-engineered hybrid traits including Liberty Link, Roundup Ready, CLEARFIELD, and YieldGard were evaluated compared to their conventional isolines in 2001. This is the second year of this study, however, there were only three common hybrids evaluated both years due to hybrid discontinuation or no availability. Grain yield production of bio-engineered corn hybrids compared to their respective conventional isolines were generally similar in 2001. Garst 8366Bt produced a significantly higher yield than its conventional isoline, Garst 8366. Thus, three bio-engineered hybrids out of 15 genotypes have produced grain yields different from their isolines during the two years of this study. This indicates grain yield performance variability can occur in some bio-engineered hybrids. Hybrid developmental characteristics, including maturity, plant height, and leaf number of the hybrids evaluated appear virtually similar.

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INTRODUCTION: Bio-engineered (also referred to as genetically modified organisms or transgenic) corn hybrids are rapidly being introduced for commercial use in the United States. These bio-engineered hybrids generally currently contain various types of herbicide and/or insect resistance which should improve crop productivity.

However, producer reports and limited research results indicate performance differences can occur when comparing bio-engineered crops to conventional hybrids (Graeber et al., 1999; Larson et al., 2000; Lauer and Wedberg, 1999). Furthermore, since the inception of the Mississippi Seed Arbitration Council in 1989, 94 percent (149 of 159) of the total complaints filed involved bio-engineered crop performance (L. Daughtry - MS Dept. of Agriculture, Bureau of Plant Industry, personal communication). The biotechnology-related problems were first reported in 1997, with only one conventional case filed prior to 1997.

Biotechnology customers assume considerable risk from performance failures. Thus, customers need additional educational information before bio-engineered products can be incorporated into successful production and utilization systems. This will improve profitability and demand for producers, manufacturers, consumers and educators.

Our objective was to compare bio-engineered hybrid performance to their closely related conventional isolines in identical cropping systems grown in various Mississippi environments. Many bio-engineered hybrids are developed by incorporating desirable genes into currently successful hybrids. Corn grain yield and plant developmental parameters including plant and ear height, maturity, leaf number, lodging and pest resistance will be measured throughout the season.

MATERIALS AND METHODS: Ten bio-engineered corn hybrids and their respective closely-related isolines were grown in field studies at five MAFES branch locations in 200. The bio-engineered hybrids evaluated were Croplan 641RR, DEKALB DKC68-70, DEKALB DKC69-70, Garst 8366Bt, Garst 8366IT, Pioneer 34B28, Pioneer

34B29, Pioneer 32K64, Pioneer 31B13 and Terral TV2140RR. The conventional isolines of these bio-engineered hybrids (in parenthesis) are Croplan 727(641RR), DEKALB DK-687 (DKC68-70), DEKALB DK697 (DKC69-70), Garst 8366 (8366Bt and 8366IT), Pioneer 34B23 (34B28 and 34B29) Pioneer 32K61 (32K64), Pioneer 3223 (31B13) and Terral TV2140 (TV2140RR). Field studies were grown at the Black Belt Branch (Brooksville) on a Brooksville silty clay, Delta Research and Extension Center (Stoneville) on a Bosket very fine sandy loam, North Mississippi Research and Extension Center (Verona) on a Leeper silty clay loam, Pontotoc Ridge-Flatwoods Branch Experiment Station (Pontotoc) on a Falkner silt loam and Prairie Research Unit (Prairie) on a Houston clay. The study at Stoneville was furrow irrigated, while all other studies were dryland culture.

Hybrids were grown in a randomized complete block design with bio-engineered hybrids paired with their conventional isoline and replicated four times. Plot size was four rows wide and varied in length (35-100 feet) depending upon location. Corn was planted in 30 inch width rows at all locations except Stoneville, which was 40 inch width rows. Hybrids at all locations were planted at a seeding rate of 28,000 seeds/acre. Conventional herbicides were utilized to control weeds.

The middle two rows of each plot were harvested with a two-row experimental plot combine. Shelled grain weight and moisture were measured and adjusted to 15.5% moisture. Data were analyzed using Statistical Analysis System (SAS) procedures for analysis of variance. Treatment means were compared using a significance level of $P\#0.05$.

RESULTS AND DISCUSSION: All locations produced moderate to excellent corn grain yields. Below-average air temperatures and adequate rainfall predominated during June and early July, contributing to high grain yield production.

Effective weed control was accomplished using conventional herbicides, minimizing variability resulting from weed competition. However, Southwestern corn borers did infest plots at the Stoneville location. Field scouting revealed nearly 20% infestation of second generation Southwestern corn borer egg masses in late June. Thus, an insecticide was aerially applied to minimize this source of variability. This application achieved relatively good control, as corn borer infestation never exceeded 10% in all treatments.

There was no significant grain yield differences between bio-engineered hybrids compared to their respective conventional isolines for nine of the ten genotypes evaluated. Only Garst 8366Bt produced a grain yield higher than its conventional isoline, Garst 8366. Garst 8366Bt yielded 21 bushels per acre more than its conventional isoline, Garst 8366. These results contrasted slightly from last year's study (Larson et al., 2001), when two CLEARFIELD hybrids, Pioneer 32Z18 and Garst 8366IT both yielded significantly less than their respective conventional isolines, Pioneer 32K61 and Garst 8366. Pioneer 32Z18 was discontinued for the 2001 season. Garst 8366IT produced a similar grain yield compared to 8366 in 2001. Garst 8366IT also produced a similar yield compared to 8366 when 2000 and 2001 data were analyzed combined.

Three bio-engineered hybrids out of 15 genotypes have produced grain yields different from their isolines during the two years of this study. This indicates grain yield performance variability can occur in some bio-engineered hybrids. This preliminary data indicates performance differences are related to specific hybrids, rather than certain bio-engineered traits. Further study is needed to confirm performance trends of specific hybrids under variable environmental conditions. Hybrid developmental characteristics, including maturity, plant height, and leaf number of bio-engineered compared to their conventional isolines appear virtually similar.

Table 1. Grain yield performance of bio-engineered hybrids during 2001.

Company	Hybrid	Trait	Yield (bu./A.)
Croplan	641RR	Roundup Ready	161
	727	Conventional	154
DEKALB	DKC68-70	YieldGard Bt	168
	DK687	Conventional	163
DEKALB	DKC69-70	YieldGard Bt	168
	697	Conventional	160
Garst	8366Bt	YieldGard Bt	181*
	8366	Conventional	160
Garst	8366IT	Clearfield	159
	8366	Conventional	159
Pioneer	31B13	YieldGard Bt	166
	3223	Conventional	170
Pioneer	32K64	YieldGard Bt	169
	32K61	Conventional	176
Pioneer	34B28	Clearfield	167
	34B23	Conventional	170
Pioneer	34B29	Liberty Link	170
	34B23	Conventional	171
Terral	TV2140RR	Roundup Ready	156
	TV2140	Conventional	162
		LSD (0.05)	11

* Significantly different from the respective isoline at $P = 0.05$.

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