

Use of GEM Germplasm for Improving Drought Tolerance, Corn Earworm Resistance and Aflatoxin Resistance

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Objectives

This project relates to the primary objectives of the parent project which includes the development and evaluation of genotypes for biotic and abiotic stresses-drought, corn ear worm (CEW), and grain mold resistance. It covers the progress from October 1, 2006 to September 30, 2007. The specific objectives of this project includes: (1) to conduct field trials for drought tolerance, CEW resistance, grain mold and yield of the top crosses of the GEM lines with Holden's (LH185, LH198, LH200, LH247, and LH283) and public tester lines; (2) to develop inbred lines from GEM populations and characterize inbred lines for stress tolerance and agronomic traits; and (3) to assay aflatoxin of 10 hybrids of the GEM lines. To better organize the field trials, the testcrosses were divided into sub-groups based on their pedigrees.

1. Testcrosses of lines from Cuban populations (Tables 1 to 3):

In 2007, 28 testcrosses of the lines derived from Cuban populations and four check hybrids and were grown under well-watered and drought conditions at Halfway and Lubbock. The drought stress intensity was an average of 50% yield reduction in drought treatment. Several test crosses of CUBA117:S15)-1A-1 yield equally or higher than the average of four commercial hybrids, including the crosses with LH185 and four GEM lines: DK888:N11)-5, DK888:N11)-7, DKXL370:N11a20-2-1, and Tx204. Tables 1 to 3 show the yield, plant and ear height, stag green ratings, and ear traits. These high yielding hybrids have tall plants and may be suitable for silage production.

All these lines are finished inbred lines and have been developed by Texas A&M Corn breeding Program in Lubbock. For simplicity, the pedigrees were abbreviated in this report. CUBA117:S15)-1A-1 is an inbred line with a tall plant, yellow flint kernels, and white cobs. CUBA117:S15)-1A-1 is better than lines from CUBA164:S20. Most of these crosses were evaluated in 2005 and 2006. The results can be found in 2005 and 2006 reports.

2. Testcrosses of lines from Brazilian populations (Tables 4-6):

In 2007, 18 testcrosses of the lines derived from Brazilian populations and four check hybrids were grown in Lubbock, Halfway, and College Station, Texas. Lines from BR52051:N04, BR51039:N15, and BR51501:N11a, and PE1:N16 have been advanced to F11 or higher generations. These lines have long ears with relatively low kernel row numbers. The BR52051:N04, BR51039:N15, and BR51501:N11a lines have dark-yellow flint or semi-flint kernels. Their crosses with B110 and LH200 have relative maturity of 118 days and tall plants. The test crosses of BR52051:N04 lines and PE1:N16 lines with B110 and LH200 produced high yield in 2007 (Tables 4 to 6), as well as 2005 and 2006, especially in the Texas High Plains under well watered conditions. These testcrosses had excellent early vigor, ears fully covered by husks, tall plants with good stay green trait, intermediate corn earworm damage and grain mold.

3. Testcrosses of lines from DK populations (Tables 7-10):

In 2007, 22 test crosses of lines from DK888:N11, DKXL370:N11a20, and DK888:N11a08f were evaluated for stress tolerance and performance at two locations in the

Teas High Plains (Halfway and Lubbock) and on e in southern Texas (Weslaco). The most promising lines are DK888:N11)-5 and DK888:N11)-7. These two lines combine well with SS-lines such as B110 and LH200. These crosses were also evaluated in 2005 and 2006. These lines have medium-late maturity, tall and strong plants, good stay green trait, and low grain mold. Their testcross plants are robust and strong.

4. Testcrosses of lines from SCROGP3 populations (Tables 11):

In 2007, 17 testcrosses of the lines from SCROGP3:N1411a, SCROGP1:N1318, SCROGP3:N2017, and SCROGP3:N3215 were evaluated along with four commercial checks in well-watered condition at Halfway and Lubbock. These lines and their crosses were also tested in 2004-2006. The crosses of the lines from SCROGP3:N1411a), SCROGP1:N1318, and SCROGP3:N2017 with B110 and LH200 flowered about the same time and yield comparable to DKC66-80 and Pioneer hybrid 31B13. These hybrids are widely grown in Texas and have a relative maturity of 117.

5. Testcrosses of lines from AR03056:N0902 (Table 12-14):

In 2007, 16 testcrosses of the lines derived from AR03056:N0902 were evaluated at Halfway and Lubbock under well watered and drought-stressed conditions. The lines from AR03056:N0902 per se has nice plants, excellent anthesis-silking synchronization, upright leaves, and yellow semi-dent kernels. Their testcrosses have early-medium maturity, produce comparable yield under well watered conditions and higher yield under drought as compared to commercial checks, have good stay green trait, intermediate resistance to corn earworm and grain mold.

6. Aflatoxin of selected GEM testcrosses (Table 14):

In 2005 and 2006, 21 experimental and four commercial checks were evaluated for aflatoxin resistance at Halfway, Lubbock, Beeville, and Corpus Christi in Texas and Mississippi State in MS. Nine crosses have at least one parent line developed from GEM breeding crosses. The aflatoxin level at Halfway and Lubbock was low and non-significant among hybrids, therefore, not presented here. The aflatoxin levels at Beeville, Corpus Christi and Mississippi State were significantly different among hybrids. Combined over five environments, S2B73BC x NC300 and S1W x CML343 had 87% and 72% less aflatoxin than the average of four check hybrids (2194 ppb); while WA22W x S1W, Tx202 x CML343, and CUBA117:S15-1A-1 x Tx205 had 62%, 51%, and 51% less aflatoxin than the check means, respectively.

GEM germplasm can be a potential source of aflatoxin resistance. However, it is much more challenging to develop lines that have acceptable agronomic characters (including yield potential) and good aflatoxin resistance. Among the nine crosses of GEM lines, only CUBA117:S15-1A-1 x Tx205 has relatively low aflatoxin. Crosses of SCROGP3:N1411a lines were highly susceptible to aflatoxin. The aflatoxin resistance is a very complex trait. It is associated with drought and tolerance stress tolerance, ear-feeding insect resistance, and morphological and biochemical characters. Aflatoxin is highly variable and is highly expensive to measure.

7. Silage yield and quality of GEM-line crosses

A silage study was conducted in 2005 and 2006 with eight hybrids including SCROGP3:N1411a x B110 and Tx205 x B110. The eight hybrids were grown under well-

watered and drought-stressed conditions at Halfway and Etter in 2005 and 2006. Drought stress was imposed by reducing irrigation by half from V-10 (with 10 fully expanded leaves) to R-3 (two weeks after flowering) stages. Data were collected on plant population per plot, pollen shedding and silking dates, plant and ear height, grain yield, silage yield and quality, and other agronomic traits. The average grain and silage yields of SCROGP3:N1411a x B110 and Tx205 x B110 were highly competitive to the dual purpose silage commercial hybrids (Table 15).

8. Germplasm Transfer:

So far, we have distributed seeds of Tx204, Tx205, and other unreleased lines to 11 seed companies.

9. Publications discussed GEM germplasm:

Field day: We presented and discussed GEM germplasm in the field day on September 15, 2006 at Kress, TX.

Wenwei Xu, Gary Odvody, and W. Paul Williams. Improving drought-tolerance and earworm resistance to reduce Aflatoxin in Corn. Page 67 in Proceedings of USDA Multi-crop Aflatoxin Elimination Workshop, Oct.16-19, Fort Worth, TX. Pp 125.

Wenwei Xu, Gary Odvody, and W. Paul Williams. Progress in breeding aflatoxin-resistant corn. The 20th Annual Multi-crop Aflatoxin Elimination Workshop, Oct.21-24, 2007. Atlanta, GA.

Xu, W. Annual report of GEM project. 2006. in USDA-ARS Germplasm Enhancement of maize 2006 Public data Summary, Ames, IA.

Xu, W. Silage corn hybrids for the Texas High Plains. Dalhart Silage workshop. Dalhart, Texas. October 30, 2007.

Table 1. Grain yield of GEM-CUBA line testcrosses under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock.

ENO	Hybrid	Yield (bu/a)				% of CK mean			
		HF-W	HF-D	ND-D	Mean	HF-W	HF-D	LB-D	Mean
1	B110 x CUBA117:S15)-1A-1	219.5	53.6	70.0	114.4	101.6	70.3	81.6	90.8
2	B113 x CUBA117:S15)-1A-1	187.6	65.0	87.4	113.3	86.8	85.3	101.9	89.9
3	C3A654-3-2-1-1-1-1-1 x CUBA117:S15)-1A-1	208.8	53.9	83.1	115.2	96.6	70.7	96.8	91.5
4	C3A654-3-2-1-2-3-1-1 x CUBA117:S15)-1A-1	189.6	49.3	78.0	105.6	87.7	64.7	90.9	83.8
5	CUBA117:S15)-1A x DK888:N11)-5	233.0	66.2	82.3	127.2	107.8	86.9	95.9	100.9
6	DK888:N11)-7 x CUBA117:S15)-1A-1	207.9	76.8	84.5	123.0	96.2	100.8	98.5	97.7
7	DKXL370:N11a20)-2-1 x CUBA117:S15)-1A-1	218.1	88.8	88.4	131.8	100.9	116.6	103.1	104.6
8	CUBA117:S15)-1A-1 x LH185	228.7	96.2	104.2	143.0	105.8	126.3	121.5	113.5
9	CUBA117:S15)-1A-1 x S2B73	145.2	61.3	64.3	90.2	67.2	80.4	75.0	71.6
10	CUBA117:S15)-1A-1 x Tx204	223.7	98.5	91.5	137.9	103.5	129.2	106.7	109.4
11	CUBA117:S15)-1A-1 x Tx205	184.7	76.6	70.9	110.7	85.5	100.6	82.6	87.9
12	B110 x CUBA164:S20)-1A-B	216.6	57.2	79.6	117.8	100.3	75.1	92.7	93.5
13	CUBA164:S20)-1A-B x C2A554-4-2-1-B-1	172.1	64.7	46.9	94.6	79.6	84.9	54.6	75.1
14	DK888:N11)-5 x CUBA164:S20)-1A-B	179.5	30.1	50.8	86.8	83.0	39.5	59.3	68.9
15	CUBA164:S20)-1A-B x Tx204	228.8	68.4	71.2	122.8	105.9	89.8	83.0	97.5
16	CUBA164:S20-1-2B-1-2-2-1 x B110			74.1	24.7			86.4	19.6
17	CUBA164:S20-1-2B-1-2-2-1-2 x DK888:N11)-5	176.2	59.5	60.2	98.6	81.5	78.1	70.1	78.3
18	CUBA164:S20-1-2B-1-2-2-1-1-1 x LH185	177.6	75.6	95.6	116.3	82.2	99.2	111.4	92.3
19	CUBA164:S20)-1C-3-1-B-1-1 x B110	190.0	58.2	86.1	111.4	87.9	76.4	100.3	88.4
20	CUBA164:S20)-1C-3-1-B x B113			88.8	29.6			103.5	23.5
21	CUBA164:S20)-1C-3-1-B x LH200	191.6	65.6	58.0	105.1	88.7	86.1	67.6	83.4
22	C3A654-3-2-1-2-3-1-1 x CUBA164:S20)-1C-3-	166.2	55.6	78.9	100.3	76.9	73.0	92.0	79.6
23	CUBA164:S20)-1C-3-1-B-1-2-1 x LH185	182.3	77.1	82.9	114.1	84.3	101.1	96.6	90.5
24	LH283 x CUBA164:S20-1-2B-1-2-2-1			84.7	28.2			98.7	22.4
25	CUBA164:S20)-1C-3-1-B-1-1 x Tx204	192.9	42.9	86.4	107.4	89.3	56.3	100.6	85.2
26	CUBA164:S20)-1C-1-B-2-1-B x Tx205			82.0	27.3			95.5	21.7
27	Cuba164:S2008a-507-1-B-1-2-1-1 x Tx204	224.4	68.8	76.9	123.4	103.8	90.3	89.6	97.9
28	Cuba164:S2008a-507-1-B-1-2-1-1-1 x Tx205	212.7	83.9	85.3	127.3	98.4	110.1	99.4	101.0
29	P34A15	192.4	68.1	87.0	115.8	89.0	89.4	101.4	91.9
30	P33M54	212.3	93.2	87.4	131.0	98.2	122.3	101.8	103.9
31	DKC66-80	218.2	70.6	93.5	127.4	101.0	92.7	109.0	101.1
32	Garst 8288	241.3	72.7	75.3	129.8	111.7	95.4	87.7	103.0
	CK Mean	216.1	76.2	85.8	126.0	100.0	100.0	100.0	100.0
	Mean	200.8	67.8	79.3	116.0	92.9	89.0	92.4	92.0
	CV%	10.8	20.6	11.8	14.4				
	LSD 0.05	44.4	28.6	19.0	30.7				

Table 2. Days to pollen shed, plant height and ear height of GEM-CUBA line under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock.

ENO	Hybrids	Days to pollen shed			Plant ht (cm)			Ear ht (cm)		
		HF-W	HF-D	LB-D	HF-W	HF-D	LB-D	HF-W	HF-D	LB-D
1	B110 x CUBA117:S15)-1A-1	79.0	71.0	82.0	278	229	222	111	85	86
2	B113 x CUBA117:S15)-1A-1	76.0	70.0	78.0	294	251	239	113	83	98
3	C3A654-3-2-1-1-1-1-1 x CUBA117:S15)-1A-1	77.0	69.0	80.0	273	218	221	121	78	97
4	C3A654-3-2-1-2-3-1-1 x CUBA117:S15)-1A-1	76.0	69.0	78.0	273	205	222	119	81	104
5	CUBA117:S15)-1A-1-1-1-1 x DK888:N11)-5	76.0	69.0	78.0	288	232	233	134	94	98
6	DK888:N11)-7 x CUBA117:S15)- 1A-1	79.0	72.0	81.0	298	248	251	125	102	113
7	DKXL370:N11a20)-2-1 x CUBA117:S15)-1A-1	78.0	70.0	80.0	281	232	235	107	90	94
8	CUBA117:S15)-1A-1 x LH185	75.0	69.0	77.0	285	235	235	98	77	88
9	CUBA117:S15)-1A-1 x S2B73	78.0	72.0	81.0	298	246	235	134	109	100
10	CUBA117:S15)-1A-1 x Tx204	78.0	69.0	81.0	304	235	238	125	97	93
11	CUBA117:S15)-1A-1 x Tx205	79.0	70.0	81.0	293	251	243	118	90	105
12	B110 x CUBA164:S20)-1A-B	77.0	69.0	79.0	283	224	225	130	94	98
13	CUBA164:S20)-1A-B x C2A554-4 DK888:N11)-5 x CUBA164:S20)- 1A-B	77.0	70.0	78.0	291	221	225	118	94	90
14	CUBA164:S20)-1A-B x Tx204	76.0	68.0	78.0	274	214	218	110	90	94
15	CUBA164:S20)-1A-B x Tx204	76.0	69.0	77.0	293	240	239	111	84	88
16	CUBA164:S20)-1-2B-1-2 x B110 CUBA164:S20)-1-2B-1-2 x			77.0			220			81
17	DK888:N11)-5 CUBA164:S20)-1-2B-1-2-2-1-1-1-1 x LH185	75.0	69.0	77.0	300	228	219	106	68	87
18	CUBA164:S20)-1C-3-1-B-1-1 x B110	74.0	66.0	76.0	276	222	225	77	53	69
19	CUBA164:S20)-1C-3-1-B x B113	76.0	68.0	76.0	273	221	216	122	91	83
20	CUBA164:S20)-1C-3-1-B x B113			76.0			215			82
21	CUBA164:S20)-1C-3-1-B x LH200 C3A654-3-2-1-2-3-1-1 x	77.0	70.0	81.0	296	235	222	125	94	94
22	CUBA164:S20)-1C-3	75.0	68.0	76.0	271	218	220	120	85	85
23	CUBA164:S20)-1C-3-1-B x LH185	72.0	65.0	76.0	271	228	230	83	60	66
24	LH283 x CUBA164:S20)-1-2B-1			78.0			228			70
25	CUBA164:S20)-1C-3 x Tx204	76.0	69.0	76.0	294	234	240	113	81	92
26	CUBA164:S20)-1C-1 x Tx205 Cuba164:S2008a-507-1-B-1 x Tx204	77.0	70.0	80.0	293	238	239	116	83	94
27	Cuba164:S2008a-507-1-B-1 x Tx205	78.0	70.0	81.0	287	231	243	126	90	95
28	P34A15	69.0	64.0	75.0	273	224	227	83	67	80
29	P33M54	76.0	69.0	77.0	283	230	236	96	77	85
30	DKC66-80	79.0	72.0	81.0	277	247	239	118	103	104
31	Garst 8288	76.0	69.0	79.0	306	235	236	106	79	97
32										
	CK Mean	75.0	68.5	78.0	284	234	235	100	81	91
	Mean	76.1	68.9	78.1	286	231	230	113	85	90
	CV%	0.6	0.9	1.2	3	4	3	10	8	9
	LSD 0.05	0.9	1.3	2.0	18	20	15	23	14	16

Table 3. Stay green rating, stalk lodging, CEW ear penetration (cm), and percentage of molded kernels of GEM-CUBA line under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

ENO	Hybrids	Stay green rating					Stalk lodging (%)			CEW	EL	Mold
		HF- W 9//5	HF- D 8/16	HF- D 9/6	LB- D 8/6	LB- D 8/16	HF- W	HF- D	LB- D	LB-D	LB- D	LB-D
1	B110 x CUBA117:S15)-1A-1	5.0	3.0	4.8	2.3	3.3	2.2	0.0	1.9	5.9	15.4	90.0
2	B113 x CUBA117:S15)-1A-1	3.5	3.0	4.5	2.3	3.3	4.4	3.0	14.6	4.1	15.8	4.0
3	C3A654-3-2-1-1-1-1-1 x CUBA117:S15)-1A-1	5.0	3.5	5.0	3.0	4.0	5.1	5.1	21.3	5.2	16.3	3.5
4	C3A654-3-2-1-2-3-1-1 x CUBA117:S15)-1A-1	5.0	3.0	4.8	2.5	4.5	1.4	1.5	18.2	3.8	15.3	3.0
5	CUBA117:S15)-1A-1-1-1-1 x DK888:N11)-5	4.3	2.8	4.8	2.0	4.3	1.5	1.4	18.5	3.6	17.7	2.5
6	DK888:N11)-7 x CUBA117:S15)-1A-1	4.5	2.8	4.8	2.8	4.3	0.0	11.2	14.0	5.8	17.9	3.0
7	DKXL370:N11a20-2-1 x CUBA117:S15)-1A-1	3.0	2.8	4.3	2.3	3.0	0.0	2.3	1.5	5.0	17.6	8.0
8	CUBA117:S15)-1A-1 x LH185	3.5	3.0	4.8	2.3	3.8	0.0	2.1	8.3	6.8	19.2	5.5
9	CUBA117:S15)-1A-1 x S2B73	5.0	3.0	5.0	2.5	3.3	1.5	3.0	6.0	4.1	14.6	6.5
10	CUBA117:S15)-1A-1 x Tx204	4.3	3.0	4.5	2.5	4.3	0.0	0.0	13.6	3.8	17.7	3.0
11	CUBA117:S15)-1A-1 x Tx205	4.3	3.0	4.5	2.5	3.3	2.7	0.0	14.4	5.4	15.9	3.0
12	B110 x CUBA164:S20)-1A-B	3.0	3.3	5.0	2.5	4.3	0.0	3.9	10.5	4.7	16.0	4.5
13	CUBA164:S20)-1A-B x C2A554-4	3.0	3.0	5.0	3.3	4.8	0.7	6.7	27.2	4.1	14.5	2.5
14	DK888:N11)-5 x CUBA164:S20)-1A-B	4.0	4.3	5.0	3.0	5.0	4.5	73.0	13.5	5.2	17.7	5.5
15	CUBA164:S20)-1A-B x Tx204	3.0	3.3	5.0	2.8	4.8	1.5	9.0	9.9	4.8	17.5	4.0
16	CUBA164:S20)-1-2B-1-2-2-1 x B110				2.5	4.5			12.6	5.3	15.6	5.0
17	CUBA164:S20)-1-2B-1-2-2-1-2 x DK888:N11)-5	3.0	3.5	4.8	2.5	5.0	3.1	7.4	10.0	6.2	18.0	3.0
18	CUBA164:S20)-1-2B-1-2-2 x LH185	4.0	3.8	4.8	3.3	5.0	2.5	4.1	2.6	5.0	17.0	4.0
19	CUBA164:S20)-1C-3-1-B x B110	3.5	3.8	5.0	3.0	4.8	2.3	58.5	50.0	4.9	17.9	4.5
20	CUBA164:S20)-1C-3-1-B x B113				3.5	5.0			2.9	4.5	17.1	4.0
21	CUBA164:S20)-1C-3-1-B x LH200	3.8	3.5	4.8	2.8	4.5	3.1	10.4	21.2	4.1	16.1	4.0
22	C3A654-3-2-1-2-3-1-1 x CUBA164:S20)-1C-3	4.5	4.5	5.0	3.3	4.8	2.3	10.1	13.0	4.9	17.7	5.5
23	CUBA164:S20)-1C-3-1-B-1-2-1 x LH185	3.3	4.3	5.0	3.0	5.0	2.5	12.5	14.5	6.9	19.3	3.0
24	LH283 x CUBA164:S20)-1-2B-1-2-2-1				2.3	3.8			0.0	7.9	19.6	4.5
25	CUBA164:S20)-1C-3-1-B-1-1 x Tx204	3.5	3.7	5.0	2.5	4.8	7.0	8.7	39.1	5.3	17.9	4.5
26	CUBA164:S20)-1C-1-B-2-1-B x Tx205				3.3	5.0			24.8	5.1	17.2	5.5
27	Cuba164:S2008a-507-1-B1-1 x Tx204	5.0	3.8	5.0	3.3	5.0	1.5	4.3	17.7	7.8	16.5	5.0
28	Cuba164:S2008a-507-1-B-1-2 x Tx205	4.0	3.8	5.0	3.3	4.8	6.3	13.4	18.3	7.1	17.3	4.5
29	P34A15	3.3	4.8	5.0	4.3	5.0	0.0	1.5	0.0	4.0	17.5	4.0
30	P33M54	3.3	3.8	5.0	3.5	5.0	0.7	0.0	2.4	4.3	18.7	3.0
31	DKC66-80	3.5	3.0	4.8	2.5	4.3	0.0	0.0	7.9	4.9	17.9	3.5
32	Garst 8288	3.0	3.5	5.0	3.5	5.0	0.7	2.9	6.5	6.3	16.9	4.5
	CK Mean	3.3	3.8	4.9	3.4	4.8	0.4	1.1	4.2	4.9	17.8	3.8
	Mean	3.8	3.4	4.8	2.8	4.4	2.1	9.1	13.7	5.2	17.1	6.9
	CV%	9.8	12.4	3.6	18.3	7.7	101.0	156.3	92.5	23.3	4.7	43.1
	LSD 0.05	0.8	0.9	0.4	2.0	0.7	ns	29.3	ns	2.4	1.6	6.1

Table 4. Grain yield of GEM-Brazil line testcrosses under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock.

ENO	Hybrids	Yield (bu/a)		% CK	
		LB-W	HF-D	LB-W	HF-D
1	B110 x BR52051:N04)-1-2	197.2	85.7	97.6	80.9
2	B110 x BR52051:N04)-1-B	212.9	89.5	105.4	84.4
3	CML32xB104)-2-1-b-2-1-2 x BR52051:N04)-1-B	182.8	70.9	90.5	66.9
4	FS8(A)S:S09-309-1-B-B-1-2-1 x BR52051:N04)-1-2 FS8B(S):S0316-1099-1-B-B-2-2-1-1-1 x	190.5	74.8	94.2	70.6
5	BR52051:N04)-1-B	155.7	45.8	77.0	43.2
6	BR51501:N11a-1-2 x B110	189.7	81.2	93.9	76.6
7	BR51501:N11a-4-1 x B110	182.7	81.1	90.4	76.6
8	B110 x PE1:N16)-2-1	184.2	85.1	91.1	80.3
9	BR51039:N15-B-B-B-2-1 x B110	137.6	49.8	68.1	47.0
10	LH200 x PE1:N16)-1	182.7	100.6	90.4	94.9
12	B107x(PR96AS1B73)-1-1-B-1-B x BR52051:N04)- 1-2	143.0	67.0	70.7	63.2
13	BR52051:N04)-1-2 x B107x(PR96AS1B73)-2-2-1-1- B-2-1	214.4	83.4	106.1	78.6
14	C3A632-1A-1-1-1-1-1 x BR52051:N04)-1-2 CML273xA632)F7-1a-2-B-1-1-1 x BR52051:N04)-1- 2	179.6	64.8	88.9	61.1
15		212.0	78.1	104.9	73.7
16	LH200 x BR52051:N04)-1-2	194.7	93.1	96.3	87.8
17	PR96AxS1)xB76-1-1-1-1-3-2 x BR52051:N04)-1-2	154.5	43.1	76.5	40.6
18	S2B73 x BR52051:N04)-1-2	145.5	78.4	72.0	74.0
19	P34A15	196.5	104.7	97.2	98.8
20	P33M54	202.5	110.0	100.2	103.8
21	DKC66-80	206.7	98.1	102.3	92.6
22	Garst 8288	202.5	111.0	100.2	104.7
	CK Mean	202.1	106.0	100.0	100.0
	Mean	184.2	80.8	91.1	76.2
	CV%	6.1	13.2		
	LSD 0.05	23.3	22.2		

Table 5. Grain yield, days to pollen shed, plant and ear height, stay green rating, and stalk lodging of GEM-Brazil line testcrosses under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

ENO	Hybrids	Days to pollen shed				Plant ht, cm				Stalk lodge, %		Stay green	
		LB-W	HF-D	LB-W	HF-D	LB-W	HF-D	LB-W	HF-D	HF-D	HF-D		
1	B110 x BR52051:N04)-1-2	80	72	266	247	43	1.5	3.0	5.0				
2	B110 x BR52051:N04)-1-B	77	70	253	246	17	1.5	3.0	4.3				
	CML32xB104)-2-1-b-2-1-2 x												
3	BR52051:N04)-1-B	79	70	236	227	1	1.5	2.8	3.3				
	FS8(A)S:S09-309-1-B-B-1-2-1 x												
4	BR52051:N04)-1-2	78	70	258	239	20	1.5	4.3	4.8				
	FS8B(S):S0316-1099-1-B-B-2-2-2-												
5	1-1-1 x BR52051:N04)-1-B	76	68	233	224	89	2.5	4.8	5.0				
6	BR51501:N11a-1-2 x B110	80	71	257	239	7	1.8	3.0	5.0				
7	BR51501:N11a-4-1 x B110	81	73	257	228	5	1.5	3.0	4.8				
8	B110 x PE1:N16)-2	82	74	280	264	6	1.5	3.0	4.5				
9	BR51039:N15-B-B-B-2-1 x B110	80	72	241	236	14	1.5	3.3	5.0				
10	LH200 x PE1:N16)-1	82	74	293	260	7	1.5	3.0	4.8				
	B107x(PR96AS1B73)-1-1-B-1-B x												
12	BR52051:N04)-1-2	78	71	253	243	52	1.5	4.3	4.8				
	BR52051:N04)-1-2 x												
	B107x(PR96AS1B73)-2-2-1-1-B-2-												
13	1	78	70	275	269	16	1.5	3.8	5.0				
	C3A632-1A-1-1-1-1-1 x												
14	BR52051:N04)-1-2	80	72	269	242	19	2.3	3.5	5.0				
	CML273xA632)F7-1a-2-B-1-1-1 x												
15	BR52051:N04)-1-2	81	72	269	251	6	1.5	3.0	5.0				
16	LH200 x BR52051:N04)-1-2	78	70	269	259	5	1.5	3.0	4.8				
	PR96AxS1)xB76-1-1-1-1-3-2 x												
17	BR52051:N04)-1-2	78	70	257	254	93	2.8	4.3	5.0				
18	S2B73 x BR52051:N04)-1-2	77	69	267	262	15	1.5	3.3	4.8				
19	P34A15	74	65	239	234	1	1.5	5.0	5.0				
20	P33M54	77	69	248	250	1	1.8	3.5	5.0				
21	DKC66-80	81	72	264	263	1	1.5	3.0	5.0				
22	Garst 8288	77	69	255	235	1	2.0	3.0	5.0				
	CK Mean	77	69	251	246	1	1.7	3.6	5.0				
	mean	79	71	259	246	20	1.7	3.5	4.8				
	CV%	1	1	3	4	66	13.2	5.7	4.1				
	LSD 0.05	2	2	18	21	27	0.5	0.4	0.4				

Table 6. Grain yield, days to pollen shed, and test weight of GEM-Brazil line testcrosses at College Station, TX in 2007.

Hybrids	Days to pollen shed	Moist, %	Test wt, lb/bu	Yield (bu/a)	% CK
BR52051:N04)-1-1 x B110	77.0	14.1	59.5	189.5	103.2
B110 x BR52051:N04)-1-2	77.0	13.5	58.0	122.5	66.7
B110 x BR52051:N04)-1-B	77.0	13.9	59.9	129.0	70.3
CML32xB104)-2-1-b-2-1-2 x BR52051:N04)-1-B	75.0	14.9	62.2	156.0	85.0
FS8(A)S:S09-309-1-B-B-1-2-1 x BR52051:N04)-1-2	74.0	14.4	60.0	109.6	59.7
FS8B(S):S0316-1099-1-B-B-2-2-2-1-1-1 x BR52051:N04)-1-B	75.0	14.3	60.1	100.4	54.7
BR51501:N11a-1-2 x B110	78.0	13.6	58.4	143.9	78.4
BR51501:N11a-3-1 x B110	77.0	13.2	57.2	134.6	73.3
BR51501:N11a-4-1 x B110	81.0	14.2	59.2	104.3	56.8
BR51501:N11a-5-1 x B110	80.0	13.5	57.4	110.5	60.2
BR51501:N11a-2-1 x S1xB76)-2-1-B-1	74.0	14.9	61.4	154.6	84.2
B110 x PE1:N16)-1	82.0	12.8	55.7	156.7	85.3
BR51039:N15)-B-B-B-2-1 x B110	79.0	14.5	59.2	160.1	87.2
LH200 x PE1:N16)-1	82.0	13.2	56.3	188.4	102.6
LH200 x PE1:N16)-2	83.0	13.1	56.5	164.7	89.7
P34A15	71.0	13.9	61.0	181.9	99.1
P33M54	75.0	14.4	61.5	208.3	113.4
DKC66-80	76.0	13.2	57.9	156.0	85.0
Garst 8288	74.0	14.2	59.9	188.2	102.5
					0.0
CK Mean	74.0	13.9	60.1	183.6	100.0
Mean	77.1	13.9	59.0	150.5	82.0
CV%	1.6	2.4	1.2	15.3	
LSD 0.05	2.6	0.7	1.5	48.2	

Table 7. Days to pollen shed and grain yield of GEM-DK line testcrosses under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock.

ENO	Entry	Days to pollen shed			Yield (bu/a)				% CK			
		HF-WFI	HF-D	LB-D	HF-W	HF-D	LB-D	Mean	HF-W	HF-D	LB-D	Mean
1	B110 x DK888:N11)-5	75.0	69.0	77.0	220.3	94.7	67.9	127.6	100	88	72	86
2	DK888:N11)-5 x B113	74.0	69.0	77.0	174.3	45.6	33.4	84.5	79	42	35	52
3	LH200 x DK888:N11-5	73.0	69.0	77.0	259.4	105.9	76.3	147.2	117	98	81	99
4	CML273xA632)F7-1a-2-B-1-1 x DK888:N11)-5	76.0	69.0	79.0	187.7	63.4	63.9	105.0	85	59	68	70
5	DK888:N11)-5 x CML32xB104)F7-2-1-b-1-B-2-1-3	76.0	69.0	78.0	212.7	90.3	63.0	122.0	96	83	67	82
6	D580MBcorn-1A-1-1-1 x DK888:N11)-5	72.0	69.0	75.0	166.8	82.0	66.9	105.3	75	76	71	74
7	DK888:N11)-5 x B107x(PR96AxS1)x(B73)F8-2-2-1-1-B-2-1	76.0	70.0	77.0	233.0	97.5	46.5	125.7	105	90	49	82
8	DK888:N11)-7 x B110	79.0	72.0	81.0	202.4	104.0	76.5	127.6	92	96	81	90
9	DK888:N11)-7 x LH200	79.0	73.0	82.0	222.7	115.8	77.5	138.7	101	107	82	97
10	P1xB73)x(CML343xB73)-1-1-B-1-1-2-1 x DK888:N11)-7	82.0	75.0	85.0	172.0	87.6	68.1	109.2	78	81	72	77
11	S2B73 x DK888:N11)-7	76.0	70.0	80.0	201.6	83.9	67.3	117.6	91	78	71	80
12	DK888:N11)-4-1 x B110	77.0	70.0	78.0	222.1	97.3	67.6	129.0	100	90	72	87
13	B110 x DK888:N11)-4-12A-1-1-1	78.0	72.0	82.0	215.3	99.9	81.1	132.1	97	92	86	92
14	DK888:N11)-12C-3-1-1 x B105xCML274)F7-3-1-1-B-B	79.0	75.0	82.0	193.9	95.3	68.8	119.3	88	88	73	83
15	DK888:N11a08f-1-B-B-1-1-1-2 x LH200	79.0	73.0	82.0	215.7	111.3	90.3	139.1	98	103	96	99
16	DK888:N11a08f-1-B-B-1-1-2 x B110	75.0	68.0	79.0	174.0	73.9	73.5	107.1	79	68	78	75
17	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1-1 x B110	78.0	70.0	80.0	233.1	105.4	78.4	139.0	105	97	83	95
18	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1-1-2 x S2B73	75.0	69.0	78.0	210.9	103.0	90.3	134.7	95	95	96	96
19	DKXL370:N11a20-76-2-B-B-1-1-2-1 x B110	76.0	69.0	77.0	191.6	89.2	71.4	117.4	87	82	76	82
20	DKXL370:N11a20-199-1-B-B-2-B-1-1-1 x B110	75.0	70.0	77.0	190.6	90.0	75.9	118.8	86	83	81	83
21	DKXL370:N11a20-199-1-B-B-2-B-1-1 x S1B76)F9-2-1-B-1-1	76.0	69.0	78.0	158.3	79.3	52.7	96.8	72	73	56	67
22	DKXL370:N11a20-76-2-B-B-1-1-1-1 x LH200	75.0	71.0	78.0	182.1	93.4	64.7	113.4	82	86	69	79
23	P34A15	68.0	65.0	74.0	207.0	107.9	84.1	133.0	94	100	89	94
24	P33M54	76.0	70.0	78.0	258.4	104.9	96.3	153.2	117	97	102	105
25	DKC66-80	78.0	73.0	83.0	208.8	112.1	99.0	140.0	94	104	105	101
26	Garst 8288	76.0	69.0	80.0	210.0	107.7	97.6	138.4	95	100	104	99
	CK mean	74.5	69.3	78.8	221.0	108.2	94.2	141.1	100	100	100	100
	Mean	75.9	70.0	78.7	204.8	93.9	73.0	123.9	93	87	77	86
	CV%	1.0	0.9	1.8	11.0	13.3	15.0					
	LSD 0.05	1.6	1.3	2.9	46.2	25.8	22.6					

Table 8. Early vigor, plant height, ear height, stalk lodging and root lodging of GEM-DK line under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock. Early vigor was scored on a 1 to 9 scale with 9 being best.

ENO	Entry	EVIGOR	Plant ht, cm			Ear ht, cm			Stalk lodging, %		
			HF-W	HF-D	LB-D	HF-W	HF-D	LB-D	HF-W	HF-D	LB-D
HFFI	HFFI	LB-D									
1	B110 x DK888:N11)-5	7.3	270	223	224	126	89	98	9.1	2.9	35.6
2	DK888:N11)-5 x B113	7.3	292	224	228	125	75	88	0.8	53.4	13.4
3	LH200 x DK888:N11)-5 CML273xA632)F7-1a-2-B-1-1 x	7.3	268	250	242	109	115	102	0.0	4.5	13.0
4	DK888:N11)-5 DK888:N11)-5 x	7.0	273	221	235	117	98	111	24.0	3.6	37.8
5	CML32xB104)F7-2-1-b-1-B-2-1-3 D580MBcorn-1A-1-1-1 x	7.0	266	218	218	121	92	89	18.9	6.6	18.9
6	DK888:N11)-5 DK888:N11)-5 x	6.8	248	212	207	104	85	95	7.1	1.5	6.9
7	B107PR96AS1B73)-2-2-1-1-B-2-1	7.0	298	244	239	119	96	93	3.0	3.7	46.4
8	DK888:N11)-7 x B110	6.8	300	254	243	122	105	105	7.7	0.9	21.7
9	DK888:N11)-7 x LH200 P1xB73)x(CML343xB73)-1-1-B-1-	6.5	295	252	229	119	106	94	1.5	2.1	8.1
10	1-2-1 x DK888:N11)-7	6.8	309	259	237	165	119	117	0.0	11.7	6.3
11	S2B73 x DK888:N11)-7	6.8	306	250	241	134	104	106	3.0	17.1	57.3
12	DK888:N11)-4-1 x B110	7.0	273	228	233	117	95	98	5.3	0.0	23.0
13	B110 x DK888:N11)-4-12A-1-1-1 DK888:N11)-12C-3-1-1 x	7.0	302	246	229	133	106	95	1.6	4.4	36.0
14	B105xCML274)F7-3-1-1-B-B DK888:N11a08f-1-B-B-1-1-1-2 x	6.8	308	261	253	146	112	111	11.9	4.8	27.2
15	LH200 DK888:N11a08f-1-B-B-1-1-2 x	6.5	283	249	235	112	102	107	0.0	1.6	14.5
16	B110 DKXL370:N11a20-2-1-B-B-B-1-2-	6.3	276	237	230	113	98	98	4.3	0.0	50.8
17	1-1-1-1-1 x B110 DKXL370:N11a20-2-1-B-B-B-1-2-	7.3	288	231	233	114	97	97	1.6	2.6	5.2
18	1-1-1-1-1-2 x S2B73 DKXL370:N11a20-76-2-B-B-1-1-	7.0	292	247	244	125	92	93	1.6	2.9	8.2
19	2-1 x B110 DKXL370:N11a20-199-1-B-B-2-	6.5	272	215	215	103	83	97	5.0	7.4	8.7
20	B-1-1-1 x B110 DKXL370:N11a20-199-1-B-B-2-	7.3	270	224	218	104	86	90	8.7	7.9	10.7
21	B-1-1 x S1B76)F9-2-1-B-1-1 DKXL370:N11a20-76-2-B-B-1-1-	6.3	281	226	224	125	93	99	25.3	5.0	24.6
22	1-1 x LH200	5.5	283	238	230	114	91	89	3.0	3.0	12.0
23	P34A15	7.5	290	227	221	117	71	70	0.0	3.0	4.3
24	P33M54	7.3	290	222	235	104	75	72	0.0	1.4	6.0
25	DKC66-80	7.3	283	254	247	128	102	103	2.2	0.0	14.6
26	Garst 8288	7.0	295	242	245	120	92	80	1.5	0.0	11.0
	CK mean	7.3	289	236	237	117	85	81	0.9	1.1	9.0
	Mean	6.9	285	236	232	120	95	96	5.6	5.9	20.1
	CV%	3.9	3	3	5	10	8	8	57.9	116.0	90.0
	LSD 0.05	0.6	19	16	22	26	16	16	6.7	0.4	37.2

Table 9. Stay green rating, CEW ear penetration (cm), and percentage of molded kernels of GEM-DK line under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

ENO	Entry	Stay green						CEW EL MOL D		
		HF-W 8/16	HF-D 9/6	LB-D 8/6	LB-D 8/15	HF-W 9/13	Mean	LB-D	LB-D	LB-D
1	B110 x DK888:N11)-5	3.0	5.0	2.8	5.0	3.8	3.9	3.4	15.0	4.0
2	DK888:N11)-5 x B113	4.3	5.0	3.8	5.0	3.0	4.2	5.8	16.0	5.5
3	LH200 x DK888:N11-5	3.3	5.0	3.5	5.0	3.8	4.1	3.4	15.0	3.0
4	CML273xA632)F7-1a-2-B-1-1 x DK888:N11)-5	4.0	5.0	2.8	4.8	4.5	4.2	4.3	15.0	3.0
5	DK888:N11)-5 x CML32xB104)F7-2-1-b-1-B-2-1-3	3.3	5.0	3.3	4.8	4.8	4.2	3.1	14.0	3.0
6	D580MBcom-1A-1-1-1 x DK888:N11)-5	3.3	5.0	3.5	5.0	4.8	4.3	6.7	17.0	3.0
7	DK888:N11)-5 x B107x(PR96AS1B73)-2-2-1-1-B-2-1	3.0	5.0	3.3	5.0	3.5	4.0	3.4	15.0	3.0
8	DK888:N11)-7 x B110	2.8	4.8	2.8	4.5	4.3	3.8	3.2	15.0	6.5
9	DK888:N11)-7 x LH200	3.0	5.0	2.3	4.8	3.5	3.7	5.2	14.0	4.5
10	P1xB73)x(CML343xB73)-1-1-B-1-1-2-1 x DK888:N11)-7	3.0	4.5	2.3	3.0	2.8	3.1	3.9	14.0	12.0
11	S2B73 x DK888:N11)-7	3.0	5.0	2.8	4.3	3.3	3.7	4.2	16.0	4.5
12	DK888:N11)-4-1 x B110	3.0	5.0	2.5	4.5	3.5	3.7	4.5	15.0	5.5
13	B110 x DK888:N11)-4-12A-1-1-1	3.0	4.8	2.5	4.3	4.5	3.8	4.1	15.0	7.0
14	DK888:N11)-12C-3-1-1 x B105xCML274)F7-3-1-1-B-B	2.5	5.0	2.5	4.8	4.8	3.9	3.6	16.0	2.5
15	DK888:N11a08f-1-B-B-1-1-1-2 x LH200	3.0	5.0	2.5	3.8	3.5	3.6	5.3	16.0	7.5
16	DK888:N11a08f-1-B-B-1-1-2 x B110	2.8	5.0	2.5	4.5	4.5	3.9	3.6	15.0	4.0
17	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1 x B110	2.5	4.8	2.5	3.3	3.0	3.2	4.7	16.0	7.0
18	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1-2 x S2B73	2.8	4.8	2.0	3.0	3.5	3.2	4.5	14.0	42.0
19	DKXL370:N11a20-76-2-B-B-1-1-2-1 x B110	3.3	5.0	2.8	4.5	3.8	3.9	4.2	16.0	6.5
20	DKXL370:N11a20-199-1-B-B-2-B-1-1-1 x B110	4.0	5.0	2.8	4.8	3.5	4.0	5.3	17.0	4.0
21	DKXL370:N11a20-199-1-B-B-2-B-1-1 x S1B76)-2-1-B-1-1	3.8	5.0	2.8	4.8	3.0	3.9	3.8	16.0	4.0
22	DKXL370:N11a20-76-2-B-B-1-1-1-1 x LH200	3.3	4.8	2.8	4.0	3.5	3.7	6.6	16.0	29.0
23	P34A15	4.8	5.0	4.0	5.0	3.5	4.5	4.5	16.0	6.0
24	P33M54	3.3	5.0	2.8	4.5	3.3	3.8	4.8	16.0	4.5
25	DKC66-80	2.5	4.8	2.3	3.0	3.5	3.2	4.5	15.0	4.0
26	Garst 8288	3.5	5.0	2.8	4.5	3.0	3.8	6.2	15.0	6.5
	CK mean	3.5	4.9	2.9	4.3	3.3	3.8	5.0	15.5	5.3
	Mean	3.2	4.9	2.8	4.4	3.7	3.8	4.5	15.4	7.3
	CV%	7.4	3.9	16.5	7.3	7.0		24.0	5.2	173.0
	LSD 0.05	0.5	ns	0.9	0.7	0.5		ns	1.6	ns

Table 10. Days to pollen shed, plant height, grain yield, and test weight of GEM-DK line testcrosses in southern Texas (Weslaco) in 2007.

Entry	Days to pollen shed	Plant ht, cm	Ear ht., cm	Moist, %	Yield, bu/a	% CK
B110 x DK888:N11)-5	71.0	217.0	67.0	13.5	122.7	95.1
LH200 x DK888:N11)-5	70.0	240.0	76.0	13.4	94.4	73.2
(DK888:N11)-5 x B110	71.0	212.0	72.0	13.5	130.1	100.8
B113 x DK888:N11)-5	70.0	210.0	58.0	13.7	122.9	95.2
DK888:N11)-5 x S1xB76)F9-2-1-B-1 CML273xA632)F7-1a-2-B-1-1 x DK888:N11)-5	70.0	202.0	67.0	13.2	142.8	110.7
CML32xB104)F7-4-B-B-1-2-1 x DK888:N11)-5	70.0	221.0	74.0	13.3	109.5	84.9
D580MBcorn-1A-1-1-1 x DK888:N11)-5	72.0	198.0	65.0	13.8	113.1	87.6
DK888:N11)-7 x B110	72.0	188.0	55.0	13.4	110.3	85.5
DK888:N11)-7 x LH200	70.0	224.0	83.0	13.3	126.3	97.9
DK888:N11)-7 x LH200	70.0	232.0	75.0	13.5	147.3	114.2
DK888:N11)-4-1 x B110	70.5	225.0	76.0	13.8	119.4	92.6
B110 x DK888:N11)-12A-1	71.0	231.0	80.0	13.8	129.4	100.3
DK888:N11)-12A-1 x LH200	68.0	229.0	81.0	13.5	130.5	101.1
DK888:N11)-12C-3-1 x B105CML274)-3- 1-1-B-B	70.0	227.0	71.0	13.3	126.7	98.2
DK888:N11a08f-1-B-B-1-1 x LH200	71.0	220.0	74.0	13.5	116.1	90.0
DK888:N11a08f-1-B-B-1-1-2 x AR16021:S08a01)-1-2	72.0	192.0	56.0	13.7	110.6	85.7
DK888:N11a08f-1-B-B-1-1-2 x B110	70.0	221.0	69.0	13.4	114.0	88.4
DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1- 1 x B110	70.0	220.0	69.0	13.4	121.2	94.0
DKXL370:N11a20-76-2-B-B-1-1-2 x B110	70.0	220.0	76.0	13.6	115.7	89.7
DKXL370:N11a20-199-1-B-B-2-B-1 x B113	68.0	208.0	57.0	13.7	86.5	67.0
DKXL370:N11a20-199-1-B-B-2-B-1 x S1xB76)F9-2-1-B-1	70.0	212.0	64.0	13.8	129.9	100.7
DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1 x LH200	70.0	220.0	62.0	13.4	135.3	104.9
DKXL370:N11a20-76-2-B-B-1-1 x LH200	71.0	220.0	71.0	13.3	119.1	92.3
DKXL370:N11a20-76-2-B-B-1-1-2 x S1C2B73-1-1-1-1	70.0	218.0	61.0	13.2	109.5	84.9
FS8(A)S:S09-309-1-B-B-1-2-1 x DK888:N11)-5	69.5	207.0	64.0	13.6	145.2	112.5
P34A15	72.0	208.0	53.0	13.3	132.4	102.7
P33M54	71.5	221.0	61.0	13.4	117.3	90.9
DKC66-80	71.0	216.0	70.0	13.3	129.1	100.1
Garst 8288	72.0	227.0	58.0	13.8	137.2	106.4
CK mean	71.6	218.0	60.5	13.5	129.0	100.0
mean	70.5	216.7	67.7	13.5	122.2	94.7
CV%	1.7	3.2	7.6	1.6	8.9	
LSD 0.05	ns	14.1	10.6	ns	22.4	

Table11. Early vigor, days to pollen shed, plant and ear height, stalk lodging (STL), stay green, and grain yield of GEM-SCROP3 line testcrosses under well-watered conditions at Halfway (HF) and Lubbock (LB), TX in 2007.

Entry	VIGOR	Days to pollen shed		Plant ht, cm		Ear ht, cm		STL			Stay green			Yield, bu/a		% CK
		LB-W	HF-W	LB-W	HF-W	LB-W	HF-W	HF-W	HF-W	LB-W	HF-W	LB-W	HF-W	LB-W	Mean	
SCROGP3:N1411a)-1-1 x B110	7.5	76	78	291	254	117	117	6.5	4.3	1.8	205.2	198.7	202.0	106.2		
(SCROGP3:N1411a)-1-2 x B110	7.3	76	79	283	260	112	94	4.7	4.3	1.5	212.0	176.0	194.0	102.1		
(SCROGP3:N1411a)-1-3 x B110	7.0	77	79	285	258	112	99	6.2	4.3	1.5	226.7	184.3	205.5	108.1		
SCROGP3:N1411a)-1-4 x B110	7.5	76	78	300	271	133	115	6.1	3.5	1.8	203.2	186.2	194.7	102.4		
SCROGP3:N1411a)-1-1 x B104	7.3	77	79	293	253	113	93	1.5	3.5	1.5	217.5	158.4	188.0	98.9		
LH200 x SCROGP3:N1411a)-1-1	7.3	78	81	300	271	119	117	0.0	3.0	1.5	222.6	153.8	188.2	99.0		
SCROGP3:N1411a)-1-1 x S9C2B76b-B	6.8	75	78	287	253	113	98	8.0	3.0	2.0	192.7	157.5	175.1	92.1		
SCROGP3:N1411a)-1-1 x LH198	7.5	75	77	289	259	111	104	1.5	3.8	1.5	193.9	154.3	174.1	91.6		
SCROGP1:N1318)-1-B x B110	7.8	76	78	282	249	118	108	1.4	3.3	1.5	217.4	188.1	202.8	106.7		
SCROGP1:N1318)-1-B x LH198	8.0	76	77	280	248	115	109	0.8	3.3	1.5	198.5	180.2	189.4	99.6		
SCROGP3:N2017)-1 -1 x B110	7.0	77	80	303	266	129	110	5.9	4.3	1.5	217.9	169.1	193.5	101.8		
SCROGP3:N2017)-1 -1 x LH200	7.8	78	79	307	264	125	105	1.5	3.0	1.5	216.4	191.2	203.8	107.2		
SCROGP3:N2001-1-B1-B-1-2-1 x B110	5.5	77	81	272	253	101	102	2.9	5.0	1.5	168.0	151.4	159.7	84.0		
SCROGP3:N3215-1-B-1-1-B-1-1 x B110	6.8	77	81	310	274	133	108	4.5	5.0	1.5	195.6	150.8	173.2	91.1		
SCROGP3:N3215-1-B-1-1-1-1 x LH198	8.5	76	78	306	271	126	101	0.0	5.0	2.0	176.3	155.6	165.9	87.3		
SCROGP3:N3215-1-B-1-1-1-1 x LH200	7.5	77	79	298	268	118	100	0.0	4.8	1.5	182.7	161.1	171.9	90.4		
SCROGP3:N3215-1-B-1-1-B-1 x S1B76-2-1-B-1	7.5	76	81	275	265	109	106	1.4	3.0	1.5	164.7	145.6	155.1	81.6		
P34K77	8.3	71	76	274	245	94	93	0.8	4.0	1.5	174.2	183.5	178.9	94.1		
P31B13	6.5	78	81	288	253	129	107	3.8	3.5	1.5	233.1	163.5	198.3	104.3		
DKC66-80	7.8	77	81	286	253	122	105	0.0	3.8	1.5	201.9	184.1	193.0	101.5		
CK Mean	7.5	75	79	282	250	115	101	1.5	3.8	1.5	203.1	177.0	190.1	100.0		
Mean	7.3	76	79	290	259	117	104	2.9	3.9	1.6	201.0	169.8	185.4	97.5		
CV%	6.3	1	1	3	4	9	11	80.1	7.2	12.6	7.3	7.8				
LSD 0.05	1	1	1	19	19	ns	24	4.8	0.6	ns	30.9	27.8				

Table12. Days to pollen shed and grain yield of GEM-AR03056:N0902 line testcrosses under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Drought stress was imposed from V12 to R2 stages at Halfway and Lubbock.

ENO	Entry	Days to pollen shed		Yield, bu/a			% CK yield		
		HF-W	LB-D	HF-W	HF-D	LB-D	HF-W	HF-D	LB-D
1	A633xFR2128)-2-B-B x AR03056:N0902)-1-1	72.0	76.0	235.4	69.7	63.3	101.2	77.4	91.3
2	AR03056:N0902)-1-1 x B104		78.0			48.1			69.4
3	AR03056:N0902)-1-1 x B110	73.0	77.0	226.2	71.5	62.0	97.2	79.4	89.5
4	AR03056:N0902)-1 x B110	72.0	77.0	233.3	56.5	64.1	100.3	62.7	92.5
5	AR03056:N0902)-1-1 x B113	72.0	76.0	185.6	45.6	77.6	79.8	50.6	112.0
6	AR03056:N0902)-1-1 x LH198	72.0	77.0	251.9	80.6	75.4	108.3	89.5	108.8
7	AR03056:N0902)-1-1 x LH200	74.0	77.0	232.7	76.5	78.8	100.1	84.9	113.8
9	C3S1B73-3-3-1-1-1 x AR03056:N0902)-1-1	76.0	80.0	282.1	70.6	41.3	121.3	78.4	59.6
10	AR03056:N0902)-1-1 x CUBA117:S15)-1A-1	76.0	78.0	187.1	67.0	82.4	80.5	74.4	118.9
11	AR03056:N0902)-1-1 x CUBA164:S20)-1A-B	72.0	77.0	201.2	69.3	41.8	86.5	76.9	60.3
12	AR03056:N0902)-1-1 x CUBA164:S20)-1C-3	72.0	76.0	221.5	66.2	83.9	95.2	73.5	121.1
13	AR03056:N0902)-1-1x S2B73BC	73.0	77.0	223.8	79.5	73.4	96.2	88.2	105.9
14	AR03056:N0902)-1-1 x S2B73 AR03056:N0902)-2-2 x	72.0	76.0	226.6	83.9	86.0	97.4	93.1	124.1
15	B107x(PR96AS1B73)-2-2 B104S1)-3-B-1-1-1-1 x	72.0	76.0	258.1	79.0	59.2	111.0	87.6	85.4
16	AR03056:N0902)-1-1	76.0	78.0	214.6	64.3	58.0	92.2	71.4	83.7
17	P34A15 (RM108)	69.0	75.0	252.8	101.6	58.6	108.7	112.8	84.5
18	P33M54 (RM113)	76.0	78.0	251.1	89.6	67.1	108.0	99.4	96.9
19	DKC66-80 (RM116)	78.0	83.0	221.9	88.6	83.7	95.4	98.3	120.7
20	Garst 8288 (RM118)	75.0	80.0	204.5	80.7	67.7	87.9	89.5	97.7
	CK mean	74.5	79.0	232.6	90.1	69.3	100.0	100.0	100.0
	Mean	73.2	77.3	228.3	74.5	67.0	98.2	82.7	96.7
	CV%	0.9	0.8	7.4	11.2	17.0			
	LSD 0.05	1.4	1.3	35.8	17.7	23.9			

Table 13. Plant height, ear height, stay green rating, and stalk lodging of GEM--AR03056:N0902 line under well-watered (W) and drought stressed (D) conditions at Halfway (HF) and Lubbock (LB), TX in 2007. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

ENO	Entry	Plant ht, cm			Ear ht, cm			Stay green				Stalk lodging, %		
		HF-W	HF-D	LB-D	HF-W	HF-D	LB-D	HF-W 9/13	HF-D 8/16	LB-D 8/06	LB-D 8/16	HF-W	LB-D	HF-D
1	A633xFR2128)F7-2-B-B x AR03056:N0902)-1-1	251	197	199	104	66	70	4.0	4.3	3.0	5.0	0.8	15.7	1.4
2	AR03056:N0902)-1-1 x B104			173			72			2.5	5.0		11.2	
3	AR03056:N0902)-1-1 x B110	260	206	209	113	80	87	3.0	3.8	2.5	4.5	3.0	17.9	0.0
4	AR03056:N0902)-1 x B110	238	189	185	95	75	72	3.5	3.8	3.0	4.8	0.0	11.6	1.5
5	AR03056:N0902)-1-1 x B113	243	202	183	95	75	72	3.3	4.0	2.3	4.5	0.0	5.0	8.6
6	AR03056:N0902)-1-1 x LH198	256	205	190	110	77	77	3.5	3.0	2.5	4.8	0.0	14.5	1.4
7	AR03056:N0902)-1-1 x LH200 C3S1B73-3-3-1-1-1 x	255	210	191	101	81	69	3.5	3.5	2.5	4.8	0.0	1.5	1.5
9	AR03056:N0902)-1-1 AR03056:N0902)-1-1 x	260	208	187	113	91	77	3.5	3.3	3.0	5.0	2.9	35.4	6.4
10	CUBA117:S15)-1A-1 AR03056:N0902)-1-1 x	274	211	193	115	92	85	3.3	3.0	3.0	3.8	0.0	11.4	1.4
11	CUBA164:S20)-1A-B AR03056:N0902)-1-1 x	250	200	184	108	79	74	3.0	3.8	3.3	5.0	0.7	40.9	7.1
12	CUBA164:S20)-1C-3 AR03056:N0902)-1-1x	254	203	194	113	91	79	3.0	4.0	2.3	4.5	0.0	5.0	18.6
13	S2B73BC	256	214	210	118	84	87	4.0	3.8	2.5	4.8	0.0	17.6	4.3
14	AR03056:N0902)-1-1 x S2B73 AR03056:N0902)-2-2 x	251	207	185	111	89	85	4.8	3.8	2.5	4.8	2.2	43.8	23.2
15	B107x(PR96AS1B73)-2-2 B104S1)-3-B-1-1-1-1 x	250	201	185	88	70	70	3.0	4.0	3.0	5.0	0.7	12.1	6.4
16	AR03056:N0902)-1-1	258	211	189	116	96	80	3.5	3.5	3.3	5.0	1.4	14.3	9.0
17	P34A15 (RM108)	274	214	186	80	64	51	3.3	4.8	3.5	5.0	0.0	7.2	2.9
18	P33M54 (RM113)	282	222	215	104	69	55	3.3	3.8	2.8	4.8	1.5	3.8	0.0
19	DKC66-80 (RM116)	281	243	217	123	97	85	3.3	3.0	2.0	3.5	1.4	0.0	2.1
20	Garst 8288 (RM118)	282	229	213	107	77	83	3.0	3.0	2.8	3.5	0.0	1.4	0.0
	CK mean	280	227	208	103	77	68	3.2	3.6	2.8	4.2	0.7	3.1	1.3
	Mean	260	209	194	106	80	75	3.4	3.7	2.7	4.6	0.8	14.2	5.3
	CV%	3	4	4	7	7	11	10.8	9.7	13.1	7.3	144.1	95.5	62.7
	LSD 0.05	17	17	17	16	12	18	0.8	0.7	0.8	0.7	ns	ns	7.1

Table 14. Aflatoxin levels of 21 TAES experiment hybrids and four commercial checks at Beeville, Corpus Christi in Texas and Mississippi State, MS in 2005 and 2006. The same tests were conducted in Lubbock and Hallway, but the aflatoxin levels were low and not significantly different among hybrids. Plants in all tests were inoculated to elevate the aflatoxin level. A log transformation of the aflatoxin data shown in this table was performed to compare the differences. ANOVA on transformed adapt was not shown here due to space limitation.

ENO	Entry	Aflatoxin (ppb)					Mean	% CK
		BV05	CC05	MS05	CC06	MS06		
1	C2A554-1 x B110	5400	1143	1146.7	1020.0	247.3	1791.5	67.6
2	C2A554-1 x LH200	2867	887	1600.0	2533.3	683.3	1714.0	64.6
3	C3A654-3-1 x B110	5033	1180	376.0	470.0	340.0	1479.9	55.8
4	C3S1B73-3-1 x Tx205	7033	2867	974.7	1163.3	1260.0	2659.6	100.3
5	C3S1B73-3-3 x LH200	4267	2200	1973.3	336.7	1026.7	1960.7	74.0
6	(S1xB73)x(B73)F9-1 x Tx205	5567	2367	633.3	1100.0	366.7	2006.7	75.7
7	(S1xB76)F7-1 x B113	5367	2300	2226.7	983.3	293.3	2234.0	84.3
8	S2B73BC x NC300	993	383	126.7	233.3	42.7	355.9	13.4
9	AR03056:N0902-1-1 x LH200	10100	1967	1653.3	1333.3	1646.7	3340.0	126.0
10	AR03056:N0902)-1-2 x S2B73	13667	2367	2106.7	1116.7	506.7	3952.7	149.1
11	CUBA117:S15)-1A-1 x Tx205	3400	1533	633.3	580.0	350.0	1299.3	49.0
12	CUBA117:S15)-3-2 x LH185	12000	3467	2933.3	1606.7	653.3	4132.0	155.8
13	(CML247xB76)F5-2-1 x T173	12033	4833	800.0	2300.0	1325.3	4258.4	160.6
14	(CML247xB76)F5-1-1-1 x Tx205	4733	2733	1106.7	796.7	540.0	1982.0	74.8
15	(CML273xA632)F7-1a-1 x Tx205	4000	2167	550.7	870.0	156.0	1548.7	58.4
16	DTP-17B x B110	7333	1233	670.7	1040.0	623.3	2180.1	82.2
17	LH200 x SCROGP3:N1411a)-1-2	4367	3100	986.7	923.3	526.7	1980.7	74.7
18	SCROGP3:N1411a)-1-1 x B110	7233	2067	533.3	1226.7	1013.3	2414.7	91.1
19	WQ22W x S1W	2533	683	634.7	820.0	336.7	1001.6	37.8
20	Tx202 x CML343	2800	2467	496.0	350.0	413.3	1305.2	49.2
21	S1W x CML343	1900	847	433.3	93.3	420.0	738.7	27.9
22	P31B13 (CK1)	5700	2333	1013.3	1066.7	1040.0	2230.7	84.1
23	Garst 8285	6867	1200	573.3	743.3	150.0	1906.7	71.9
24	Triumph 1416 (RM113)	15333	3033	1146.7	2366.7	943.3	4564.7	172.2
25	DKC66-80	6633	1217	618.7	656.7	390.0	1903.1	71.8
	CK mean	8633	1946	838.0	1208.3	630.8	2651.3	100.0
	Mean	6268	2023	1037.9	1029.2	611.8	2194.0	82.8
	CV%	34	28	72.4	46.0	66.9		
	LSD 0.05	3476	933	1225.4	946.1	667.3		

Table 15. Average grain yield of eight hybrids under well watered (WW) and drought (DRT) conditions at Etter and Halfway, Texas in 2005 and 2006. The grain and forage yields were adjusted to a standard 15.5% and 65%, respectively.

Hybrids	Grain yield (bu/a)						Forage yield (kg/a)					
	WW		DRT		Total		WW		DRT		Total	
C3A654-4 x B110	160.7	bc	86.4	ab	123.5	bc	23935.1	a	16989.6	a	20462.4	a
S2B73 x NC300	141.0	d	77.4	bc	109.2	de	20398.1	b	15247.4	ab	17822.7	bc
SGP3-1-1 x B110	155.1	bcd	75.1	bc	115.1	cd	24131.8	a	15629.7	ab	19880.8	ab
S1W x CML343	145.6	cd	56.8	d	101.2	e	20680.9	b	13325.4	b	17003.1	c
Tx205 x B110	161.8	b	67.6	cd	114.7	cd	21678.9	ab	15962.2	ab	18820.6	abc
Garst 8288 (CK1)	155.4	bcd	75.0	bc	115.2	cd	21380.8	ab	15220.6	ab	18300.7	bc
P31B13 (CK2)	178.2	a	97.3	a	137.7	a	22956.4	ab	17955.6	a	20456.0	a
DKC66-80 (CK3)	161.5	b	93.2	a	127.4	b	22407.0	ab	15131.8	ab	18769.4	abc
Test mean	157.4		78.6		118.0		22196.1		15682.8		18939.5	
CV%	12.1		18.4		14.3		17.3		22.6		19.5	

Means in a column with the same letter are not significantly different at 5% level.