



OKLAHOMA PANHANDLE LIMITED IRRIGATION SORGHUM SILAGE PERFORMANCE TRIAL, 2007



PRODUCTION TECHNOLOGY CROPS

OKLAHOMA COOPERATIVE EXTENSION SERVICE
DEPARTMENT OF PLANT AND SOIL SCIENCES
DIVISION OF AGRICULTURAL SCIENCES & NATURAL RESOURCES
OKLAHOMA STATE UNIVERSITY

PT 2007-11

November 2007

Vol. 19, No.11

Rick Kochenower

Area Research and Extension Specialist
Plant and Soil Sciences Department

Britt Hicks

Area Extension Livestock Specialist
Northwest District

TRIAL OBJECTIVES AND PROCEDURES

In the coming years with natural gas prices rising and the possibility of water supplies diminishing, sorghum silage may replace corn silage in the panhandle region. Sorghum requires less water than corn, therefore less irrigation is required. Many seed companies have increased efforts to bring higher quality sorghum silage hybrids to market. Among these are brown mid-rib, photoperiod sensitive, conventional forage sorghums, and sorghum/sudan hybrids. In 2006, the Oklahoma Cooperative Extension Service re-established a sorghum silage performance trial in the Oklahoma panhandle to evaluate sorghum silage with limited irrigation. Limited irrigation has many definitions, the most common being one-half of normal irrigation or less. For the purpose of this trial, eight inches of irrigation was defined as being the maximum to be applied.

This trial provides producers, extension educators, industry representatives, and researchers with information on silage sorghum hybrids marketed in Oklahoma. Company or brand name, entry designation, plant characteristics, and maturity information, were provided by the companies (Table 1). Oklahoma State University did not verify this information. Company participation was voluntary, therefore some hybrids marketed in Oklahoma were not included in the test.

Limited irrigated test plots were established at the Oklahoma Panhandle Research and Extension Center (OPREC), in Goodwell. Two rows (25 feet long) were seeded at a target population of 50,000 plants/ac for brown mid-rib, and a target of 70,000 plants/ac for all other entries. The lower population for brown midribs may help with lodging associated with these hybrids. Experimental design was a randomized complete block with four replications. Prior to harvest five-foot alleys were cut to facilitate harvest. Ten feet of one row was hand harvested, weighed and three plants were randomly selected to run through a chipper shredder. Samples were then dried at 65° C until weight was constant for two consecutive days. Maturity was checked periodically to monitor development so plots could be harvested when most entries were between soft and hard dough. Photoperiod sensitive hybrids were harvested on the last date. In 2007 all hybrids were harvested on the same date. Ensilage production is reported as tons/ac adjusted to 65% moisture (Table 2). This is consistent with current ensiling practices.

- Planting date: June 13, 2007
- Harvest date: October 8, 2007
- Previous crop: Soybean
- Soil type: Richfield Clay Loam
- Soil Test: N: 34 lbs/ac P: 24 K: 868 pH: 8.0
- Fertilizer applied: N: 170 lbs/ac P: 40 lbs P₂O₅/ac K: 0
- Herbicide: Cinch ATZ Lite @ 2.0 qt/ac (Preemergence)
- Tillage: Strip-till
- Irrigation:

May	Jun.	Jul.	Aug.	Sept.
1.0	1.0	2.0	3.0	0.0

• Rainfall:	May	June	July	Aug.	Sep.	Total	
	2006	2.16	2.34	2.05	4.06	1.19	11.80
	2007	1.48	1.62	2.00	0.26	0.35	5.71

Data Collected

Lodging:	scale 1 – 4; 1-no lodging, 2-less than 25%, 3-25 – 50%, 4-greater than 50%
Plant population:	Plants/ac
Yield	Lbs/ac of Dry matter and tons/ac of silage

The silages were analyzed for the following nutrients and are reported on a dry mater basis in Tables 2 and 3.

- **Crude Protein:** The total protein in the sample including true protein and non-protein nitrogen (% Nitrogen X 6.25).
- **NDF (neutral detergent fiber):** A measure of hemicellulose, cellulose and lignin representing the fibrous bulk of the forage. These three components are classified as cell wall or structural carbohydrates. They give the plant rigidity enabling it to support itself as it grows. Hemicellulose and cellulose can be broken down by microbes in the rumen to provide energy to the animal. NDF is negatively correlated with intake.
- **ADF (acid detergent fiber):** A measure of cellulose and lignin. Cellulose varies in digestibility and is negatively influenced by the lignin content. ADF is negatively correlated with overall digestibility.
- **Lignin:** Indigestible plant component. Lignin has a negative impact on cellulose digestibility. As lignin content increases, digestibility of cellulose decreases thereby lowering the amount of energy potentially available to the animal.
- **TDN (Total Digestible Nutrients):** Denotes the sum of the digestible protein, digestible non-structural carbohydrates (sugars and starch), digestible NDF and 2.25 X the digestible fat.
- **IVTD (In Vitro True Digestibility):** An anaerobic fermentation performed in the laboratory to simulate digestion as it occurs in the rumen. Rumen fluid is collected from ruminally cannulated high producing dairy cows consuming a typical total mixed ration. Forage samples are incubated in rumen fluid and buffer for a specified time period at 102.2°F (body temperature). During this time, the microbial population in the rumen fluid digests the sample as would occur in the rumen. Upon completion, the samples are extracted in neutral detergent solution to leave behind the undigested fibrous residue. The result is a measure of digestibility that can be used to estimate energy.
- **NEI (Net Energy for Lactation):** An estimate of the energy value of a feed used for maintenance plus milk production during lactation and for maintenance plus the last two months of gestation for dry, pregnant cows.
- **NEm (Net energy for Maintenance):** An estimate of the energy value of a feed used to keep an animal in energy equilibrium, i.e., neither gaining or losing weight.
- **NEg (Net Energy for Gain):** An estimate of the energy value of a feed used for body weight gain above that required for maintenance.

Results

The growing conditions in 2007 were less than ideal with very limited rainfall, therefore two more inches of irrigation was applied when compared to 2006. The total rainfall for May through September was 48% of the total for 2006. The reduced rainfall and limited irrigation reduced yields when compared to 2006, this is evident by hybrids having higher two-year average yields. Also the total for 2007 can be somewhat misleading in that the 2 inch total in July was received in one event of approximately 45 minutes; therefore much of that rainfall was not effective.

Yield data for the various hybrids are reported in Table 2. The silage yield in tons per acre is reported along with a yield expressed as lbs of dry matter (DM) per acre (measure of hay production). In addition a yield of digestible DM per acre is reported. This was calculated by multiplying lbs DM/acre and %IVTD. The nutrient profiles of the various hybrids are reported in Table 3.

Small differences in yield or other parameters should not be overemphasized. Least Significant Differences (L.S.D.) are shown at the bottom of each table. Unless two entries differ by at least the L.S.D. shown, little confidence can be placed in one being superior to another. The coefficient of variability (C.V.) is provided as an estimate of the precision of the data with respect to the mean.

The following people have contributed to this report by assisting in crop production, data collection, and publication; Donna George, Lawrence Bohl, Matt LaMar, Craig Chesnut, Tony Mills, and Eddie Pickard. Their efforts are greatly appreciated.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Bob Whitson, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agricultural Sciences and Natural Resources.

Table 1. Characteristics of Sorghum Silage Hybrids in OPREC Performance Trial, 2007.

Company Brand Name	Hybrid	Sorghum Type	Maturity (days)	Male Sterile	Brown Mid-rib
Walter Moss Seed Co., Ltd.	4Ever Green BMR	Forage	180	PS	Yes
Walter Moss Seed Co., Ltd.	SU-2-LM	Sudan	100	No	No
Walter Moss Seed Co., Ltd.	Mega Green	Sudan	180	No	No
Walter Moss Seed Co., Ltd.	38 Special BMR	Sudan	100	No	Yes
Walter Moss Seed Co., Ltd.	Millenium BMR	Forage	85	No	Yes
NC+ Hybrids	NC+ Nutri-Choice II	Forage	90	Fertile	No
Sorghum Partners Inc	Sordan Headless	Sorg X Sud	NA	Photo	No
Sorghum Partners Inc	Trudan Headless BMR	Hybrid Sud	NA	Photo	Yes
Sorghum Partners Inc	NK 300	Hybrid Forage	90	No	No
Sorghum Partners Inc	Trudan Headless	Hybrid Sud	NA	Photo	No
NC+ Hybrids	Nutri-Ton II	Forage	90	Fertile	no
NC+ Hybrids	BMR 77F	Forage	70	Fertile	Yes
Walter Moss Seed Co., Ltd.	4Ever Green	Forage	180	PS	No
Walter Moss Seed Co., Ltd.	Century BMR	Sudan	80	No	Yes

Table 2. Ensilage Yields and and harvest parameters for OPREC Sorghum Silage Performance Trial, 2007.

Company Brand Name	Hybrid	Digestible DM lbs/ac		DM Yield (lbs/ac)		Ensilage Yield (tons/ac)		Plant Population plants/ac	Harvest Moisture	Lodging %
		2007	2-year	2007	2-year	2007	2-year			
NC+ Hybrids	NC+ Nutri-Choice II	9,000	9,600	11,600	13,000	16.6	18.6	53,100	0.66	1
Sorghum Partners Inc	NK 300	9,000	9,300	11,700	12,400	16.7	17.7	51,400	0.61	3
Walter Moss Seed Co., Ltd.	Mega Green	8,200	9,000	11,300	13,200	16.1	18.9	54,300	0.73	2
Walter Moss Seed Co., Ltd.	SU-2-LM	8,100	8,300	10,900	11,800	15.6	16.8	55,500	0.68	1
Sorghum Partners Inc	Sordan Headless	6,900	7,600	9,500	11,000	13.6	15.7	51,400	0.74	1
Walter Moss Seed Co., Ltd.	4Ever Green BMR	7,500	7,200	9,700	9,300	13.9	13.2	47,200	0.74	1
Walter Moss Seed Co., Ltd.	Millenium BMR	5,200	6,800	6,700	8,800	8.5	12.6	42,400	0.64	2
Sorghum Partners Inc	Trudan Headless BMR	3,700	6,800	4,600	9,400	6.6	15.4	42,300	0.71	2
Walter Moss Seed Co., Ltd.	38 Special BMR	4,100	4,800	4,900	6,400	7.1	9.2	40,800	0.63	3
NC+ Hybrids	Nutri-Ton II	9,900	----	12,600	----	18.0	----	49,800	0.65	2
Walter Moss Seed Co., Ltd.	4Ever Green	6,900	----	9,200	----	13.1	----	47,500	0.75	2
Sorghum Partners Inc	Trudan Headless	6,000	----	8,200	----	11.7	----	60,100	0.71	1
NC+ Hybrids	BMR 77F	4,900	----	6,300	----	9.0	----	50,400	0.64	4
Walter Moss Seed Co., Ltd.	Century BMR	3,800	----	5,200	----	7.5	----	55,200	0.66	3
	Mean	6,700	7,700	8,700	10,600	12.5	15.4	50,100	0.68	----
	C.V.%	18.7	19.8	19.5	19.9	19.5	19.9	9.0	5.0	----
	L.S.D.	2,100	2,000	2,700	2,800	4.1	3.8	7,600	0.06	----

Table 3. Ensilage Quality OPREC Sorghum Silage Performance Trial, 2007.

Company Brand Name	Entry Designation	Lbs Milk/ ton DM	CP*	ADF * %	NDF * %	Lignin %	TDN %	Energy Values *Mcal/lb		
								Lact.	Maint.	Gain
Walter Moss Seed Co., Ltd.	4Ever Green BMR	2,400	7.3	36.7	57.3	5.0	61.7	0.57	0.57	0.32
Walter Moss Seed Co., Ltd.	SU-2-LM	2,240	6.5	32.3	51.5	5.6	57.7	0.56	0.53	0.27
Walter Moss Seed Co., Ltd.	Mega Green	2,160	8.0	35.0	55.5	6.2	57.3	0.54	0.52	0.26
Walter Moss Seed Co., Ltd.	38 Special BMR	2,660	7.5	59.7	48.6	4.0	64.7	0.64	0.64	0.37
Walter Moss Seed Co., Ltd.	Millenium BMR	2,700	7.8	28.0	46.2	4.9	65.0	0.66	0.64	0.38
NC+ Hybrids	NC+ Nutri-Choice II	2,460	8.3	32.6	54.2	6.1	61.5	0.59	0.58	0.33
Sorghum Partners Inc	Sordan Headless	2,362	8.0	35.9	54.0	5.9	60.3	0.57	0.56	0.31
Sorghum Partners Inc	Trudan Headless BMR	2,540	7.5	31.4	49.7	4.7	63.0	0.62	0.61	0.34
Sorghum Partners Inc	NK 300	2,390	8.0	33.0	49.1	5.6	61.0	0.60	0.58	0.32
Sorghum Partners Inc	Trudan Headless	2,150	7.2	36.1	53.0	5.3	57.0	0.55	0.51	0.26
NC+ Hybrids	Nutri-Ton II	2,470	6.7	32.8	50.6	4.6	61.7	0.61	0.59	0.30
NC+ Hybrids	BMR 77F	2,460	6.0	31.2	52.5	5.5	61.7	0.60	0.58	0.33
Walter Moss Seed Co., Ltd.	4Ever Green	2,330	8.4	32.8	53.6	5.3	60.3	0.58	0.56	0.30
Walter Moss Seed Co., Ltd.	Century BMR	2,130	7.2	35.6	57.7	6.3	57.0	0.53	0.51	0.26
	Mean	7.0	7.5	33.1	52.4	5.4	60.7	0.59	0.57	0.31
	C.V.%	2,390	10.4	7.5	5.7	19.0	4.3	5.9	7.3	12.1
	L.S.D.	280	1.3	4.2	5.0	NS	4.4	0.06	0.07	0.06