

GEM Breeding Crosses, Topcrosses, and Advanced Lines for Improving Drought Tolerance, Grain Mold Resistance, and Corn Earworm 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. The specific objectives of this project includes: (1) to conduct field trials for drought tolerance, CEW resistance, grain mold and yield of the topcrosses of the GEM lines with Holden's (LH185, LH198, LH200, LH247, and LH283) and public tester lines; (2) to assay aflatoxin of 10 hybrids of the GEM lines; (3) To advance and characterize inbred lines from GEM breeding crosses; and (4) to perform second-year field evaluation of 25 new GEM breeding crosses for drought tolerance, grain mold resistance, and CEW resistance. This report will focus on the report on objectives 1, 2, and 4. To better organize the field trials, the testcrosses were divided into sub-groups based on their pedigrees.

1. Testcrosses of Lines from Cuban Populations:

In 2006, four check hybrids and 15 testcrosses of the lines derived from Cuban populations were grown at three locations in the Texas High Plains. Lines from CUBA117:S15 and CUBA164:S20 have been advanced to F₁₂ generation. These lines have white cobs and yellow flint kernels with kernel texture. The lines per se have good stalks. They combine well with both stiff stalk (e.g. B110, LH200) and non-stiff stalk lines (e.g. Tx204 and Tx205). Their test crosses are medium-late in maturity, have average stay green trait and intermediate response to earworm feeding, and low grain mold (Tables 1 to 3). Some of the crosses may have severe common smut. The testcrosses were also evaluated in 2005 under well watered and drought conditions (Table 4). These testcrosses had excellent early vigor, and ears were fully covered, but not very tightly, by husks. In both 2005 and 2006, crosses with B113 and LH185 performed very well.

In an aflatoxin study, crosses of GEM lines including (CUBA117:S15)-3-2 x LH185, (CUBA117:S15)-1A-1 x Tx205, C3S1B73-3-1 x Tx205, (AR03056:N0902)F9-1-1 x LH200, LH200 x (SCROGP3:N1411a)F9-1-2 were grown along with 15 hybrids in Lubbock, Halfway, Corpus Christi and Beeville for aflatoxin assays where the test plots were inoculated with *A. flavus*. The aflatoxin level at Corpus Christi, Beeville, and Mississippi State was high and significantly different among the hybrids. Unfortunately, these hybrids had aflatoxin levels similar to the commercial checks. Under the inoculated conditions at the three sites, (CUBA117:S15)-1A-1 x Tx205 had an average aflatoxin of 1855 ppb as compared to the 3805 ppb of the means of four commercial hybrids (P31B13, Garst 8285, Triumph 1416, and DKC66-80), which was equivalent to 49% of commercial check hybrid means. The risk of the aflatoxin accumulation in this hybrid is below average (Table 5)

Currently, we are increasing seeds of two sister inbred lines from CUBA117:S15 and three sister lines from CUBA164:S20 in the winter nursery. These lines have good agronomic traits and unique characters such as good kernel textures. We plan to one inbred line from each breeding cross.

Table 1. Yield and stay green rating of GEM-CUBA line testcrosses at Etter (ET), Halfway (HF) and Lubbock (LB), TX in 2006. The Etter test was well watered. Drought stress was imposed from V12 to R2 stages (DRT) at Halfway and Lubbock and post-tassel at Halfway (Post).

ENO	Entry	Yield (bu/a)							Stay green					
		ET-WW	% CK	HF-WW	HF-DRT1	HF-POST	LB-DRT	Mean	ET-WW	HF-WW	LB-DRT	HF-DRT	HF-POST	Mean
1	CUBA117:S15)-1A-1 x B110	199	95	89	25	36	20.1	42	2.5	5.0	4.0	2.8	3.0	3.5
2	B113 x CUBA117:S15)-1A-1 DK888:N11)F2S2-5-B-1-1-1-1-1 x	217	104	59	27	43	41.1	42	2.3	4.0	3.8	3.5	3.0	3.3
3	CUBA117:S15)-1A-1-1-1	204	97	79		69	40.8	63	2.3	4.0	3.3		3.0	3.1
4	CUBA164:S20)-1C-3-1-B x B110	202	97	68	51	64	40.1	56	2.5	4.5	3.5	3.0	3.3	3.4
5	CUBA164:S20)-1C-3-1-B x LH200	196	94	73	31	76	28.3	52	2.5	3.0	3.0	2.5	2.8	2.8
6	CUBA164:S20)-1-2B-1-2-2-1 x B110	221	105	65	33	58	39.6	49	2.3	3.9	3.0	3.0	2.8	3.0
7	CUBA164:S20)-1C-3-1-B x B113	134	64	86		67	26.6	60	2.5	3.1	3.8		3.3	3.2
8	CUBA164:S20)-1C-1-B x LH185	212	101	119	68	85	42.0	78	2.8	3.5	3.5	3.8	3.3	3.4
9	CUBA164:S20)-1C-3-1-B x Tx205	177	85	116		84	40.3	80	2.8	3.9	3.5		3.0	3.3
10	CUBA164:S20)-1C-3-1-B-1 x Tx204	211	101	82		79	45.3	69	2.0	3.7	3.5		3.0	3.0
11	CUBA164:S20)-1-2B-1-2-2-1-1 x Tx204 AR03056:N0902)-1-1-B-1-B x	201	96	77	47	60	38.7	56	3.0	3.9	4.0	3.0	3.5	3.5
12	CUBA164:S20)-1-2B-1-2-2-1-2	212	101	74	41	74	47.3	59	2.8	3.9	3.8	3.3	2.8	3.3
13	LH283 x CUBA164:S20)-1-2B-1-2-2-1 CUBA164:S20)-1-2B-1-2-2-1-2 x	169	81	75	40	43	24.1	45	2.3	3.3	3.5	2.3	2.5	2.8
14	DK888:N11)F2S2-5-B-1-1-1-1-1-1	189	90	78	40	72	33.9	56	2.5	4.0	3.3	2.8	3.0	3.1
15	Cuba164:S2008a-507-1-B-1-2-1-1 x Tx204 S1W-1-1-1-B x Cuba164:S2008a-507-1-B-	214	102	93	42	61	34.3	58	2.8	4.5	3.8	3.3	3.0	3.5
16	1-2-B-1	197	94	89	45	50	28.8	53	1.8	3.0	2.5	2.3	2.5	2.4
17	P34A15	203	97	99	61	74	41.6	69	3.0	4.5	3.8	4.0	3.0	3.7
18	P33M54	216	103	70	36	64	35.1	51	2.7	4.3	3.3	3.0	3.3	3.3
19	DKC66-80	228	109	91	56	87	37.2	68	2.0	4.0	3.5	2.3	2.3	2.8
20	Garst 8288	191	91	145	36	79	24.9	71	2.8	3.2	2.8	3.8	3.0	3.1
	CK mean	210	100	101	47	76	34.7	65	2.6	4.0	3.3	3.3	2.9	3.2

Test mean of 20 entries	200	95	86	43	66	35.5	58	2.5	3.9	3.4	3.0	3.0	3.2
CV%	10		27	25	18	15.6		15.1	7.1	ns	15.1	12.5	
LSD 0.05	41		ns	22	25	11.7		ns	0.5		0.9	ns	

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 2. Days to pollen shed, plant height, ear height, and stalk lodging of GEM-CUBA line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Entry	Days to pollen shed			Plant ht. (cm)		Ear ht. (cm)		Stalk lodging (%)		
		ET-	HF-	LB-	HF-	LB-	HF-	HF-	ET-	HF-	HF-
		WW	WW	WW	WW	DRT	WW	DRT	WW	WW	POST
1	CUBA117:S15)-1A-1 x B110	76	77	74	244	174	102	82	6	6	7
2	B113 x CUBA117:S15)-1A-1 DK888:N11)F2S2-5-B-1-1-1-1-1 x	72	74	69	256	179	88	78	10	2	11
3	CUBA117:S15)-1A-1-1-1	73	74	69	224	181	90	89	8	1	2
4	CUBA164:S20)-1C-3-1-B x B110	73	76	71	225	168	96	89	13	13	13
5	CUBA164:S20)-1C-3-1-B x LH200	74	74	73	220	179	87	77	2	2	4
6	CUBA164:S20-1-2B-1-2-2-1 x B110	74	75	71	230	169	97	65	3	2	8
7	CUBA164:S20)-1C-3-1-B x B113	73	75	71	240	153	99	57	5	2	10
8	CUBA164:S20)-1C-1-B x LH185	70	72	68	233	174	94	68	5	2	4
9	CUBA164:S20)-1C-3-1-B x Tx205	73	73	70	249	199	91	89	10	4	10
10	CUBA164:S20)-1C-3-1-B-1 x Tx204	73	76	68	234	183	91	80	4	6	9
11	CUBA164:S20-1-2B-1-2-2-1-1 x Tx204 AR03056:N0902)-1-1-B-1-B x CUBA164:S20-1-2B-	73	74	68	218	177	80	69	1	2	3
12	1-2-2-1-2	72	72	69	214	160	79	74	2	2	2
13	LH283 x CUBA164:S20-1-2B-1-2-2-1 CUBA164:S20-1-2B-1-2-2-1-2 x DK888:N11)F2S2-	73	75	71	239	182	92	73	4	2	3
14	5-B-1-1-1-1-1-1	73	74	70	218	174	78	76	2	2	1
15	Cuba164:S2008a-507-1-B-1-2-1-1 x Tx204	75	78	74	252	182	104	82	5	13	4
16	S1W-1-1-1-B x Cuba164:S2008a-507-1-B-1-2-B-1	75	75	71	213	169	89	73	4	7	7
17	P34A15	70	73	67	214	183	74	63	4	1	1
18	P33M54	74	75	73	212	183	73	66	0	3	0
19	DKC66-80	75	78	74	244	190	98	73	3	0	1
20	Garst 8288	73	73	71	274	201	89	75	4	1	3
	CK mean	73	75	71	236	189	83	69	3	1	2
	Test mean	73	74	70	232	178	89	75	5	4	5

CV%	1	1	2	9	5	9	11	91	81	69
LSD 0.05	2	2	3	ns	18	14	18	ns	5	8

Table 3. CEW damage (CEW), ear length, molded kernels, and smut incidence of GEM-CUBA line testcrosses at Halfway (HF) and Lubbock (LB), TX in 2006. Drought stress was imposed from V12 to R2 stages (DRT) at Halfway and Lubbock and post-tassel at Halfway (Post).

ENO	Entry	Early vigor			Smut (%)		Molded kernels (%)	CEW (cm)	EL (cm)	RATIO (%)
		LB-DRT	HF-WW	HF-POST	LB-DRT	LB-DRT	LB-DRT	LB-DRT		
1	CUBA117:S15)F7-1A-1 x B110	3.3	1.8	2.9	11.5	8.2	14.6	56.0		
2	B113 x CUBA117:S15)F7-1A-1 DK888:N11)F2S2-5-B-1-1-1-1-1 x	3.8	8.0	22.1	8.0	6.1	16.6	37.4		
3	CUBA117:S15)F7-1A-1-1-1	3.3	4.8	14.5	10.5	6.7	17.5	38.5		
4	CUBA164:S20)F7-1C-3-1-B x B110	3.5	0.8	2.0	10.0	8.4	17.8	47.2		
5	CUBA164:S20)F7-1C-3-1-B x LH200	3.5	1.0	1.2	10.0	6.3	16.5	38.2		
6	CUBA164:S20-1-2B-1-2-2-1 x B110	3.0	5.7	4.7	12.5	6.7	17.1	39.2		
7	CUBA164:S20)F7-1C-3-1-B x B113	3.0	3.3	0.0	10.0	6.8	15.6	43.8		
8	CUBA164:S20)F7-1C-1-B x LH185	3.0	1.6	0.0	17.5	6.4	18.2	35.2		
9	CUBA164:S20)F7-1C-3-1-B x Tx205	3.0	2.2	3.8	11.5	7.0	19.1	36.6		
10	CUBA164:S20)F7-1C-3-1-B-1 x Tx204	3.3	0.8	4.5	14.0	6.6	17.4	37.9		
11	CUBA164:S20-1-2B-1-2-2-1-1 x Tx204 AR03056:N0902)F9-1-1-B-1-B x	3.5	0.0	15.7	11.5	6.7	16.5	40.7		
12	CUBA164:S20-1-2B-1-2-2-1-2	3.5	2.4	29.5	11.5	7.2	18.9	38.3		
13	LH283 x CUBA164:S20-1-2B-1-2-2-1 CUBA164:S20-1-2B-1-2-2-1-2 x	3.5	2.4	15.4	9.0	7.6	19.1	40.0		
14	DK888:N11)F2S2-5-B-1-1-1-1-1-1 Cuba164:S2008a-507-1-B-1-2-1-1 x	3.3	1.6	23.7	15.0	7.5	18.2	41.2		
15	Tx204 S1W-1-1-1-B x Cuba164:S2008a-507-1-	3.8	0.8	10.0	14.0	6.9	17.9	38.7		
16	B-1-2-B-1	3.0	0.0	8.4	6.0	4.1	15.5	26.5		
17	P34A15	3.5	0.0	1.3	15.0	6.5	16.2	39.8		
18	P33M54	3.3	2.6	22.0	15.0	7.9	18.2	43.4		
19	DKC66-80	3.0	2.1	1.3	22.5	8.6	18.8	45.8		
20	Garst 8288	3.3	0.8	2.8	9.0	6.6	16.5	40.0		
	CK mean	3.3	1.4	6.8	15.4	7.4	17.4	42.3		

Test mean	3.3	2.1	9.3	12.2	6.9	17.3	40.2
CV%	12.0	82.0	62.4	43.3	9.3	6.1	11.4
LSD 0.05	ns	3.1	12.2	ns	1.4	2.2	9.6

Note: Ratio = CEW/EL *100.

Table 4. Yield, earworm damage (CEW), molded kernels (mold), and husk coverage of GEM-CUBA line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB), TX under well-watered and drought (DRT) conditions in 2005.

ENO	Entry	Yield (bu/a)					Mean	% CK	CEW		
		ET-WW	HF-WW	HF-DRT	LB-WW	(cm)			Mold (%)	Husk	
3	CUBA117:S15)-1A-1 x B110	194	134	52	166	137	94	6.1	3.0	3.3	
4	B113 x CUBA117:S15)-1A-1	203	158	58	181	150	103	7.0	5.5	3.3	
5	CUBA117:S15)-1A-1 x Tx205	171	166	50	183	142	98	6.2	4.0	3.5	
7	Tx204x CUBA164:S20)-1C-1-B	203	157		186	182	125	7.5	7.0	3.0	
8	CUBA164:S20)-1C-1-B x LH185	176	166	71	168	145	100	6.6	5.0	2.5	
9	CUBA164:S20)-1C-3-1 x LH185	162	162	62	176	141	97	6.1	5.0	3.0	
18	P34K77	158	172	47	173	138	94	5.0	3.0	3.3	
19	P31B13	185	181	59	211	159	109	4.9	3.5	3.5	
20	DKC66-80	208	182	51	170	153	105	5.7	4.0	4.0	
	CK Mean	167	178	53	185	146	100	5.2	3.5	3.6	
	Test mean of 20 entries	169	156	51	167	136	93	6.9	5.3	2.7	
	CV%	9	10	16	6			13.8	34.2	9.6	
	LSD 0.05	32	30	17	21			2.0	3.8	0.5	

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green. Husk coverage was rated on a 1 to 5 scale with 1 loose and 5 very tight and fully covered.

Table 5. Aflatoxin levels (ppb) of selected hybrids at Corpus Christi and Beeville, TX and Mississippi State, MS in 2005. Plants were inoculated with a high aflatoxin producing *A. flavus* strain.

ENO	Entry	Beeville	Corpus Christi	Mississippi State	Mean	% CK	Sig.
1	C2A554-1 x B110	5400	1143	1146.7	2563.3	67.4	abcdefg
2	C2A554-1 x LH200	2867	887	1600.0	1784.4	46.9	defg
3	C3A654-3-1 x B110	5033	1180	376.0	2196.4	57.7	efg
4	C3S1B73-3-1 x Tx205	7033	2867	974.7	3624.9	95.2	abcdef

5	C3S1B73-3-3 x LH200	4267	2200	1973.3	2813.3	73.9	abcdef
6	(S1xB73)x(B73)F9-1 x Tx205	5567	2367	633.3	2855.6	75.0	abcdef
7	(S1xB76)F7-1 x B113	5367	2300	2226.7	3297.8	86.7	abcde
8	S2B73BC x NC300	993	383	126.7	501.1	13.2	h
9	AR03056:N0902-1-1 x LH200	10100	1967	1653.3	4573.3	120.2	abcde
10	AR03056:N0902-1-2 x S2B73	13667	2367	2106.7	6046.7	158.9	ab
11	CUBA117:S15-1A-1 x Tx205	3400	1533	633.3	1855.6	48.8	defg
12	CUBA117:S15-3-2 x LH185	12000	3467	2933.3	6133.3	161.2	a
13	(CML247xB76)-2-1 x T173	12033	4833	800.0	5888.9	154.7	abcd
14	(CML247xB76)-1-1-1 x Tx205	4733	2733	1106.7	2857.8	75.1	abcdef
15	(CML273xA632)-1a-1 x Tx205	4000	2167	550.7	2239.1	58.8	cdefg
16	DTP-17B x B110	7333	1233	670.7	3079.1	80.9	bcdefg
17	LH200 x SCROGP3:N1411a-1-2	4367	3100	986.7	2817.8	74.0	abcdef
18	SCROGP3:N1411a-1-1 x B110	7233	2067	533.3	3277.8	86.1	abcdef
19	WQ22W x S1W	2533	683	634.7	1283.8	33.7	fg
20	Tx202 x CML343	2800	2467	496.0	1920.9	50.5	efg
21	S1W x CML343	1900	847	433.3	1060.0	27.9	gh
22	P31B13 (CK1)	5700	2333	1013.3	3015.6	79.2	abcdef
23	Garst 8285	6867	1200	573.3	2880.0	75.7	bcdefg
24	Triumph 1416 (RM113)	15333	3033	1146.7	6504.4	170.9	abc
25	DKC66-80	6633	1217	618.7	2822.9	74.2	defg
	CK mean	8633	1946	838.0	3805.7	100.0	
	Test mean	6268	2023	1037.9	4154.7		
	CV%	34	28	72.4	38.6		
	LSD 0.05	3476	933	1225.4	2595.4		

Note: means with a common letter are not significantly different at 5% level.

2. Testcrosses of Lines from DK Populations:

In 2005 and 2006, about 25 testcrosses of lines from DK888:N11 and DKXL370:N11a20 were evaluated for stress tolerance and performance at three locations in the Texas High Plains. These lines are at F₁₀ to F₁₂ generations with little segregation.

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. The best crosses include LH200 x DK888:N11)F2S2-5-B-1-1-1-1-2-2, CML32xB104)F7-4-B-B-1-2-1 x DK888:N11)F2S2-5-B-1-1-1-1-2-1, DK888:N11)F2S2-7-B-2-B-1-2 x LH200, DK888:N11)F3S4-12A-1-2-1 x LH200, DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1 x B110, DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1 x B110 (Tables 6 to 8).

We are increasing seed of these inbred lines in our winter nursery for public release. These lines can be useful for making medium-late hybrids with high potential for silage production.

Table 6. Yield and days to pollen shed of GEM-DK line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB), TX under well watered (WW) and drought stressed conditions (DRT) in 2006.

ENO	Entry	Days to pollen shed		Yield (bu/a)					
		ET-WW	LB-DRT	ET-WW	HF-WW	HF-DRT	LB-DRT	Mean	% CK
1	B110 x DK888:N11)F2S2-5-B-1-1-1-1-2-2	73	71	198	131	35	65	107	93
2	LH200 x DK888:N11)F2S2-5-B-1-1-1-1-2-2	73	71	235	143	49	63	122	106
3	(DK888:N11)F2S2-5-B-1-1-2 x B110	73	72	183	114	41	62	100	86
4	B113 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	72	70	168	97	25	62	88	76
5	DK888:N11)F2S2-5-B-1-1-1-1-1-1 x S1xB76)F9-2-1-B-1	73	73	188	92	30	46	89	77
6	CML273xA632)F7-1a-2-B-1-1 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	73	73	202	100	29	75	102	88
7	CML32xB104)F7-4-B-B-1-2-1 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	73	70	221	117	22	84	111	96
8	D580MBcorn-1A-1-1-1 x DK888:N11)F2S2-5-B-1-1-1-1-1-1	70	69	215	131	38	62	111	96
9	DK888:N11)F2S2-7-B-2-B-1-1-1 x B110	75	74	206	98	25	50	95	82
10	DK888:N11)F2S2-7-B-2-B-1-2 x LH200	75	75	203	133	52	69	114	99
11	DK888:N11)F3S4-4-1-1-1-1 x B110	73	74	196	116	39	78	107	93
12	B110 x DK888:N11)F3S4-12A-1-1-1	74	74	201	126	37	58	105	91
13	DK888:N11)F3S4-12A-1-2-1 x LH200	73	74	229	125	53	47	114	98
14	DK888:N11)F3S4-12C-3-1-1 x B105xCML274)F7-3-1-1-B-B	79	77	236	99	33	55	106	91
15	DK888:N11a08f-1-B-B-1-1 x LH200 (S)	73	73	192	111	29	59	98	85
16	DK888:N11a08f-1-B-B-1-1-2 x AR16021:S08a01)F7-1-2-B-1-B	73	71	144	106	47	59	89	77
17	DK888:N11a08f-1-B-B-1-1-2 x B110	72	74	127	112	62	52	88	76
18	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1 x B110	72	70	235	110	32	70	112	97
19	DKXL370:N11a20-76-2-B-B-1-1-2 x B110	72	72	169	112	35	43	90	77
20	DKXL370:N11a20-199-1-B-B-2-B-1 x B113	73	69	186	74	26	58	86	74
21	DKXL370:N11a20-199-1-B-B-2-B-1 x S1xB76)F9-2-1-B-1	73	73	159	105	27	40	83	71
22	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1 x LH200 (S)	73	72	221	115	9	51	99	85
23	DKXL370:N11a20-76-2-B-B-1-1 x LH200 (S)	70	69	162	119	32	69	96	83
24	DKXL370:N11a20-76-2-B-B-1-1-2 x S1C2B73-1-1-1-1	72	68	158	103	32	55	87	75
25	FS8(A)S:S09-309-1-B-B-1-2-1 x DK888:N11)F2S2-5-B-1-1-1-1-1-1	70	68	148	114	55	70	97	84
26	P34A15	70	68	191	140	45	73	112	97
27	P33M54	73	72	239	142	18	76	119	103

28	DKC66-80	74	75	228	149	23	83	121	104
29	Garst 8288	73	74	263	126	37	44	117	101
	CK mean	73	72	230	133	31	69	116	100
	Test mean of 29 entries	73	72	197	116	35	61	102	88
	CV%	1	2	12	13	33	20		
	LSD 0.05	2	3	46	25	23	25		

Table 7. Stalk lodging, plant height, ear height, and stay green rating of GEM-DK line testcrosses at Halfway (HF) and Lubbock (LB), TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Entry	Plant ht.									
		Stalk lodging (%)			(cm)		Ear ht. (cm)		Stay green rating		
		HF- WW	HF- DRT	LB- DRT	HF- WW	LB- DRT	HF- WW	LB- DRT	HF- WW	HF- DRT	LB- DRT
1	B110 x DK888:N11)F2S2-5-B-1-1-1-1-2-2	4.0	11	2	237	195	115	88	4.5	3.0	3.5
2	LH200 x DK888:N11)F2S2-5-B-1-1-1-1-2-2	3.4	10	7	261	192	113	82	3.9	2.8	2.5
3	(DK888:N11)F2S2-5-B-1-1-2 x B110	8.3	1	2	244	195	98	92	4.3	3.5	3.0
4	B113 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	0.0	8	0	236	173	93	66	4.3	2.8	3.0
5	DK888:N11)F2S2-5-B-1-1-1-1-1 x S1xB76)F9-2-1-B-1	3.3	15	1	234	171	96	84	3.8	3.0	2.8
6	CML273xA632)F7-1a-2-B-1-1 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	4.2	6	0	248	168	109	87	4.0	2.8	2.8
7	CML32xB104)F7-4-B-B-1-2-1 x DK888:N11)F2S2-5-B-1-1-1-1-2-1	0.8	5	1	241	179	99	78	4.3	3.5	3.0
8	D580MBcorn-1A-1-1-1 x DK888:N11)F2S2-5-B-1-1-1-1-1	2.4	8	0	233	161	101	58	4.0	3.0	2.5
9	DK888:N11)F2S2-7-B-2-B-1-1-1 x B110	11.7	16	1	274	192	117	95	4.3	2.8	3.0
10	DK888:N11)F2S2-7-B-2-B-1-2 x LH200	6.4	4	2	267	206	110	89	3.5	3.0	3.0
11	DK888:N11)F3S4-4-1-1-1-1 x B110	3.9	9	2	246	192	117	94	3.3	3.5	3.0
12	B110 x DK888:N11)F3S4-12A-1-1-1	2.4	7	5	277	194	117	91	4.3	3.0	3.3
13	DK888:N11)F3S4-12A-1-2-1 x LH200	2.5	8	1	272	187	100	85	3.8	3.0	2.5
14	DK888:N11)F3S4-12C-3-1-1 x B105xCML274)F7-3-1-1-B-B	2.5	1	0	268	195	118	90	3.8	2.8	2.5
15	DK888:N11a08f-1-B-B-1-1 x LH200 (S)	1.7	2	0	246	185	92	81	3.4	3.0	2.5
16	DK888:N11a08f-1-B-B-1-1-2 x AR16021:S08a01)F7-1-2-B-1-B	3.0	7	1	224	161	92	75	4.3	3.0	2.8
17	DK888:N11a08f-1-B-B-1-1-2 x B110	3.3	12	1	259	187	125	79	4.3	2.8	2.8
18	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1-1 x B110	2.7	8	4	257	192	99	84	3.9	2.8	2.8
19	DKXL370:N11a20-76-2-B-B-1-1-2 x B110	7.2	8	1	251	183	101	82	4.3	2.5	3.0
20	DKXL370:N11a20-199-1-B-B-2-B-1 x B113	0.8	14	3	277	188	118	86	3.3	3.3	2.8
21	DKXL370:N11a20-199-1-B-B-2-B-1 x S1xB76)F9-2-1-B-1	4.7	9	2	277	174	109	89	3.3	2.8	2.5
22	DKXL370:N11a20-2-1-B-B-B-1-2-1-1-1 x LH200 (S)	3.2	9	0	267	200	100	81	3.3	2.5	2.5

23	DKXL370:N11a20-76-2-B-B-1-1 x LH200 (S)	2.4	7	2	232	164	85	72	4.3	2.8	3.0
24	DKXL370:N11a20-76-2-B-B-1-1-2 x S1C2B73-1-1-1-1	0.0	7	3	244	193	87	80	4.0	3.0	3.5
25	FS8(A)S:S09-309-1-B-B-1-2-1 x DK888:N11)F2S2-5-B-1-1-1-1-1-1	8.8	11	1	221	175	88	75	5.0	3.5	3.0
26	P34A15	0.8	8	2	252	182	90	75	4.3	3.0	3.5
27	P33M54	0.0	3	0	249	176	92	67	4.0	3.5	3.5
28	DKC66-80	0.0	5	0	253	199	106	82	4.0	2.8	2.8
29	Garst 8288	0.0	2	3	267	205	89	73	3.0	3.5	3.0
	CK mean	0.4	5	1	259	190	89	74	3.6	3.2	3.2
	Test mean	3.3	8	2	252	185	102	81	3.9	3.0	2.9
	CV%	74.8	66	103	4	6	11	12	7.4	11.5	13.2
	LSD 0.05	4.1	ns	3	17	23	18	20	0.5	ns	ns

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 8. Stay green rating, husk coverage, corn earworm damage (CEW), molded kernels (mold) and yield of GEM-DK line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB), TX under well-watered (WW) and drought conditions (DRT) in 2005.

ENO	Entry	Stay green rating		Husk	CEW	Mold	Yield (bu/a)					
		HF- WW	LB- WW		(cm)	(%)	ET- WW	HF- WWI	LB- WWI	LB- DRT	Mean	% CK
1	(DK888:N11)F2S2-5-B-1-1-1 x B110	4.3	2.8	3.0	6.7	7.5	140	145	190	46	130	90
2	(DK888:N11)F2S2-5-B-1-1-1 x LH200	4.8	2.0	2.5	6.9	4.5	177	120	189	69	139	96
3	(DK888:N11)F2S2-5-B-1-1-2 x B110	4.0	2.5	3.3	6.2	3.5	195	146	185	51	144	99
4	B110 x (DK888:N11)F2S2-7-B-1	3.3	2.5	3.3	5.1	3.5	167	146	159	54	131	91
5	B110 x (DK888:N11)F2S2-7-B-2	4.0	2.0	3.8	5.7	6.5	179	135	173	66	138	95
6	(DK888:N11)F3S4-4-1-1 x B110	4.5	2.0	3.5	6.2	4.5	169	157	185	66	144	100
7	(DK888:N11)F3S4-4-1-1 x LH247	4.5	2.5	3.0	5.6	4.0	167	133	157	61	129	89
8	(DKXL370:N11a20-2-1-B-B-B-1-1 x B110	4.0	2.5	2.8	7.9	8.0	193	145	179	57	143	99
9	B110 x (DKXL370:N11a20-2-1-B-B-B-1-2-1-1	4.0	2.0	3.0	6.5	7.0	189	136	177	61	141	97
10	(DKB844:S1601-517-1-B-B-B-1 x Tx205	3.0	1.8	3.8	5.1	5.0	178	113	207	59	139	96
18	P34K77	3.8	2.8	3.0	5.7	4.5	166	135	156	57	129	89
19	P31B13	4.0	1.8	3.5	4.4	3.5	176	181	197	92	162	112
20	DKC66-80	3.5	1.8	4.0	5.9	3.5	175	150	171	82	144	100
	CK mean	3.8	2.1	3.5	5.3	3.8	172	155	175	77	145	100
	Test mean of 20 entries	4.1	2.3	3.3	6.2	5.3	165	135	175	58	133	92

CV%	10.0	11.7	15.4	11.6	29.1	9	11	7	20
LSD 0.05	0.8	0.6	ns	1.5	ns	29	31	27	24

Note: Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green. Husk coverage was rated on a 1 to 5 scale with 1 = loose husk and 5 = ears fully and tightly covered by husks.

3. Testcrosses of Lines from Brazilian Populations:

In 2006, four check hybrids and 15 testcrosses of the lines derived from Brazilian populations were grown in three Texas High Plains locations. Lines from BR52051:N04, BR51039:N15, and BR51501:N11a, and PE1:N16 are at F₁₄, F₈, F₆ and F₁₀ generations respectively. 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, yield comparable to the commercial check hybrids, have tall plants with good stay green trait, show intermediate corn earworm damage and grain mold (Tables 9 to 11).

In 2005, crosses of two BR52051:N04 lines with B110 and LH200 x PE1:N16)F3S4-1-1 were evaluated in four environments. Their performance was similar to 2006 (Tables 12 and 13). The 2005 data also indicated that these testcrosses had excellent early vigor, ears were fully covered, but not very tightly, by husks.

Currently, we are increasing seeds of one inbred line from BR52051:N04, and two from BR51039:N15, and four PE1:N16 in the winter nursery. These lines have good agronomic traits, produce high yielding hybrids, and may increase nutritional value due to their dark-yellow kernels. These lines could also be used for silage production. We plan to release one inbred line from each breeding cross.

Table 9. Yield and stay green rating of GEM-Brazil line testcrosses at Etter, Halfway and Lubbock, TX in 2006. Tests at Halfway and Etter were well watered and Lubbock test was drought stressed from V12 to R2 stages.

ENO	Hybrids	Yield (bu/a)				Stay green rating			
		Etter	Halfway	Lubbock	Mean	Halfway	Etter	Lubbock	Mean
1	(BR52051:N04)F8-1-1 x B110	227.8	111.6	32.2	123.9	3.8	2.0	2.8	2.8
2	B110 x BR52051:N04)F8-1-2-1-1-B	249.1	83.8	25.4	119.4	4.3	2.0	4.0	3.4
3	B110 x BR52051:N04)F8-1-B-B-1-B	211.7	88.5	19.4	106.5	3.5	2.0	4.0	3.2
4	CML32xB104)F7-2-1-b-2-1-2 x BR52051:N04)F8-1-B-B-1-B	179.0	82.9	28.4	96.7	3.0	2.0	3.0	2.7
5	FS8(A)S:S09-309-1-B-B-1-2-1 x BR52051:N04)F8-1-2-1-1-B	193.6	78.0	32.8	101.5	4.0	2.5	3.5	3.3
6	FS8B(S):S0316-1099-1-B-B-2-2-2-1-1-1 x BR52051:N04)F8-1-B-B-1-B	142.8	65.7	22.0	76.8	3.3	3.3	4.0	3.5
7	BR51501:N11a-1-2 x B110	193.9	84.2	20.1	99.4	4.0	2.3	4.0	3.4

8	BR51501:N11a-3-1 x B110	212.1	64.9	18.0	98.3	4.0	2.0	3.3	3.1
9	BR51501:N11a-4-1 x B110	183.6	78.2	24.9	95.6	4.3	1.8	4.0	3.3
10	BR51501:N11a-5-1 x B110	202.7	79.6	31.6	104.6	4.5	2.3	3.3	3.3
11	BR51501:N11a-2-1 x S1xB76)F9-2-1-B-1	161.0	49.6	35.8	82.2	3.3	2.5	3.0	2.9
12	B110 x PE1:N16)F3S4-2-1-3-1	198.7	73.3	22.9	98.3	3.5	2.0	3.0	2.8
13	BR51039:N15-B-B-B-2-1 x B110	170.3	63.8	22.7	85.6	4.3	2.0	3.3	3.2
14	LH200 (S) x PE1:N16)F3S4-1-1-1-1	220.6	92.3	21.2	111.4	3.3	2.0	2.5	2.6
15	LH200 (S) x PE1:N16)F3S4-2-1-3-1	214.8	103.9	19.6	112.8	3.0	2.3	3.0	2.8
16	P34A15	197.0	89.8	46.2	111.0	4.0	3.0	4.3	3.8
17	P33M54	221.5	82.2	29.6	111.1	4.0	3.0	2.5	3.2
18	DKC66-80	235.5	93.1	35.3	121.3	3.5	2.8	3.5	3.3
19	Garst 8288	173.3	120.1	26.2	106.5	3.0	2.8	3.5	3.1
	CK mean	206.8	96.3	34.3	112.5	3.6	2.9	3.4	3.3
	Test mean of 19 entries	199.4	83.4	27.1	103.3	3.7	2.3	3.4	3.1
	CV%	11.8	18.9	24.4		8.7	16.6	12.2	12.5
	LSD 0.05	48.1	33.0	13.9		0.6	0.8	0.9	0.8

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 10. Days to pollen shed, plant height, ear height, and stalk lodging of GEM-Brazil line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Hybrids	Days to pollen shed			Plant height (cm)		Ear height (cm)		Stalk lodging (%)	
		ET- WW	HF- WW	LB- DRT	HF- WW	LB-DRT	LB-DRT	HF- WW	ET- WW	HF- WW
1	(BR52051:N04)F8-1-1 x B110	74	76	74	267	186	94	125	2	5
2	B110 x BR52051:N04)F8-1-2-1-1-B	73	76	74	253	180	90	122	8	5
3	B110 x BR52051:N04)F8-1-B-B-1-B CML32xB104)F7-2-1-b-2-1-2 x	74	76	74	258	181	104	113	15	2
4	BR52051:N04)F8-1-B-B-1-B FS8(A)S:S09-309-1-B-B-1-2-1 x	73	76	74	234	176	85	106	4	0
5	BR52051:N04)F8-1-2-1-1-B FS8B(S):S0316-1099-1-B-B-2-2-2-1-1-1 x	73	75	74	260	187	82	111	10	7
6	BR52051:N04)F8-1-B-B-1-B	73	74	69	219	165	78	90	26	5
7	BR51501:N11a-1-2 x B110	74	76	76	246	172	93	118	11	3
8	BR51501:N11a-3-1 x B110	75	77	75	244	183	99	112	9	2
9	BR51501:N11a-4-1 x B110	77	79	75	256	187	97	120	3	6

10	BR51501:N11a-5-1 x B110	75	76	75	247	180	73	86	13	13
11	BR51501:N11a-2-1 x S1xB76)F9-2-1-B-1	75	78	77	245	175	87	112	25	6
12	B110 x PE1:N16)F3S4-2-1-3-1	77	79	76	289	193	93	136	4	6
13	BR51039:N15-B-B-B-2-1 x B110	75	79	75	248	185	79	117	15	9
14	LH200 (S) x PE1:N16)F3S4-1-1-1-1	77	80	76	279	192	90	137	14	16
15	LH200 (S) x PE1:N16)F3S4-2-1-3-1	76	79	78	280	192	101	118	0	3
16	P34A15	69	73	67	226	177	69	73	5	3
17	P33M54	73	76	73	224	174	65	75	4	5
18	DKC66-80	73	78	75	243	180	85	95	5	0
19	Garst 8288	70	73	69	268	191	81	105	13	5
	CK mean	71	75	71	240	180	75	87	7	3
	Test mean of 19 entries	74	77	74	252	182	86	109	10	5
	CV%	1	2	2	5	5	10	6	42	91
	LSD 0.05	2	3	2	27	ns	17	14	9	ns

Table 11. CEW damage to ears (CEW), ear length, percent of molded grains, and smut of GEM-Brazil line testcrosses Lubbock, TX in 2006.

ENO	Hybrids	CEW (cm)	EL (cm)	RATIO (%)	Molded kernels (%)	Smut (%)
1	(BR52051:N04)F8-1-1 x B110	7.0	17.5	40.0	8.0	3.1
2	B110 x BR52051:N04)F8-1-2-1-1-B	7.5	17.5	43.0	14.0	0.0
3	B110 x BR52051:N04)F8-1-B-B-1-B CML32xB104)F7-2-1-b-2-1-2 x	10.0	16.0	62.7	11.5	0.0
4	BR52051:N04)F8-1-B-B-1-B FS8(A)S:S09-309-1-B-B-1-2-1 x	5.5	19.0	28.9	8.0	3.4
5	BR52051:N04)F8-1-2-1-1-B FS8B(S):S0316-1099-1-B-B-2-2-2-1-1-1 x	6.0	20.5	29.4	5.0	2.4
6	BR52051:N04)F8-1-B-B-1-B	8.0	16.0	50.2	10.5	3.1
7	BR51501:N11a-1-2 x B110	7.5	15.5	49.2	20.0	2.3
8	BR51501:N11a-3-1 x B110	7.0	18.0	38.9	12.5	1.6
9	BR51501:N11a-4-1 x B110	6.0	17.5	34.5	9.0	9.4
10	BR51501:N11a-5-1 x B110	6.0	18.0	33.3	10.5	9.4
11	BR51501:N11a-2-1 x S1xB76)F9-2-1-B-1	7.0	17.0	41.2	9.0	4.8
12	B110 x PE1:N16)F3S4-2-1-3-1	10.0	15.5	64.6	17.5	4.8

13	BR51039:N15-B-B-B-2-1 x B110	7.5	17.5	43.0	9.0	0.0
14	LH200 (S) x PE1:N16)F3S4-1-1-1-1	10.0	16.5	61.1	14.0	0.0
15	LH200 (S) x PE1:N16)F3S4-2-1-3-1	10.5	17.5	59.2	22.5	1.7
16	P34A15	8.5	14.5	59.0	8.0	0.0
17	P33M54	8.0	17.5	45.4	15.0	2.4
18	DKC66-80	7.0	17.5	40.0	11.5	0.0
19	Garst 8288	7.0	14.5	48.1	12.5	0.0
	CK mean	7.6	16.0	48.2	11.8	0.6
	Test mean of 19 entries	7.7	17.0	45.9	12.0	2.6
	CV%	17.1	7.8	17.4	41.0	93.4
	LSD 0.05	2.9	2.8	16.7	ns	4.9

Note: Ratio = CEW/EL *100.

Table 12 Yield, stay green rating, earworm damage (CEW), ear length (EL), molded kernels (mold), and husk coverage of GEM-Brazil line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB), TX under well-watered and drought (DRT) conditions in 2005.

ENO	Entry	Yield (bu/a)						Stay green	CEW (cm)	EL (cm)	RATIO	Mold (%)		Husk
		ET- WW	HF- WW	HF- DRT	LB- WWI	Mean	% CK					LB- WW	LB- WW	
	(BR52051:N04)F8-1-1 x													
1	B110	167	146	48	184	136	94	2.0	6.3	24	26	5.0	3.5	
	(BR52051:N04)F8-1-2 x													
2	B110	188	174	42	166	142	98	2.0	8.6	24	36	4.5	3.8	
10	LH200 x (PE1:N16)F3S4-1-1	182	144	37	181	136	93	2.3	6.9	22	32	5.5	3.5	
18	P34K77	158	172	47	173	138	94	2.7	5.0	19	26	3.0	3.3	
19	P31B13	185	181	59	211	159	109	2.0	4.9	19	26	3.5	3.5	
20	DKC66-80	208	182	51	170	153	105	2.0	5.7	22	26	4.0	4.0	
	CK Mean	167	178	53	185	146	100	2.2	5.2	20	26	3.5	3.6	
	Test mean of 20 entries	169	156	51	167	136	93	2.4	6.9	21	33	5.3	2.7	
	CV%	9	10	16	6			13.8	13.8	5	14	34.2	9.6	
	LSD 0.05	32	30	17	21			0.5	2.0	2	9	3.8	0.5	

Note: Stay green rating was on a 1 to 5 scale on with 1 = 100% green and 5 = 0% green; husk coverage was rated on a 1 to 5 scale with 1 loose and 5 very tight and fully covered.

Table 13. Early vigor, days to pollen shed, plant height, and smut incidence of GEM-Brazil line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB), TX under well-watered and drought (DRT) conditions in 2005.

ENO	Entry	Vigor		Days to pollen shed			Smut (%)		STL (%)	Plant height (cm)				
		ET- WW	ET- WW	HF- WW	HF- DRT	LB- WW	Mean	ET- WW	HF- WW	HF- DRT	HF- WW	HF- DRT	LB- WW	Mean
1	(BR52051:N04)F8-1-1 x B110	3.8	75	74	68	72	72	0	2	42	253	210	242	235
2	(BR52051:N04)F8-1-2 x B110	3.3	77	74	72	72	74	0	1	45	251	220	259	243
10	LH200 x (PE1:N16)F3S4-1-1	3.5	80	76	76	75	77	4	1	25	278	241	259	259
18	P34K77	3.5	72	69	67	68	69	2	0	20	243	195	242	227
19	P31B13	3.5	77	73	70	73	73	2	0	20	241	207	230	226
20	DKC66-80	2.8	77	73	73	71	73	0	0	18	230	226	240	232
	CK Mean	3.5	73	71	70	71	71	3	0	19	238	209	237	228
	Test mean of 20 entries	3.5	73	71	68	70	71	2	1	36	238	204	236	226
	CV%	5.8	1	2	2	1		76	143	27	3	5	4	
	LSD 0.05	0.4	1	3	2	2		4	3	20	15	21	19	

Early vigor was rated on a 1 to 5 scale with 1 being weak and 5 being strong.

4. Testcrosses of lines from AR03056:N0902 and other Argentina Populations:

In 2006, 14 testcrosses of the lines derived from AR03056:N0902, AR16021:S08a01, and AR16035:S02 at Etter, Halfway, and Lubbock under well watered and drought-stressed conditions in 2005 and 2006. The lines from AR03056:N0902 perse has nice plants, excellent anthesis-silking synchronization, upright leaves, yellow semi-dent kernels. The testcrosses of these lines (especially the AR03056:N0902 line) 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. Most crosses had low common smut incidence but some crosses had 30-50% plants with smut (Tables 14-18).

Lines of AR03056:N0902, AR16021:S08a01, and AR16035:S02 have been advanced to F16, F13, and F13 generations, respectively. We are increasing the seeds of these inbred lines in winter nursery, two sister lines for each breeding crosses.

Table 14. Grain yield (bu/a) of GEM-AR3 line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Entry	Yield (bu/a)					Yield (bu/a)				
		ET- WW	HF- WW	LB- WW	Mean	%	HF- DRT	HF- DRT	LB- DRT	Mean	%

	WW	WW	WW		CK	DRT	Post	DRT		CK	
A633xFR2128)F7-2-B-B x AR03056:N0902)F9-											
1	1-1-1-B-B	212.5	126.9	126.9	155.4	106.8	37.9	60.9	54.0	50.9	107.9
2	AR03056:N0902)F9-1-1-1-B x B104	222.9	77.3	77.3	125.8	86.5	32.5	84.9	22.1	46.5	98.5
3	AR03056:N0902)F6xB113-B-B-1-1 x B110	182.4	96.9	96.9	125.4	86.2	28.2	73.4	19.3	40.3	85.4
4	AR03056:N0902)F9-1-1-1-B x B110	211.1	109.5	109.5	143.4	98.5	47.4	86.8	27.6	53.9	114.3
5	AR03056:N0902)F9-1-2-B x B110	231.0	108.4	108.4	149.3	102.6	54.0	111.3	27.8	64.4	136.4
6	AR03056:N0902)F9-1-3-B x B110	165.5	99.6	99.6	121.6	83.6	31.8	109.1	26.2	55.7	118.0
7	AR03056:N0902)F9-1-B1-B-B x B110	214.3	76.6	76.6	122.5	84.2	46.2	94.6	26.8	55.9	118.4
8	AR03056:N0902)F9-1-1-1-B x B113	142.4	86.1	86.1	104.9	72.1	33.3	66.6	35.7	45.2	95.7
9	AR03056:N0902)F9-1-1-1-B x LH198 (S)	187.3	123.5	123.5	144.8	99.5	43.8	79.7	33.0	52.1	110.5
10	AR03056:N0902)F9-1-1-1-B x LH200 (S)	222.4	87.5	87.5	132.4	91.0	53.0	86.3	29.6	56.3	119.3
AR03056:N0902)F9-1-2-B x											
11	AR16021:S08a01)F7-1-1-B	148.4	64.6	64.6	92.5	63.6	33.2	48.3	23.6	35.1	74.3
C3S1B73-13-4-1-1 x AR03056:N0902)F9-1-1-B-											
12	1-B	198.3	75.2	75.2	116.2	79.9	60.1	55.5	33.1	49.6	105.1
C3S1B73-3-3-1-1-1 x AR03056:N0902)F9-1-1-1-											
13	B-B	195.2	72.4	72.4	113.4	77.9	43.5	83.2	26.1	50.9	107.9
14	LH247 (S) x AR03056:N0902)F9-1-1-1-B	188.7	107.8	107.8	134.8	92.6	22.3	57.0	11.9	30.4	64.4
15	P34A15	205.8	127.5	127.5	153.6	105.6	45.3	79.1	31.3	51.9	110.0
16	P33M54	231.5	77.5	77.5	128.8	88.6	26.6	76.4	15.3	39.4	83.5
17	DKC66-80	242.4	103.5	103.5	149.8	102.9	63.4	83.6	35.9	61.0	129.2
18	Garst 8288	221.2	113.8	113.8	149.6	102.8	21.1	65.3	23.0	36.5	77.3
	CK Mean	225.2	105.6	105.6	145.5	100.0	39.1	76.1	26.4	47.2	100.0
	Test mean of 18 entries	201.3	96.4	96.4	131.4	90.3	40.2	77.9	27.9	48.7	103.1
	CV%	9.4	18.6	18.6			28.0	17.9	23.4		
	LSD 0.05	36.7	37.6	37.6			23.6	29.3	13.7		

Table 15. Days to pollen shedding (DTP), stay green rating, and grain yield of GEM-AR3 line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2005.

Entry	DTP		Stay green, 8/10	Stay green, 9/9	Yield (bu/a)				
	ET-	HF-	HF-DRT	HF-	ET-WW	HF-WW	HF-DRT	Mean	% CK

	WW	WW	WW							
B110 x (AR03056:N0902)F9-1-1	73	67	2.7	4.5	194.8	134.1	71.4	133.4	95.9	
B110 x (AR03056:N0902)F9-1-2	73	68	2.8	3.8	197.6	147.8	61.4	135.6	97.5	
B113 x (AR03056:N0902)F9-1-1	70	68	3.2	3.8	144.5	97.3	56.2	99.3	71.4	
(AR03056:N0902)F9-1-2 x LH198	73	67	3.0	3.5	157.2	132.8	104.6	131.6	94.6	
(AR03056:N0902)F9-1-2 x LH200	74	69	2.8	3.5	186.1	160.5	68.6	138.4	99.5	
LH200 x (AR03056:N0902)F9-1-1	73				173.9			173.9	125.0	
LH247 x (AR03056:N0902)F9-1-1	73	68	3.5	5.0	164.3	113.6	46.9	108.3	77.8	
LH247 x (AR03056:N0902)F9-1-2	73	67	3.8	4.5	160.0	114.5	51.4	108.6	78.1	
(AR03056:N0902)F9-1-2 x (AR16021:S08a01)F7-1-2	73	69	3.0	5.0	145.0	117.8	52.7	105.1	75.6	
P34K77	70	67	4.3	4.5	156.8	146.2	51.6	118.2	85.0	
Garst 8285	76	70	2.3	3.0	195.8	166.5	70.9	144.4	103.8	
P31B13	77	72	2.3	4.5	206.0	160.5	113.6	160.0	115.0	
DKC66-80	77	71	2.5	3.5	186.1	143.7	71.2	133.7	96.1	
CK Mean	75	70	2.8	3.9	186.2	154.2	76.8	139.1	100.0	
Mean of 32 entries	73	68	3.1	4.2	182.6	139.9	67.3	129.9	93.4	
CV%	1	2	13.2	11.5	8.3	11.9	21.0			
LSD).05	2	3	0.8	1.0	30.2	34.0	28.9			

Note: Kernel color is for the female lines (GEM lines). Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 16. Days to pollen shedding (DTP), plant height, ear height of GEM-AR3 line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Entry	DTP			Plant height (cm)			Ear height (cm)					
		HF- WW	HF- WW	LB- WW	HF- DRT	HF- POst	LB- DRT	HF- WW	LB- WW	HF- DRT	HF- Post	LB- DRT	
	A633xFR2128)F7-2-B-B x AR03056:N0902)F9-1-												
1	1-1-B-B	72	217	217	192	200	171	78	78	79	67	74	
2	AR03056:N0902)F9-1-1-1-B x B104	73	245	245	184	207	149	71	71	83	76	82	
3	AR03056:N0902)F6xB113-B-B-1-1 x B110	74	211	211	188	198	163	77	77	80	75	79	
4	AR03056:N0902)F9-1-1-1-B x B110	74	203	203	195	193	163	82	82	96	83	90	
5	AR03056:N0902)F9-1-2-B x B110	76	248	248	188	199	154	110	110	87	86	85	

6	AR03056:N0902)F9-1-3-B x B110	72	214	214	181	193	165	88	88	79	84	88
7	AR03056:N0902)F9-1-B1-B-B x B110	75	210	210	178	202	161	93	93	87	97	82
8	AR03056:N0902)F9-1-1-1-B x B113	73	222	222	183	198	149	86	86	79	81	76
9	AR03056:N0902)F9-1-1-1-B x LH198 (S)	73	217	217	190	197	162	85	85	83	72	79
10	AR03056:N0902)F9-1-1-1-B x LH200 (S)	75	232	232	199	215	169	93	93	77	84	77
11	AR03056:N0902)F9-1-2-B x AR16021:S08a01)F7-1-1-B	74	195	195	178	194	148	84	84	79	70	66
12	C3S1B73-13-4-1-1 x AR03056:N0902)F9-1-1-B-1-B	75	215	215	180	193	149	99	99	84	87	81
13	C3S1B73-3-3-1-1-1 x AR03056:N0902)F9-1-1-1-B-B	76	224	224	198	217	168	96	96	91	88	89
14	LH247 (S) x AR03056:N0902)F9-1-1-1-B	73	217	217	181	202	157	82	82	68	71	66
15	P34A15	74	237	237	220	227	176	72	72	78	67	71
16	P33M54	75	221	221	206	239	158	83	83	69	80	70
17	DKC66-80	77	242	242	233	232	184	101	101	95	82	91
18	Garst 8288	74	280	280	220	244	194	109	109	75	83	82
	CK Mean	75	245	245	220	235	178	91	91	79	78	79
	Test mean of 18 entries	74	225	225	194	208	163	88	88	82	79	79
	CV%	2	8	8	4	3	4	11	11	8	8	9
	LSD 0.05	2.5	39	39	17	12	15	20	20	13	13	15

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 17. Smut, molded kernels, corn earworm feeding damage to ears (CEW), and ear length of GEM-AR3 line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006

ENO	Entry	Smut (%)				Mean	Mold (%)	CEW (cm)	EL (cm)	RATIO (%)
		HF-Post	LB-WW	HF-DRT	HF-WW		LB-DRT	LB-DRT	LB-DRT	LB-DRT
	A633xFR2128)F7-2-B-B x AR03056:N0902)F9-									
1	1-1-1-B-B	28.9	1.9	12.2	1.9	11.2	6.0	7.1	19.5	36.7
2	AR03056:N0902)F9-1-1-1-B x B104	2.0	7.8	0.0	7.8	4.4	12.5	7.0	18.0	38.9
3	AR03056:N0902)F6xB113-B-B-1-1 x B110	1.1	0.0	5.4	0.0	1.6	15.0	7.3	15.1	47.9
4	AR03056:N0902)F9-1-1-1-B x B110	1.8	1.6	5.5	1.6	2.6	15.0	8.4	18.4	46.0
5	AR03056:N0902)F9-1-2-B x B110	3.9	0.0	3.3	0.0	1.8	15.0	8.1	18.0	45.2

6	AR03056:N0902)F9-1-3-B x B110	3.9	10.1	3.8	10.1	7.0	16.5	7.1	17.8	39.8
7	AR03056:N0902)F9-1-B1-B-B x B110	6.3	0.0	1.7	0.0	2.0	20.0	8.1	16.3	50.0
8	AR03056:N0902)F9-1-1-1-B x B113	7.5	0.9	17.5	0.9	6.7	8.0	6.5	15.6	41.6
9	AR03056:N0902)F9-1-1-1-B x LH198 (S)	7.9	0.8	0.0	0.8	2.4	10.0	6.4	16.1	39.4
10	AR03056:N0902)F9-1-1-1-B x LH200 (S)	6.3	1.6	0.9	1.6	2.6	12.5	9.1	18.5	49.3
11	AR03056:N0902)F9-1-2-B x AR16021:S08a01)F7-1-1-B	49.6	4.2	36.5	4.2	23.6	14.0	7.9	20.0	39.6
12	C3S1B73-13-4-1-1 x AR03056:N0902)F9-1-1- B-1-B	24.6	7.0	10.9	7.0	12.4	6.0	6.4	18.1	35.2
13	C3S1B73-3-3-1-1-1 x AR03056:N0902)F9-1-1- 1-B-B	18.0	8.9	11.0	8.9	11.7	15.0	6.4	15.5	41.2
14	LH247 (S) x AR03056:N0902)F9-1-1-1-B	5.4	2.7	14.3	2.7	6.3	15.0	7.9	17.3	45.8
15	P34A15	0.0	0.0	2.2	0.0	0.5	10.0	7.3	16.1	44.9
16	P33M54	7.4	2.4	19.2	2.4	7.8	25.0	9.3	16.8	55.5
17	DKC66-80	0.0	0.0	0.0	0.0	0.0	15.0	7.3	18.0	40.4
18	Garst 8288	1.4	1.0	1.0	1.0	1.1	32.5	9.0	17.0	53.2
	CK Mean	2.2	0.8	5.6	0.8	2.4	20.6	8.2	17.0	48.5
	Test mean of 18 entries	9.8	2.8	8.1	2.8	5.9	14.6	7.6	17.3	43.9
	CV%	80.4	ns	97.4	ns		55.9	15.4	8.8	15.2
	LSD 0.05	16.5		16.5		ns	ns	ns	ns	

Table 18. Stay green rating (SG) and stalk lodging of GEM-AR3 line testcrosses at Etter (ET), Halfway (HF), and Lubbock (LB) in TX under well-watered (WW) and drought conditions (DRT) in 2006.

ENO	Entry	Stay green rating				Early vigor	Stalk lodging (%)			
		ET-WW	HF-DRT	HF-Post	LB-DRT	LB-DRT	HF-Post	LB-WW	HF-DRT	HF-WW
1	A633xFR2128)F7-2-B-B x AR03056:N0902)F9-1-1-1-B-B	2.3	3.8	3.5	4.0	4.0	0.0	2.7	6.1	2.7
2	AR03056:N0902)F9-1-1-1-B x B104	2.0	3.0	2.0	3.3	3.8	2.0	1.7	9.0	1.7
3	AR03056:N0902)F6xB113-B-B-1-1 x B110	2.3	3.0	2.5	3.8	4.0	2.6	1.6	2.8	1.6
4	AR03056:N0902)F9-1-1-1-B x B110	2.8	3.0	3.0	3.5	4.0	2.6	2.4	5.6	2.4
5	AR03056:N0902)F9-1-2-B x B110	2.5	3.0	2.3	3.0	4.0	7.9	1.1	6.6	1.1
6	AR03056:N0902)F9-1-3-B x B110	3.0	3.0	2.5	3.3	3.8	3.9	3.8	9.9	3.8
7	AR03056:N0902)F9-1-B1-B-B x B110	3.5	3.0	2.5	2.8	3.5	5.6	9.4	6.9	9.4

8	AR03056:N0902)F9-1-1-1-B x B113	3.5	3.0	2.3	3.3	3.8	2.5	1.7	6.4	1.7
9	AR03056:N0902)F9-1-1-1-B x LH198 (S)	2.3	3.0	2.5	3.3	3.8	3.3	0.0	2.8	0.0
10	AR03056:N0902)F9-1-1-1-B x LH200 (S)	2.5	3.0	3.0	3.8	3.3	3.6	0.0	0.0	0.0
11	AR03056:N0902)F9-1-2-B x AR16021:S08a01)F7-1-1-B	3.8	3.0	2.3	3.0	3.8	3.7	2.5	2.0	2.5
12	C3S1B73-13-4-1-1 x AR03056:N0902)F9-1-1-B-1-B	4.0	3.8	4.3	3.8	4.0	22.3	4.5	12.2	4.5
13	C3S1B73-3-3-1-1-1 x AR03056:N0902)F9-1-1-1-B-B	3.3	2.5	2.8	3.5	4.3	7.0	0.0	7.5	0.0
14	LH247 (S) x AR03056:N0902)F9-1-1-1-B	3.0	3.0	2.0	4.0	3.8	3.6	0.0	1.0	0.0
15	P34A15	3.3	3.3	4.0	4.0	4.3	0.8	3.1	1.0	3.1
16	P33M54	2.8	3.3	3.0	3.3	3.5	8.3	6.5	8.6	6.5
17	DKC66-80	2.3	2.3	1.5	3.3	3.5	0.0	3.3	2.4	3.3
18	Garst 8288	2.8	3.0	2.5	2.8	3.3	4.9	0.0	0.0	0.0
	CK Mean	2.8	2.9	2.8	3.3	3.6	3.5	3.2	3.0	3.2
	Mean	2.9	3.0	2.7	3.4	3.8	4.7	2.5	5.0	2.5
	CV%	21.0	8.2	24.4	9.7	8.4	59.0	105.0	71.5	105.0
	LSD 0.05	ns	0.5	ns	0.7	ns	5.8	ns	7.6	ns

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

5. Testcrosses of AR01150:N04 and Other Argentina Populations (GEM-AR2):

Twenty-one testcrosses of the lines derived from AR01150:N04, AR16021:S08a01, AR16035:S02 and AR16035:N09 were evaluated at Etter and Halfway, TX in 2005 and 2006. Two lines have white kernels and cobs. The plots were well watered. The 2006 data at Halfway was poor and not reported.

The crosses of AR01150:N04-213-1-B-B-1-1-1, AR01150:N04-545-1-B-B-2-1-1, and AR01150:N04-617-1-B-B-B-1-1-1-1 with LH198 and B110 performed well in three environments. (Tables 19-20)

Table 19. Days to pollen, stay green rating, yield (bu/a) of GEM-AR2 line testcrosses at Etter, TX in 2006.

ENO	Hybrids	Kernel color	DTP	Stay green	Yield (bu/a)	% CK
1	AR01150:N04-046-1-B-B-1-1-1-1 x B110	w	71.5	3.0	196.3	83.7
3	AR01150:N04-046-1-B-B-1-3-1-1-1 x LH198 (S)	w	70.0	2.5	214.2	91.3
4	AR01150:N04-213-1-B-B-1-1-1 x B113	y	73.0	2.5	216.6	92.3
5	AR01150:N04-213-1-B-B-1-1-1 x LH198	y	74.0	2.5	252.7	107.8
8	AR01150:N04-213-1-B-B-1-1-1-3-1 x B110	y	73.0	3.0	236.1	100.7
9	AR01150:N04-213-1-B-B-2-1-1-1 x B110	y	73.0	3.0	216.4	92.3
10	AR01150:N04-545-1-B-B-2-1-1 x LH198	y	70.0	3.0	230.3	98.2

13	AR01150:N04-617-1-B-B-B-1-1-1-1 x LH198 (S)	y	70.0	2.5	238.2	101.6
16	AR16021:S08a01)F7-1-2-B-1-B x LH185 (N)	y	73.0	2.5	225.9	96.3
17	AR16035:S02-443-1-B-B-1-1-2-1 x LH185	y	70.0	2.0	197.0	84.0
18	AR16035:S02-443-1-B-B-1-2-1-1-1-1 x NC300	y	76.0	2.0	209.6	89.4
19	AR16035:S02-443-1-B-B-1-2-1-1 x B110	y	73.0	2.0	212.9	90.8
20	AR16035:S02-443-1-B-B-1-2-1-1-1-1 x C3A654-3-2-1-2-1	y	71.5	2.5	228.2	97.3
21	AR03056:N09-327-1-B-B-2-1 x B110	y	75.0	2.5	215.1	91.7
22	P34K77		70.0	3.0	204.3	87.1
23	P31B13		75.0	2.0	279.7	119.3
24	P33T17		71.5	4.0	241.9	103.2
25	DKC66-80		73.0	2.5	212.1	90.5
	CK mean		72.4	2.9	234.5	100.0
	Test mean		72.1	2.7	212.7	
	CV%		1.5		12.4	
	LSD 0.05		2.1		55.7	

Note: Kernel color is for GEM-AR2 lines. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 20. Plant height (PHT), ear height (EHT), stay green rating, smut incidence, and grain yield of GEM-AR2 line testcrosses at Etter and Halfway, TX in 2005.

ENO	Hybrids	PHT	EHT	SG908	Smut	Smut	Yield (bu/a)			
		cm	cm	1 to 5	%	%	Etter	Halfway	Mean	% CK
1	AR01150:N04-046-1-B-B-1-1-1-1-1 x B110	227	111	5.0	3.3	5.0	171.5	153.4	162.5	97.2
4	AR01150:N04-213-1-B-B-1-1-1 x B113	222	91	4.3	1.7	0.0	144.2	151.6	147.9	88.5
5	AR01150:N04-213-1-B-B-1-1-1 x LH198	238	99	4.5	0.0	2.4	178.6	128.2	153.4	91.7
10	AR01150:N04-545-1-B-B-2-1-1 x LH198	226	107	3.5	0.0	1.5	157.5	144.4	151.0	90.3
19	AR16035:S02-443-1-B-B-1-2-1-1 x B110	251	120	3.5	6.1	2.5	180.6	146.3	163.5	97.8
17	AR16035:S02-443-1-B-B-1-1-2-1 x LH185	237	110	4.3	7.7	4.0	188.4	137.1	162.8	97.3
	AR16035:S02-443-1-B-B-1-2-1-1-1-1 x									
18	NC300	259	121	3.3	3.4	0.8	175.1	145.2	160.2	95.8
22	P34K77	231	102	3.8	1.7	0.0	139.9	150.0	144.9	86.7
23	P31B13	244	130	3.8	1.7	2.4	200.6	167.9	184.2	110.2
24	P33T17	236	103	4.0	0.0	0.0	186.8	158.0	172.4	103.1
25	DKC66-80	237	110	3.5	0.0	0.0	176.3	158.2	167.2	100.0

CK mean	237	111	3.8	0.8	0.6	175.9	158.5	167.2	100.0
Test mean of 25 entries	231	106	4.0	5.7	2.1	162.9	138.5	150.7	90.1
CV%	6	8	7.2	44.7	109.0	8.9	8.1		
LSD 0.05	28	17	0.6	5.3	4.8	30.5	23.5		

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

6. Testcrosses of Lines from Chilean Populations:

In 2005 and 2006, 17 testcrosses of lines from three breeding crosses, CH05015:N12, CH05015:N15, and CH05015:N1502 of Chilean population CH05015 (race Camelia) were evaluated for stress tolerance and performance at two Texas High Plains locations. These lines are at F₉ to F₁₂ generations with little segregation.

In 2006, CH05015:N12-147-1-B-B-3-1-1 x B110, CH05015:N15-82-1-B-B-1-1-2-1-2-1 x B110, CH05015:N15-87-1-B-B-2-1-1 x B110, CH05015:N15-87-1-B-B-2-1-1 x B113 yield higher than other crosses. In 2005, the top yielding test crosses include CH05015:N12-21-1-B-B-1 x LH198, CH05015:N12-32-1-B-B-SIB-B-2 x B113, CH05015:N15-82-1-B-B-1-1-2-1 x B110, B113 x (CH05015:N1502)-1-2-B. None of the crosses yield significantly higher than commercial checks (Tables 21 to 23).

This group of lines is the earliest GEM materials I have worked with so far. In addition, these lines have flint kernels with good texture. The original CH05015 breeding crosses looked very good, but they lack heat tolerance genes. The progenies of CH05015 breeding crosses are highly susceptible to heat stress. Many lines from these populations were dropped during the line development. The lines listed in Tables 1 to 3 have been selected for reduced leaf firing and tassel blasting under high temperatures. Short-season hybrids are increasingly used in the High Plains in order to reduce irrigation and avoid late season drought stress. We need to find good early testers to fully explore the potential of these lines.

Table 21. Yield and days to pollen shed of GEM-Chile line testcrosses at Etter (ET) and Halfway (HF), TX under well watered (WW) and post-tassel drought stressed conditions (Post) in 2006.

ENO	Entry	Days to pollen shed		Yield (bu/a)				
		ET-WW	HF-Post	ET-WW	HF-WW	HF-Post	Mean	% CK
1	CH05015:N12-33-1-B-B-SIB-1-3-1 x B110	72	67	178	141	67	129	85
2	CH05015:N12-36-1-B-B-SIB-1-1-1 x B110	70	66	151	121	75	116	76
3	CH05015:N12-33-1-B-B-SIB-1 x LH198	70	64	182	51	60	98	65
4	CH05015:N12-147-1-B-B-3-1-1 x B110	70	66	214	157	73	148	98
5	CH05015:N15-82-1-B-B-1-1-2-1-2-1 x B110	70	65	211	121	78	137	90
6	CH05015:N15-82-1-B-B-1-1-3-1 x B110	70	66	206	143	54	134	89

7	CH05015:N15-82-1-B-B-1-1-2-1-2-1 x LH198	70	66	188	123	70	127	84
8	B113 x CH05015:N15-82-1-B-B-1-1-1-1	68	65	172	50	54	92	61
9	B113 x CH05015:N15-82-1-B-B-1-1-2-1-2	70	65	178	135	79	131	86
10	CH05015:N15-87-1-B-B-2-1-1 x B110	70	67	208	153	60	140	93
11	CH05015:N15-87-1-B-B-2-1-1 x B113	72	66	205	150	62	139	92
12	CH05015:N15-166-1-B-B-4-1-1 x B110	73	66	180	138	59	126	83
13	CH05015:N15-166-1-B-B-4-1 x LH198	70	66	198	130	70	133	88
14	CH05015:N1502)-1-1-B-B x B110	72	65	181	136	57	125	82
15	B113 x (CH05015:N1502)-1-1-B	70	65	177	124	73	125	82
16	CH05015:N1502)-1-1-B x LH247	69	65	176	136	52	121	80
17	CH05015:N1502)-2 x GEMS-0002	70	65	170	128	54	117	78
18	P34A15	70	66	205	163	74	147	97
19	P33M54	73	67	235	163	57	152	100
20	DKC66-80	73	69	223	156	88	156	103
	CK mean	72	67	221	161	73	152	100
	Test mean	71	66	192	131	66	130	86
	CV%	1	1	10	13	14		
	LSD 0.05	2	2	42	35	20		

Table 22. Early vigor, plant height, ear height, stalk lodging, and stay green rating of GEM-Chile line testcrosses at Etter (ET) and Halfway (HF), TX under well-watered (WW) and post-tassel drought conditions (post) in 2006.

ENO	Entry	Early vigor	Plant height (cm)		Ear height (cm)		Stalk lodging (%)			Stay green rating		
		HF-WW	HF-WW	HF-Post	HF-WW	HF-Post	ET-WW	HF-WW	HF-Post	ET-WW	HF-WW	HF-Post
1	CH05015:N12-33-1-B-B-SIB-1-3-1 x B110	2.8	249	203	96	90	29	2	15	3.0	3.0	3.8
2	CH05015:N12-36-1-B-B-SIB-1-1-1 x B110	3.5	270	222	126	105	64	8	5	3.5	4.8	3.3
3	CH05015:N12-33-1-B-B-SIB-1 x LH198	3.5	243	204	101	83	38	2	30	3.0	3.0	4.3
4	CH05015:N12-147-1-B-B-3-1-1 x B110	3.5	255	203	104	81	16	4	5	2.7	3.0	3.3
5	CH05015:N15-82-1-B-B-1-1-2-1-2-1 x B110	2.8	285	221	108	84	14	1	3	2.8	3.0	3.5
6	CH05015:N15-82-1-B-B-1-1-3-1 x B110	3.5	275	221	104	89	9	2	3	2.8	3.0	4.0
7	CH05015:N15-82-1-B-B-1-1-2-1-2-1 x LH198	3.0	290	241	102	85	7	6	7	2.8	3.3	2.5
8	B113 x CH05015:N15-82-1-B-B-1-1-1-1	3.3	261	214	95	73	12	3	4	3.5	4.0	3.0
9	B113 x CH05015:N15-82-1-B-B-1-1-2-1-2	3.0	255	225	92	90	7	3	3	2.5	4.0	3.8

10	CH05015:N15-87-1-B-B-2-1-1 x B110	3.3	262	230	107	86	14	3	7	2.5	4.0	3.0
11	CH05015:N15-87-1-B-B-2-1-1 x B113	3.8	253	218	97	78	13	2	2	2.8	3.3	4.0
12	CH05015:N15-166-1-B-B-4-1-1 x B110	3.8	286	227	132	96	36	7	10	2.3	3.0	2.8
13	CH05015:N15-166-1-B-B-4-1 x LH198	3.3	279	228	114	91	7	1	6	2.3	2.5	3.0
14	CH05015:N1502)F8-1-1-B-B x B110	3.0	304	240	133	102	10	1	5	2.5	4.3	3.5
15	B113 x (CH05015:N1502)-1-1-B	3.5	256	233	107	102	15	4	4	3.0	4.0	3.5
16	CH05015:N1502)-1-1-B x LH247	3.0	266	235	96	84	16	7	3	3.3	4.0	3.5
17	CH05015:N1502)-2 x GEMS-0002	3.5	241	206	98	99	33	3	10	4.3	5.0	4.5
18	P34A15	3.3	267	209	73	65	8	4	3	2.8	3.3	4.5
19	P33M54	3.0	276	227	106	79	6	2	3	2.8	3.3	4.3
20	DKC66-80	3.3	286	237	116	88	9	2	0	2.5	3.0	2.0
	CK mean	3.2	276	224	98	77	8	3	2	2.7	3.2	3.6
	Test mean	3.3	268	222	105	87	18	3	6	2.9	3.5	3.5
	CV%	8.1	4	5	10	7	72	66	56	12.8	5.5	16.9
	LSD 0.05	5.5	21	21	21	13	27	ns	7	0.8	0.4	1.2

Note: Early vigor was rated on a 1 to 5 scale at V8 stage with 1 being weak and 5 being strong. Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

Table 23. Early vigor, days to pollen shed, stalk lodging, smut incidence, and yield of GEM-Chile line testcrosses at Etter (ET) and Halfway (HF), TX under well-watered conditions in 2005.

ENO	Entry	Early vigor	Days to pollen shed		Stalk lodging	Smut	Yield (bu/a)			% CK
			ET	HF	(%)	(%)	ET	HF	Mean	
1	CH05015:N12-21-1-B-B-1 x LH198	3.5	73	71	0	0	206	162	184	106
2	CH05015:N12-32-1-B-B-SIB-B-1-B-2-1 x LH247	3.5	70	68	1	1	165	137	151	87
3	CH05015:N12-32-1-B-B-SIB-B-2 x B113	3.3	74	71	2	2	177	165	171	99
4	CH05015:N12-33-1-B-B-SIB-1 x LH198	3.8	73	74	0	0	162	154	158	91
5	CH05015:N12-92-1-B-B-1 x B110	3.0	73	72	0	7	135	131	133	77
6	CH05015:N12-147-1-B-B-1 x LH247	3.8	72	69	0	1	128	147	138	79
7	CH05015:N15-82-1-B-B-1-1-2-1 x B110	3.5	73	71	0	0	174	156	165	95
8	CH05015:N15-82-1-B-B-1-1-2-1 x LH198	3.8	73	73	0	0	162	144	153	88
9	CH05015:N15-82-1-B-B-1-1-3-1 x B110	3.8	73	71	0	1	164	127	145	84
10	CH05015:N1502)-1-1 x B110	3.5	73	71	1	25	138	160	149	86

11	CH05015:N1502)-1-2-B x B110	3.3	73	70	1	14	123	136	130	75
12	B113 x (CH05015:N1502)-1-1-B	3.3	72	70	0	3	148	152	150	87
13	B113 x (CH05015:N1502)F8-1-2-B	3.5	72	71	1	5	147	173	160	93
14	CH05015:N1502)-1-2 x LH185	3.0	70	69	0	30	95	141	118	68
15	CH05015:N1502)-1-2 x LH200	3.0	70	68	1	17	153	158	156	90
16	CH05015:N1502)-1-1-B x LH247	3.3	72	69	0	8	156	140	148	86
17	CH05015:N1502)-2 x GEMS-0002 (OSU 43)	3.3	70	68	0	0	164	147	156	90
18	P34K77	3.5	72	71	0	2	140	149	144	83
19	P31B13	3.5	77	75	0	3	189	204	196	113
20	DKC66-80	3.0	77	71	0	0	183	173	178	103
									0	0
	CK mean	3.3	75	72	0	1	171	175	173	100
	Test mean of 20 entries	3.4	73	70	0	6	156	153	154	89
	CV%	7.0	2	1	ns	99	12	11		
	LSD 0.05	0.5	2	2		12	37	35		

Note: Early vigor was rated on a 1 to 5 scale at V8 stage with 1 being weak and 5 being strong

7. Testcrosses of Lines from FS Populations:

In 2006, 20 testcrosses of lines from FS8A(T):N1801, FS8B(T):N11a and AR13026:N08C06 x (FS8A(T):N11a1-19) were tested at Etter and Halfway, TX. In 2005, 7 testcrosses were grown in four environments in Texas. These lines from FS8A(T):N1801 and FS8B(T):N11a have been advanced to F13 generation. These inbred lines have nice looking plants and good heat tolerance. The testcrosses from these lines have above average overall, but not top, performance. The best crosses include FS8A(T):N1801)-1-1-B x B110, FS8B(T):N11a)-1-4-1-1-1 x LH247, and (FS8A(T):N1801)-1 x B113 (Tables 24 and 25).

We are increasing seed of these inbred lines in our winter nursery for public release. These lines can be useful for making medium-late hybrids with high potential for silage production.

Table 24. Early vigor, days to pollen shed, plant height, ear height, stalk lodging, and yield of GEM-FS line testcrosses at Etter (ET) and Halfway (HF), TX under irrigated conditions in 2006.

ENO	Entry	Early vigor		Days to pollen shed		Plant ht (cm)		Ear ht. (cm)		Stalk lodging (%)		Yield (bu/a)	
		HF	ET	HF	HF	HF	ET	HF	ET	HF	Mean	CK	
1	FS8A(T):N1801)-1-1-B x B110	3.3	70	65	257	106	7	3	192	130	161	88	
2	FS8A(T):N1801)-1-1-B-B x B113	3.3	70	64	272	93	30	5	164	97	130	71	

3	FS8A(T):N1801)-1-1-B x B105	3.3	70	65	243	96	5	3	182	122	152	83
4	FS8A(T):N1801)-1-1-B x LH200	2.8	74	69	268	101	2	4	237	119	178	97
5	FS8A(T):N1801)-1-1-B x LH247	3.0	70	64	233	73	9	1	207	141	174	95
6	FS8A(T):N1801)-1-1-B-B x LH198	3.5	70	64	239	92	4	2	197	129	163	89
7	B110 x (FS8B(T):N11a)-1-3-1	2.8	73	67	300	121	14	3	183	94	138	76
8	FS8B(T):N11a)-1-4-1-1-1 x LH247	3.0	72	66	269	90	7	2	208	92	150	82
9	FS8B(T):N11a)-1-3-B x LH200	2.8	72	67	273	96	3	10	214	117	166	90
10	FS8B(T):N11a)-1-3-1-B-B x B113	3.3	73	67	301	118	16	3	202	85	144	78
11	(FS8B(S):S0301)-1-2 x B113	3.8	70	64	256	102	12	1	173	119	146	80
12	AR13026:N08C06x(FS8A(T):N11a1-19)-1-B-B-B-1-1-1 x B110	3.3	73	67	281	116	14	12	239	148	194	106
13	AR13026:N08C06x(FS8A(T):N11a1-19)-1-B-B-B-1 x B110	3.0	73	68	273	108	27	4	243	132	188	102
14	AR13026:N08C06x(FS8A(T):N11a1-19)-1-B-B-B-1-1 x LH200 (S)	3.0	73	67	252	93	7	0	200	123	161	88
15	AR13026:N08C06x(FS8A(T):N11a1-19)-1-B-B-B-1-3-1 x LH247 (S)	3.0	70	65	277	117	8	2	202	105	153	84
16	AR13026:N08C06x(FS8A(T):N11a1-19)-1-B-B-B-1-B-1 x B113	3.3	72	65	291	107	6	7	199	140	169	92
17	FS8(A)S:S09-309-1-B-B-2-1-1 x B113	3.3	70	65	264	105	20	4	185	132	158	86
18	FS8B(S):S0316-1099-1-B-B-2-2-2-1-1 x Tx204	3.0	73	66	266	103	20	4	199	130	165	90
19	FS8B(T):N11a)F8-1-4-1-1-1 x CML254xB105)F5-BMxCM105-B-B3-1-2	3.5	70	64	284	121	44	6	147	110	129	70
20	FS8B(T):N11a)F8-1-4-1-1-B x B105xCML274)F7-3-1-3-1-B	3.0	74	71	308	134	5	6	180	110	145	79
21	P34A15	3.0	70	66	246	76	4	7	246	116	181	99
22	P33M54	3.0	73	68	271	91	0	5	272	156	214	117
23	DKC66-80	2.8	74	69	261	115	0	0	192	149	170	93
24	Garst 8288	3.0	70	66	286	109	20	3	219	117	168	92
											0	0
	CK Mean	2.9	72	67	266	98	6	4	232	134	183	100
	Test mean of 24 entries	3.1	72	66	269	103	12	4	203	121	162	89
	CV%	9.0	2	1	3	10	53	102	10	15	12	
	LSD 0.05	ns	3	1	17	21	13	ns	43	38	40	

Note: Early vigor was rated at V8 stage on a 1 to 5 scale with 1 being weak and 5 being strong.

Table 25. Smut (%), stay green rating, husk coverage, corn earworm damage (CEW), ear length (EL), molded kernels, and yield of GEM-FS line testcrosses at Etter (ET), Halfway (HF) and Lubbock (LB), TX under well-watered (WW) and drought conditions (DRT) in 2005.

ENO	Entry	Smut (%)		Stay green		Husk	CEW	EL	Mold	Yield (bu/a)				Mean	% CK
		HF-	ET-	HF-	LB-	LB-	LB-	LB-	LB-	ET-	HF-	LB-	LB-		
		WW	WW	WW	WW	WW	WW	WW	WW	WW	WW	WW	DRT		
11	(FS8A(T):N1801)-1 x B110	1	1	4.5	2.3	4.3	7.3	21.4	6.0	151	102	196	45	123	85
12	(FS8A(T):N1801)-1 x B113	1	0	4.5	2.3	3.0	6.2	20.9	5.5	157	130	192	71	137	95
13	(FS8A(T):N1801)-1 x LH198	2	1	3.0	2.3	3.3	5.5	20.1	4.5	162	122	151	37	118	81
14	(FS8A(T):N1801)-2-1 x B113	2	3	4.8	2.3	3.5	6.1	19.8	8.0	116	134	167	41	114	79
15	B110 x (FS8B(T):N11a)-1-3-1	2	4	4.8	3.0	3.0	6.9	20.5	5.5	166	123	163	52	126	87
16	(FS8B(T):N11a)-1 x LH247	0	10	4.5	2.5	2.8	7.3	20.6	4.5	130	132	151	42	114	78
17	(FS8B(S):S0301)-1-2 x B113	0	0	5.0	2.3	3.0	7.2	21.4	6.0	154	117	156	48	119	82
18	P34K77	2	4	3.8	2.8	3.0	5.7	19.7	4.5	166	135	156	57	129	89
19	P31B13	2	3	4.0	1.8	3.5	4.4	19.5	3.5	176	181	197	92	162	112
20	DKC66-80	0	2	3.5	1.8	4.0	5.9	22.3	3.5	175	150	171	82	144	100
	CK mean	1	3	3.8	2.1	3.5	5.3	20.5	3.8	172	155	175	77	145	100
	Test mean of 20 entries	2	4	4.1	2.3	3.3	6.2	21.1	5.3	165	135	175	58	133	92
	CV%	122	ns	10.0	11.7	15.4	11.6	3.0	29.1	9	11	7	20		
	LSD 0.05	6		0.8	0.6	ns	1.5	1.3	ns	29	31	27	24		

Note: Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green. Husk coverage was rated on a 1 to 5 scale with 1 = loose husk and 5 = ears fully and tightly covered by husks.

8. Second-year field evaluation of 25 new GEM breeding crosses for drought tolerance, grain mold resistance, and CEW resistance.

In 2005, a set of 53 GEM breeding crosses were evaluated for yield, corn earworm damage, grain mold, and other agronomic traits. Based on the 2005 data, we chose the best 24 crosses and evaluated them under well watered and post-tassel drought conditions. Under each water treatment, the test used two-row plots and three replications. The well-watered plots had poor data and not included in this report.

When choosing a breeding cross, one should choose those with high yielding, good stay green rating (low value), low earworm damage, low grain mold. Table 1 shows the data from 2006 and 2005.

Table 26. Days to pollen shed (DTP), plant height (PHT), ear height (EHT), stay green rating, earworm damage (CEW), ear length, (EL), molded kernels (mold) and yield of GEM breeding crosses under post-tassel drought stress in 2006 and under well watered conditions in 2005 at Halfway, TX.

ENO06	PED	Year 2006								Year 2005						
		DTP	PHT (cm)	EHT (cm)	STL (%)	Smut (%)	Stay green	Yield (bu/a)	% CK	Yield (bu/a)	CEW (cm)	EL (cm)	Mold (%)	Kernel color	Cob color	Seed size
1	AR17026:N1012	65	224	81	5	23	2.3	59	79	161.9	6	19	6	yd	rc	x
2	B73 x Mo17	66	248	103	1	7	4.5	50	68	174.3	10	19	6	yd	rc	l-k v
3	BR105:N1641	69	244	107	2	21	2.3	49	66	158.6	6	18	10	yd	rc	s-k
4	BR105:N99d	72	259	103	9	2	2.0	51	69	172.7	5	22	4	ysd	rc	m-k l-k
5	BR106:S99a	71	261	116	1	7	2.3	24	32	147.8	6	21	4	yd	rc	vv
6	BR106:T33a20	70	268	104	0	7	2.5	46	62	161.5	10	25	8	yd	c	l-k v
7	BR106:T33a99a	70	242	100	3	4	2.8	38	51	189.8	5	18	4	yd	rc	v l-k
8	BR51403:N1617	68	237	89	6	6	2.5	44	59	150.5	7	19	7	yd	c	l-k
9	BR51721:N20	71	261	115	4	11	2.3	43	58	154.9	8	24	6	yd	wc	l-k
10	CHIS462:N2441	72	258	112	4	4	3.0	41	56	155.1	8	21	6	yd	rc	l-k
11	CUBA164:S99f	71	259	130	4	5	3.0	30	40	163.5	5	18	4	yd	rc	
12	DKXL370:S08d45	66	236	105	0	10	3.3	42	57	161.1	6	20	4	yd	rc	m-k
13	MDI022:N99d	73	263	139	4	2	3.0	25	34	155.1	5	19	3	yd	rc	m-k
14	NEI9004:S2817a	67	241	97	2	11	3.3	44	59	155.6	5	18	5	yd	rc	m-k
15	NEI9004:S2817c	67	243	114	7	15	3.0	27	36	171.3	6	20	4	yd	rc	l-k
16	SANM126:N1299b	69	267	114	4	4	2.8	42	56	170.6	7	20	5	yd	rc	l-k
17	UR01089:S24	66	234	97	11	4	2.8	50	67	157.2	8	19	7	ysd	rc	l-k
18	UR02005:N2011c	65	211	99	5	11	4.3	64	87	159.0	5	16	4	yd	rc	l-k
19	UR11002:N4011c	65	211	84	3	3	4.3	56	75	155.4	7	18	4	yd	rc	m-k
20	UR11002:S14	67	247	92	7	3	2.5	46	62	181.0	5	19	4	yd	rc	l-k v
21	UR11003:S17e45	67	243	93	4	5	3.3	45	60	161.3	6	21	5	yd	c	m-k
22	UR13010:N0602	66	232	87	4	3	3.8	67	90	160.4	9	19	6	yd	rc	l-k
23	UR13085:N0228	65	240	92	3	8	3.3	58	78	157.1	6	20	4	yd	rc	l-k v
24	UR13085:S99g	66	248	110	4	11	2.5	39	53	155.2	6	21	6	yd	rc	m-k m-k
25	P34K77	64	240	85	2	13	3.8	68	91	189.3	6	18	4	yd	wc	v
26	P31B13	72	242	103	0	9	2.3	89	119	229.4	6	20	4	yd	rc	l-k v

27	DKC66-80	70	242	91	5	1	2.0	67	90	185.2	4	23	3	yd	rc	l-k
	CK mean	69	241	93	2	8	2.7	74	100	201.3						
	Test mean	68	244	102	4	8	2.9	48		150.0						
	CV%	2	4	9	74	73	16.0	25		7.7						
	LSD 0.05	2	21	19	ns	12	1.0	25		23.1						

Note: Stay green rating was on a 1 to 5 scale with 1 = 100% green and 5 = 0% green.

9. Publications discussed GEM germplasm:

Wenwei Xu and Mike Blanco. 2006. Use of exotic germplasm to improve stress tolerance. NCR-167 Annual Meeting, Guelph, Canada. Feb. 21-22, 2006.

A field day was held on August 9, 2006 at Etter, TX. GEM lines and their testcrosses were showed and discussed in the field day.