Silage Corn Hybrids for the Texas High Plains

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Introduction

Silage corn acreage in Texas has doubled from 70,000 acres in 1995 to 160,000 acres in 2006. Most of this increase has occurred in the High Plains. The number of dairies located in this region has more than doubled since 2000. Seven of the top milk producing counties in Texas are now located in the region. In September 2007, a new cheese plant was opened in Dalhart by the Hilmar Cheese Company. The Dalhart plant can process 5 millions pounds of milk per day and will elevate the demand for silages. Silage corn production will play an increasingly important role in the economic development in Texas, especially in the Texas High Plains.

Hybrid Types

Hybrid selection is the most important decision for silage corn producers. When choosing a hybrid, one needs to consider silage yield, quality, and maturity. There are a range of silage hybrids available on the market, including dual-type hybrids, leafy hybrids, and brown-midrib (BMR) hybrids. Dual-type hybrids are usually taller and later in maturity and have a higher percentage of tropical germplasm than the typical grain hybrids. Leafy silage hybrids have a dominant gene, *Lfy1*, an extra two leaves above the ear, and lower ear height compared to normal corn. The *Lfy1* gene was initially discovered by Shavers in 1983 and is believed to be located on the long arm of chromosome 3. The researchers received a U.S. utility patent which expired in 2005. Leafy hybrids usually have tall flexible stalks, thinner stalk rinds, wider leaves, soft and white cobs, and softer kernels. The BMR hybrid plants have a brown midrib due to a genetic mutation. Four BMR genes have been reported in corn, *bm1*, *bm2*, *bm3*, and *bm4*. All four genes are recessive and respectively located on chromosomes 5, 1, 4, and 9. A corn plant must be homozygous at one of the genes (*bm1bm1*, *bm2bm2*, *bm3bm3, or bm4bm4*) in order to express the BMR trait. This means that parental lines of a BMR hybrid must express the BMR trait, which adds challenge in breeding BMR hybrids. Usually, the silage yield of BMR hybrids is lower than normal hybrids. What is important about BMR corn plants is they have 25% lower lignin content than normal corn and have higher digestibility. Cows feeding on BMR corn potentially produce more milk. Currently, commercial hybrids utilize the *bm3* gene.

There has been very little research on breeding, variety testing, and management of silage corn in the public sectors in the Texas High Plains. Producers need new hybrids adapted to local environments and information to compare and choose available hybrids. An initial small scale study was conducted at Etter and Halfway in Texas by a graduate student of Dr. Xu in 2005 and 2006. All data were collected by hand. Plants were chopped by running them through a tree limb chipper. This method was an extremely labor and time consuming process, and limited us to test a large number of hybrids.

2007 State Silage Corn Performance Test at Etter

In 2007, we obtained a John Deere 5200 small-plot silage chopper equipped with a Hege silage plot weighing system with the grants from TAES-PUF, Texas Corn Producers Board, and Dow AgroSciences. With the chopper, we conducted a State Silage Corn Performance Test at the Texas A&M North Plains Research Field at Etter, Texas in 2007. The test consisted of 26 corn-silage hybrids that were entered by commercial seed companies on a fee basis. This report describes the test design and results.

The test used a randomized complete block design with three replications. Each plot had four rows, 18 feet long at 30-inch row spacing with 3-foot alleys. The target population was 30,976 plants/a. Rows were parallel to the pivot track, but generally oriented south to north. The previous crop was sorghum. In early spring, stubble was shredded and the field was worked with a tandem disk. Granular urea and mono-ammonium phosphate were broadcast on March 12 at the rate of 350 lbs N/a and 100 lbs P/a. Fertilizer was immediately incorporated into the soil by two diskings. Seedbeds were listed on March 22 using a lister-bottom plow. Dual II Magnum at the rate of 1.67 pts./a, tank-mixed with Atrazine 4L at 1.5 pts./a was broadcast applied pre-plant on April 10, 2007. Prior to planting, seedbeds were prepared by a rod-weeder and rolling cultivator. Seeds were planted on May 1 using a John Deere Max-Emerge planter fitted with ALMACO cone-type planter boxes and a cable-trip system. Lorsban 15G was applied at 6.5 lbs/a through planter units to control corn rootworm. At four-leaf stage, plant stands were hand-thinned to a uniform target population. On June 7, 1.5 oz. (wt.)/a Option and 8 fl. oz /a Banvel were applied broadcast for weed control. The field was irrigated three times per week at the 100% ET level through a center-pivot irrigation system fitted with LESA emitters at 60" spacing. The rainfall from planting to harvesting was 3.71 inches. Data were recorded on plant counts per plot, flowering dates, plant and ear heights, and root and stalk lodging. Plots were harvested on August 27, when the average stage of growth reached 50% milk line. Plots were cut 5 inches above the ground. About 2 lb of the chopped sub-samples were taken, weighed for fresh weight, dried at 50^0C for 3-4 days, weighed for dry weight, and then analyzed for silage quality using NIR method by the Diary One Forage Lab (Ithaca, NY).

The average forage yield of the 26 hybrids was 30.0 tons/a at the adjusted 65% moisture level, ranging from 26.7 to 33.4 tons/a. Yield of TMF2L844 and TMF2Q731 was significantly higher than the test mean, but no hybrids yielded significantly lower the test mean. Later-maturing hybrids generally yielded better than earlier ones, but, earlier hybrids TMF2Q731, NC+5451RB, and NC+6125RBD yielded competitively to later hybrids. Stands were relatively uniform. WEXP 605 and WEXP 652R had below average stands and low yield. The harvest moisture ranged from 60.9% to 68.8% with a mean of 65.9%, within the reasonable range for harvest. The C.V. values of 5.7% for forage yield and 1.6% for the forage moisture indicated that this was a very uniform test; the field was well managed; weeds were well controlled; plant population was uniform; fertilizer and water were sufficient. Stalk and root lodging were rare and not reported. Several silage traits assayed with NIR are also shown in Table 1. TDN values ranged from 66.7% to 71.7%, with NC+6125RBD, 8249YG/RR, and F2F721 being highest. TMF2L844, the second highest forage yielder, returned the lowest TDN value, however, the highest forage yielder, TMF2Q731 returned an average TDN value. In general, forage yield and %TDN values were inversely related. BMR hybrids had generally higher %TDN values and yielded slightly below average. Some conventional hybrids were comparable to BMR hybrids in %TDN and forage yield. These results are available at the State Crop Performance Test Program (http://varietytesting.tamu.edu) and the TAES Lubbock Center websites (http://lubbock.tamu.edu). These results will help producers, extension specialists and consultants select commercial hybrids best suited to the Texas High Plains.

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Table 1. Means of forage yield, moisture, agronomic traits, and nutritional values of the State Silage-Corn Performance Test at Etter, Texas in 2007. Nutritional values shown are on dry matter basis.

HYBRID	COMPANY	RM	Trait	Stand %	Days to pollen	Plant ht., in	Ear ht in	Moist %	Yield ton/a	Yield yank	% Crude protein	% ADF	% NDF	% Lignin	% Starch	% TDN	NEM Mcal /lb	NEG Mcal /lb	NEL Mcal /lb	SS NEL Mcal /lb	SS Proc. NEL, Mcal/lb
58K40	Dyna-Gro Seed	118		94.3	74	124	57	66.3	30.41	12	7.2	27.0	44.9	4.1	31.7	68.0	0.69	0.42	0.69	0.63	0.66
58K22	Dyna-Gro Seed	118		100.0	74	119	49	67.3	30.38	13	6.5	27.5	45.6	3.8	32.6	68.3	0.69	0.42	0.69	0.62	0.66
58P59	Dyna-Gro Seed	116	YG/RR2	95.3	71	116	47	68.4	29.51	16	6.9	23.9	40.6	3.8	38.1	70.3	0.73	0.45	0.73	0.65	0.69
58K02	Dyna-Gro Seed	119		96.9	72	116	50	67.8	29.49	17	6.9	26.0	42.6	3.8	35.7	68.7	0.70	0.43	0.71	0.63	0.67
8249YG1/RR	Garst Seed	117	YG/RR2	96.9	70	123	44	62.2	30.42	11	7.1	21.5	38.1	3.9	40.2	71.3	0.74	0.47	0.75	0.66	0.70
F2F797	Mycogen Seeds	115	BMR	97.9	70	112	46	66.2	29.03	20	7.3	23.3	40.6	3.9	37.2	70.3	0.73	0.46	0.73	0.65	0.69
F2F721	Mycogen Seeds	113	BMR	98.4	69	112	41	64.8	26.80	25	7.1	23.7	41.3	3.2	36.7	71.0	0.74	0.46	0.74	0.66	0.70
F2F610	Mycogen Seeds	108	BMR	100.0	69	117	53	62.9	29.08	19	7.2	24.4	42.5	3.5	35.7	70.3	0.73	0.45	0.72	0.65	0.69
2A120CL	Mycogen Seeds	123	CL	94.3	75	131	60	68.8	31.07	9	7.0	29.0	47.8	4.0	29.6	67.7	0.68	0.41	0.68	0.62	0.65
TMF2L844	Mycogen Seeds	118		100.0	75	126	56	67.4	33.33	2	6.7	28.9	47.1	4.2	29.9	66.7	0.67	0.41	0.67	0.61	0.64
TMF2N804	Mycogen Seeds	116	HXI/RR2	100.0	75	125	42	66.2	31.27	6	7.0	27.8	45.4	4.1	32.8	68.0	0.69	0.42	0.69	0.62	0.65
TMF2Q731	Mycogen Seeds	113	HXI	99.5	70	121	50	63.8	33.36	1	6.9	25.4	42.1	3.9	35.2	69.3	0.71	0.44	0.72	0.64	0.68
TMF2Q716	Mycogen Seeds	110		98.4	69	114	55	63.1	29.11	18	7.5	25.9	43.4	3.7	34.7	70.0	0.72	0.44	0.71	0.64	0.68
NC+ 7402R	NC+ Hybrids	120	RR2	96.4	73	116	53	68.7	30.71	10	7.3	28.0	47.2	4.0	30.6	67.0	0.68	0.41	0.68	0.61	0.65
NC+ 7373RB	NC+ Hybrids	120	YG/RR2	100.0	75	118	57	67.1	31.41	5	7.0	26.3	44.5	3.8	32.4	69.0	0.71	0.44	0.71	0.64	0.67
NC+ 6361RB	NC+ Hybrids	116	YG/RR2	96.9	71	117	42	66.6	29.99	15	6.8	25.5	42.4	3.8	36.1	69.3	0.71	0.44	0.71	0.64	0.68
NC+ 6125RBD	NC+ Hybrids	116	YG+/RR2	96.9	68	113	35	63.4	30.21	14	7.0	22.6	38.9	3.6	38.3	71.7	0.75	0.48	0.75	0.67	0.71
NC+ 5451RB	NC+ Hybrids	114	YG/RR2	100.0	69	112	46	64.9	31.12	8	7.5	24.9	42.7	3.8	33.5	69.7	0.72	0.44	0.72	0.65	0.68
NC+ 5392B	NC+ Hybrids	112	YG	100.0	68	104	42	60.9	27.60	23	7.1	23.6	40.8	3.6	36.7	70.0	0.73	0.45	0.73	0.65	0.69
1977CbRR	Triumph Seed	117	YG/RR2	97.4	72	113	44	66.1	31.13	7	7.1	24.2	41.7	3.8	33.9	70.0	0.73	0.45	0.72	0.65	0.69
WEXP 691RB	Wilbur-Ellis	119	YG/RR2	96.9	72	122	51	67.7	32.12	3	7.1	29.1	47.5	4.1	29.6	67.0	0.67	0.40	0.67	0.61	0.64
INT 9681	Wilbur-Ellis	119		94.8	72	119	50	67.3	31.42	4	7.1	26.3	44.1	4.1	33.5	68.7	0.70	0.43	0.70	0.63	0.67
WEXP 652R	Wilbur-Ellis	115	RR2	83.3	70	123	42	66.2	26.67	26	7.3	27.1	45.6	4.1	29.9	67.3	0.68	0.41	0.68	0.62	0.65
WEXP 664R	Wilbur-Ellis	116	RR2	94.3	72	127	47	66.3	27.93	22	7.0	28.6	46.4	3.9	30.2	67.3	0.68	0.41	0.68	0.62	0.65
WEXP 665	Wilbur-Ellis	116		90.1	73	122	44	67.0	28.41	21	7.4	27.2	44.1	4.0	31.7	67.3	0.69	0.42	0.69	0.62	0.66
WEXP 605	Wilbur-Ellis	118		84.9	73	114	41	66.4	27.44	24	7.2	25.0	42.0	3.9	35.3	69.7	0.71	0.44	0.72	0.64	0.68
Mean				96.3	71.6	118.3	47.7	65.9	29.98		7.1	25.9	43.7	3.9	33.9	69.0	0.71	0.43	0.71	0.63	0.67
CV%				5.6	1.7	2.6	11.8	1.6	5.71		6.62	5.18	4.04	6.13	5.32	1.42	2.39	3.52	2.32	1.98	2.08
LSD 0.05				8.6	2.0	4.9	9.2	1.7	2.79		ns	2.18	2.86	0.38	2.93	1.60	0.03	0.02	0.03	0.02	0.02

YG= Yield Gard insect resistance, HXI= Hurculex I insect resistance, RR2= Roundup Ready Corn 2 herbicide resistance, CL= Clearfield herbicide resistance, BMR= Brown midrib..