2011 State Silage Corn Performance Test on the Texas High Plains

Wenwei Xu[1], Thomas Marek[2], Yongtao Yu[3], Andy Cranmer[4], Brent Bean[5], and Dennis Pietsch[6]

Introduction

Silage corn production is an important part of the economy in Texas High Plains. In 2010, Texas planted a total of 2.3 million acres of corn for both grain and silage, and harvested 140,000 acres for silage with an average silage yield of 18.0 tons per acre (USDA National Agricultural Statistical Services, www.nass.usda.gov). Most of the silage corn in Texas is grown on the High Plains where a number of dairies and cattle feedlots are located. The Texas State Silage Corn Performance Test in the High Plains was initiated in 2007, and has been conducted at the North Plains Research Field at Etter and the Texas AgriLife Research Station at Halfway (Xu et al, 2007; 2009, 2010). Commercial seed companies have an opportunity to enter hybrids at either or both test sites on a fee basis. To our knowledge, this is the only public field testing available on the Texas High Plains. Our goal is to provide producers with timely and unbiased production information on yield, quality, and agronomic traits.

2011 State Silage Corn Performance Test at Etter

Field operation: The Texas Panhandle test was conducted under a center pivot system at the Texas AgriLife North Plains Research Field near Etter. It involved 35 commercial hybrids and seven experimental hybrids from the Texas AgriLife Research corn breeding program located in Lubbock (Table 1). Hybrids F2F622 and F2F714 contain the brown midrib trait. This test used a randomized complete block design with three replications, four-row plots, 18 feet in length, a 30-inch row spacing, and 2-foot alleys. The test was planted on April 29 and harvested on September 3, 2011. Granular urea and mono-ammonium phosphate were broadcast on March 21 at the rate of 336 lbs N/ac and 157 lbs P/ac (P_2O_5). Fertilizers were incorporated into the soil by disking twice. Seedbeds were listed on April 11 using a lister-bottom plow. Rows were concentric to the pivot tracks, but the plots were generally oriented with a north to south direction. The previous crop was wheat, followed by summer fallow. A mix of Bicep II Magnum at the rate of 2.1 qt./ac and Balance Flex at the rate of 3 oz./ac was applied on May 4, 2011, and incorporated into soil by using a rolling cultivator. Lorsban 15G was applied at 6.5 lbs/ac at planting to control corn rootworm. At the three-leaf stage, seedlings were hand-thinned to a uniform target population of 32,912 plants/a. Due to the lack of seasonal rainfall and limited startup soil moisture, the field was irrigated prior to planting and irrigation was applied throughout the season in a total of 20 irrigation events. A total of 34.3 acre-inches water was pumped from planting to harvest with effective irrigation computed at 30.8 inches due to the abnormally intense and sustained meteorological conditions. In-season rainfall only totaled 2.4 inches with effective crop rainfall being computed as 0.8 inches. Seasonal irrigation timing and management was maintained at no more than a 55% depletion level of field capacity between irrigations to prevent water stress.

[1]Corn Breeder, Texas AgriLife Research, Lubbock; [2]Irrigation Engineer, Texas AgriLife Research, Amarillo; [3]Visiting Scientist, Texas AgriLife Research, Lubbock; [4]Farm Research Services Manager, Texas AgriLife Research, Halfway; [5]Agronomist, Texas AgriLife Extension, Amarillo; and [6]Director, Crop Testing Program, Texas AgriLife Research, College Station. Corresponding author: W. Xu, Tel. 806-746-4015, E-mail: we-xu@tamu.edu.

Texas AgriLife Research and Extension-Lubbock Center Technical Report No. 11-4.

Data was recorded on stand, flowering dates, plant and ear height, root and stalk lodging, and moisture content at harvest. The two center rows of each plot were harvested on September 3 (average milk line being at 50%) using a John Deere 5200 small-plot silage chopper equipped with a Hagie silage plot weighing system. Plants were cut 5 inches above the ground surface. Approximately 2 lbs of a chopped sub-sample were collected from each plot, weighed for fresh weight, dried at 50^0C, weighed for dry weight, and then analyzed for silage quality using NIR methods by the Dairy One Forage Lab (Ithaca, NY). The moisture content was calculated by using the fresh and dry weight of the sub-samples.

Results: Weather during the 2011 crop season was highly unusual: consistently windy, cool from planting to early-May, hot from late-May through harvest, and very low rainfall during the season. The cold and windy conditions lasted several days after planting, and as a result, plants in most plots were below the target population of 32,912 plants per acre.

Most hybrids had a reported relative maturity of 116-118 days. The average day from planting to pollen shedding was 77 days. A few hybrids flowered much earlier or later (Table 1). Plant height ranged from 8.4 ft to 10.4 ft. Stalk and root lodging at the harvest time was either zero or negligible, and therefore, not reported.

Forage yields of the 43 hybrids tested at the Etter location differed significantly, ranging from 28.3 to 36.2 tons/ac, with an average of 33.0 tons/ac at the adjusted 65% moisture level. The top five yielding hybrids were DynaGro V5683 VT3 (36.2 tons/ac), Texas AgriLife WXY11C (35.7 tons/ac), Golden Acres 28Z47 (35.1 tons/ac), Mycogen T20911 (35.4 tons/ac), and Monsanto DKC67-88 (35.1 tons/ac). But no hybrids yielded significantly higher than the test mean. Two hybrids (Blue River 70R50 and Mycogen F2F622) yielded significantly lower than the test mean, primarily due to lower plant counts per plot.

The whole plant moisture at harvest was 64.6% ranging from 59.0% (BH8860GT) to 69.5% (CF6126 GT). The low C.V. values of 6.98% for forage yield and 3.0% for forage moisture indicated that this was, in general, a good and uniform test.

Silage quality was assayed with NIR. Most of the quality traits were significantly different among the entries (Table 2). Nutritionists use different quality traits depending on their needs, but TDN and IVTD24 are commonly used to represent forage digestibility. In this test, IVTD24 values ranged from 69.67% to 82.33% with an average of 76.7%. Mycogen F2F714 is a brown midrib silage hybrid and had the highest IVTD24 value among the 43 hybrids. A high value of TDN and IVTD24 means higher digestibility per ton of silage. Digestibility of corn silage is highly correlated to the amount of grain produced and chemical composition of stalks. A good silage hybrid should have high values in the tonnage, protein, starch, and digestibility and low values in ADF, NDF, and lignin.

2011 State Silage Corn Performance Test at Halfway

This test was conducted under a center pivot system field at the Texas AgriLife Research Station at Halfway and had 27 commercial hybrids and 8 experimental hybrids from the Texas AgriLife Research corn breeding program located in Lubbock. Design and data collection was similar to the Etter test. Unfortunately, the test plots were located in a sloped area of the center pivot. The extremely hot weather and low well capacity lead to uneven plant growth and development. After the test was harvested and data analyzed, it was determined that there existed confounding factors from the data and it was subsequently decided to not publish the results because of these impacts.

These results are available at the State Crop Performance Test Program (http://varietytesting.tamu.edu) and the Texas AgriLife Research Lubbock Center websites (http://lubbock.tamu.edu). These results will help producers, Extension specialists and consultants select commercial hybrids best suited for the Texas High Plains.

The citation of this research can be referenced as: Wenwei Xu, Thomas Marek, Yongtao Yu, Andy Cranmer, Brent Bean, and Dennis Pietsch. 2011. 2011 State Silage Corn Performance Test on the Texas High Plains. Texas AgriLife Research and Extension-Lubbock Center Technical Report No.11-4. pp.8.

References

Wenwei Xu, Bruce Spinhirne, Thomas Marek, Brent Bean, and Dennis Pietsch. 2007. Silage corn hybrids for the Texas High Plains. TAES-Lubbock Center Technical Publication No.07-2. pp.2.

Wenwei Xu, Thomas Marek, Bruce Spinhirne, Bruce Carlson, Travis John, Brent Bean, and Dennis Pietsch. 2009. 2009 State Silage Corn Performance Test in the Texas High Plains. Texas AgriLife Research and Extension-Lubbock Center Technical Report No.09-4. pp.10.

Wenwei Xu, Thomas Marek, Andy Cranmer, Bruce Carlson, Jonny Beck, Brent Bean, and Dennis Pietsch. 2010. 2010 State Silage Corn Performance Test on the Texas High Plains. Texas AgriLife Research and Extension-Lubbock Center Technical Report No.10-3. pp.12.

Table 1. Means of forage yield adjusted to 65% moisture and agronomic traits of the State Silage Corn Performance Test at Etter, Texas in 2011.

ENO	Hybrid	Company	RM	Trait	Stand %	Days to anthesis	Plant ht., in	Ear ht. in	Moist %	Yield tons/ac	% Test mean	Yield rank	Duncan's test
1	TMF2L872	Mycogen	119	HX1/RR	80.1	79.0	120.6	50.3	68.3	33.3	100.9	21	a-j
2	T20911	Mycogen	118	HX1/RR	82.6	78.0	120.7	48.6	66.3	35.4	107.3	4	a-d
3	F2F714	Mycogen	112	HXT/RR/BMR	90.2	77.0	122.6	51.4	64.3	29.6	89.9	41	j-l
4	F2F622	Mycogen	110	HXT/RR/BMR	83.8	74.7	116.7	46.5	63.0	28.9	87.6	42	kl
5	GAX-6152	Golden Acres	118	VT3P	91.7	74.7	106.8	40.8	66.0	31.5	95.5	35	e-l
6	28V71	Golden Acres	117	VT3P	81.1	75.3	113.0	42.1	62.1	33.2	100.8	22	a-j
7	28V81	Golden Acres	118	VT3P	76.3	74.7	105.4	46.1	63.9	35.1	106.4	6	a-e
8	28Z47	Golden Acres	118	RR	91.4	77.0	124.4	50.4	65.3	35.5	107.7	3	a-c
9	CF 6120 RR	Golden Acres	122	RR	79.5	79.7	121.7	53.7	68.8	33.9	103.0	13	a-i
10	CF 6126 GT	Golden Acres	120	GT	79.8	79.7	118.4	49.9	69.8	31.9	96.8	32	c-l
11	BH 8895 VTTP	B-H Genetics	118	GENVT3P	84.6	76.0	110.5	39.9	63.9	30.5	92.4	40	i-l
12	BH 9018 VTTP	B-H Genetics	119	GENVT3P	87.1	77.0	109.3	42.9	60.0	35.0	106.0	7	a-e
13	BH 8719 RR/HXT	B-H Genetics	117	RR/HXT/LL	82.1	77.0	115.2	51.6	66.1	32.4	98.4	28	b-k
14	X11152 VTTP	B-H Genetics	117	GENVT3P	83.8	74.7	106.7	40.7	65.6	34.8	105.7	9	a-e
15	X10065 VT3	B-H Genetics	116	VT3	97.0	72.7	101.1	40.3	62.3	33.4	101.3	18	a-i
16	X10080 GT	B-H Genetics	115	GT	83.6	80.3	110.6	44.0	64.5	33.6	102.0	15	a-i
17	XP 8711	B-H Genetics	116	NONE	90.4	76.0	114.8	41.2	63.5	32.4	98.4	29	b-k
18	BH 8860 GT	B-H Genetics	116	GT	88.4	77.0	113.4	43.8	59.0	33.1	100.3	23	a-j
19	X8021	B-H Genetics	115	None	91.4	78.0	113.8	42.5	63.8	33.3	101.1	20	a-i
20	X10110GTBT11	B-H Genetics	116	GT/CB/LL	88.6	75.3	111.9	47.6	62.1	32.9	99.9	24	a-j
21	DKC 67-88	Monsanto	117	GENVT3P	92.7	77.0	113.5	48.6	61.2	35.1	106.6	5	a-e
22	DKC 64-69	Monsanto	114	VT3	93.4	74.0	109.6	39.6	62.7	30.7	93.2	39	h-l
23	Integra 9650	Wilbur-Ellis	115	VTPRO	97.2	76.0	118.2	45.1	62.6	33.6	101.8	16	a-i
24	Integra 9682	Wilbur-Ellis	118	VT3	72.5	78.0	116.4	50.5	67.2	34.8	105.5	10	a-f
25	D56VP69	DynaGro	116	RR/CB/CRW	92.2	76.0	106.2	42.0	61.0	34.4	104.3	12	a-h

Table 1. Means of forage yield adjusted to 65% moisture and agronomic traits of the State Silage Corn Performance Test at Etter, Texas in 2011 (continued).

ENO	Hybrid	Company	RM	Trait	Stand %	Days to anthesis	Plant ht., in	Ear ht., in	Moist %	Yield Tons/ac	% Test mean	Yield rank	Duncan's test
26	V5683 VT3	DynaGro	116	RR/CB/CRW	85.4	79.7	113.1	42.8	63.1	36.2	109.8	1	a
27	CX 11615	DynaGro	115	GT/CB	89.4	76.0	112.6	40.7	64.2	31.0	93.9	37	g-l
28	CX 11417	DynaGro	117	RR/CB/CRW	80.6	74.7	108.8	43.3	64.8	31.8	96.3	34	d-l
29	70R50	Blue River	114	None	78.0	72.7	102.4	36.7	60.4	28.3	85.7	43	l
30	71M36	Blue River	114	None	82.1	74.7	113.0	45.5	65.5	32.8	99.4	25	a-j
31	73B33	Blue River	115	None	91.4	76.0	113.5	41.1	64.9	32.8	99.4	26	a-j
32	76H50	Blue River	115	None	90.4	77.0	107.1	41.5	64.4	33.6	101.8	17	a-i
33	WXY10D	TX AgriLife		None	79.8	78.0	115.7	51.7	69.5	34.4	104.5	11	a-g
34	WXY10F	TX AgriLife		None	75.3	79.0	117.1	45.8	66.5	31.1	94.4	36	f-l
35	WXY11D	TX AgriLife		None	94.4	77.0	107.9	47.9	63.0	34.9	106.0	8	a-e
36	WXY11A	TX AgriLife		VT3	65.4	77.0	113.8	46.2	67.7	32.1	97.5	31	b-k
37	WXY11B	TX AgriLife		VT3	79.3	77.0	115.4	46.5	67.8	33.3	101.1	19	a-i
38	WXY11C	TX AgriLife		None	93.7	77.0	118.4	50.8	65.2	35.7	108.2	2	ab
39	WXY11D	TX AgriLife		VT3	88.1	74.7	111.5	42.0	63.5	31.8	96.6	33	c-l
40	WXY11E	TX AgriLife		VT3	96.7	76.0	109.8	41.5	64.0	32.7	99.1	27	a-j
41	17254	Triumph		HX1/RR	92.2	74.7	115.1	43.6	66.2	33.7	102.3	14	a-i
42	2288H	Triumph		HX1/RR	63.9	81.0	118.8	50.0	68.2	30.9	93.7	38	g-l
43	1956H	Triumph		HX1/RR	76.0	78.0	115.7	48.0	64.5	32.2	97.8	30	b-k
	Test mean				85.2	76.6	113.3	45.2	64.6	33.0	100.0		
	CV%				6.7	1.7	4.3	11.6	3.0	6.9			
	LSD 0.05				9.2	2.2	19.9	21.6	3.1	3.7			

Note: ENO = entry number, RM = relative maturity, YG= Yield Guard insect resistance, HX= Herculex insect resistance, RR2= Roundup Ready Corn 2 herbicide resistance; VT3 = CRW + RR2 + YG. BM3 = brown midrib conferred by *bm3* gene.
Stand = Percent of the target plants 32,912 plants per acre. Hybrid yields with the same letters are not significantly different from each other at 5% level.

Table 2. Forage quality of the State Silage Corn Performance Test at Etter, Texas in 2011.

ENO	Hybrid	Company	CP	ADF	NDF	Lignin	Starch	TDN	IVTD24	IVTD24 rank	Duncan's test	NDFD24	MILK1	MILK2
1	TMF2L872	Mycogen	8.5	28.0	46.7	4.1	25.1	70.0	75.3	30	b-h	47.3	2971.0	3173.7
2	T20911	Mycogen	8.2	27.1	45.0	3.7	30.6	72.0	75.3	31	b-h	45.7	2955.0	3203.0
3	F2F714	Mycogen	9.0	23.6	39.5	3.7	35.9	75.0	82.3	1	a	54.0	3148.7	3439.3
4	F2F622	Mycogen	8.6	24.7	43.2	3.4	32.1	74.0	79.7	6	a-d	53.0	3076.7	3337.3
5	GAX-6152	Golden Acres	8.8	23.5	40.0	3.7	33.3	74.0	79.7	7	a-d	49.7	3027.3	3296.7
6	28V71	Golden Acres	8.7	23.9	40.7	3.5	33.3	73.0	77.3	20	a-g	44.3	2968.3	3238.7
7	28V81	Golden Acres	8.6	25.9	44.2	4.1	29.9	71.0	74.7	36	b-h	43.3	2910.3	3152.0
8	28Z47	Golden Acres	8.7	23.0	39.3	3.6	37.4	74.0	78.7	12	a-f	46.0	3022.7	3325.3
9	CF 6120 RR	Golden Acres	9.3	28.8	47.3	4.6	23.3	69.0	74.3	37	c-h	45.7	2981.0	3170.0
10	CF 6126 GT	Golden Acres	8.9	31.9	51.1	4.8	18.4	64.0	69.7	43	h	41.0	2562.3	2712.0
11	BH 8895 VTTP	B-H Genetics	8.2	21.9	37.7	3.0	39.4	75.0	80.0	5	a-c	47.0	3025.0	3344.7
12	BH 9018 VTTP	B-H Genetics	8.4	26.4	45.1	3.8	30.7	72.0	75.7	28	b-g	46.0	2938.7	3187.7
13	BH 8719 RR/HXT	B-H Genetics	8.3	26.5	43.8	3.9	30.1	71.0	75.3	32	b-h	44.0	2892.7	3136.7
14	X11152 VTTP	B-H Genetics	8.7	22.4	39.4	3.4	34.9	76.0	79.7	8	a-d	47.7	3143.0	3426.3
15	X10065 VT3	B-H Genetics	8.6	24.8	41.7	3.9	32.4	73.0	77.0	23	a-g	45.3	3017.0	3279.7
16	X10080 GT	B-H Genetics	8.7	27.6	45.9	4.1	27.6	70.0	74.0	39	d-h	43.3	2850.3	3073.7
17	XP 8711	B-H Genetics	8.2	24.6	41.2	3.7	36.2	74.0	78.7	13	a-f	48.0	3075.0	3368.3
18	BH 8860 GT	B-H Genetics	7.8	26.1	44.3	3.5	32.8	72.0	75.7	29	b-g	44.3	2901.0	3167.3
19	X8021	B-H Genetics	8.6	25.3	42.5	3.4	32.7	73.0	77.3	21	a-g	47.0	2996.7	3262.0
20	X10110GTBT11	B-H Genetics	8.3	22.3	38.6	3.5	38.5	74.0	78.3	14	a-f	43.3	2977.0	3289.0
21	DKC 67-88	Monsanto	8.5	24.8	42.9	3.5	32.0	73.0	77.3	22	a-g	46.7	2991.7	3250.7
22	DKC 64-69	Monsanto	8.4	22.0	38.0	3.5	37.8	75.0	80.3	2	ab	48.7	3075.7	3382.3
23	Integra 9650	Wilbur-Ellis	7.6	25.9	43.2	3.3	33.2	71.0	75.3	33	b-h	43.3	2833.3	3102.3
24	Integra 9682	Wilbur-Ellis	9.3	21.8	37.7	3.7	35.5	75.0	80.3	3	ab	48.7	3149.7	3437.0
25	D56VP69	DynaGro	8.5	24.8	42.5	3.4	32.9	74.0	78.0	16	a-g	48.0	3063.0	3329.7

Table 2. Forage quality of the State Silage Corn Performance Test at Etter, Texas in 2011 (continued).

ENO	Hybrid	Company	CP	ADF	NDF	Lignin	Starch	TDN	IVTD24	IVTD24 rank	Duncan's test	NDFD24	MILK1	MILK2
26	V5683 VT3	DynaGro	9.4	24.9	43.5	3.3	32.5	73.0	78.0	17	a-g	49.3	3024.0	3287.3
27	CX 11615	DynaGro	8.3	22.7	38.9	3.5	37.0	75.0	79.7	9	a-d	46.7	3048.0	3347.7
28	CX 11417	DynaGro	8.0	30.5	50.4	4.1	25.6	68.0	72.3	42	gh	45.0	2795.7	3003.3
29	70R50	Blue River	8.7	23.2	39.6	3.4	35.4	76.0	79.7	10	a-d	48.3	3130.0	3417.3
30	71M36	Blue River	8.4	27.4	45.8	3.6	28.9	72.0	76.7	24	a-g	49.0	3008.0	3242.3
31	73B33	Blue River	8.8	24.1	41.2	3.2	33.7	74.0	78.0	18	a-g	46.7	3040.7	3313.7
32	76H50	Blue River	9.0	24.1	40.9	3.6	34.0	73.0	78.3	15	a-f	46.7	3005.0	3280.3
33	WXY10D	TX AgriLife	9.2	22.1	38.0	3.7	35.1	75.0	80.3	4	ab	48.3	3148.0	3432.7
34	WXY10F	TX AgriLife	9.0	25.8	43.6	3.7	30.5	72.0	77.7	19	a-g	48.7	3009.7	3257.0
35	WXY11D	TX AgriLife	8.7	25.6	43.0	3.6	32.3	72.0	76.7	25	a-g	46.3	2946.3	3208.0
36	WXY11A	TX AgriLife	8.5	27.8	47.1	3.8	25.1	70.0	75.0	35	b-h	47.0	2936.0	3139.0
37	WXY11B	TX AgriLife	9.1	22.9	38.7	3.6	34.5	74.0	79.0	11	a-e	46.3	3054.3	3333.7
38	WXY11C	TX AgriLife	8.2	28.0	46.7	3.7	29.6	71.0	75.3	34	b-g	47.0	2947.3	3187.7
39	WXY11D	TX AgriLife	8.4	25.1	42.8	3.5	31.3	71.0	76.3	27	b-g	44.3	2877.0	3131.3
40	WXY11E	TX AgriLife	8.0	28.5	47.5	4.0	26.8	68.0	73.0	41	f-h	42.7	2772.0	2989.3
41	17254	Triumph	8.5	26.3	44.6	3.7	30.5	72.0	76.7	26	a-g	47.7	2972.7	3220.0
42	2288H	Triumph	9.0	27.7	46.9	3.9	25.4	71.0	74.3	38	c-h	45.3	2967.3	3172.7
43	1956H	Triumph	8.3	27.8	46.3	3.9	28.8	69.0	73.3	40	e-h	42.3	2768.3	3001.7
	Test mean		8.6	25.7	43.4	3.7	30.6	71.6	76.7			46.3	2961.3	3209.8
	CV%		5.4	14.2	12.2	10.1	18.6	4.3	4.6			6.3	5.1	5.8
	LSD 0.05		0.8	ns	ns	0.6	9.6	5.1	5.7			4.8	245.3	306.1

1. IVTD24: *In vitro* true digestibility (IVTD) after 24 hours of incubation in rumen fluid. It measures digestibility and can be used to estimate energy. A higher value of IVTD 24 hr presents a better forage quality.
2. Forage nutritional values based on NIR analysis.

ADF: Acid detergent fiber, a measure of cellulose and lignin. ADF is negatively correlated with overall digestibility.

CP: Crude protein, the total protein in the sample including true protein and non-protein nitrogen.

Lignin: indigestible plant component and has a negative impact on cellulose digestibility.

NDF: Neutral detergent fiber, a measure of hemicellulose, cellulose and lignin representing the fibrous bulk of the forage. NDF is negatively correlated with intake

NFC: Percentage of non-fibrous carbohydrates; estimates the amount of rapidly digestible carbohydrates in a forage.

NDFD24: Percentage of NDF that is digestible by *in vitro i*ncubation.

MILK 1: Estimated lbs. of milk produced per ton of dry matter.

MILK 2: Estimated lbs. of milk produced per ton of processed dry matter.

Starch: primarily in the grain, later maturing hybrids have lower starch since all hybrids were harvested at the same time.

TDN: Total digestible nutrients. It represents the sum of the digestible protein, digestible nitrogen-free extract, digestible crude fiber and 2.25X the digestible fat.

Milk lbs./ton of DM: an estimated potential milk yield per ton of forage dry matter based on digestibility and energy content of the forage.