OKLAHOMA PANHANDLE LIMITED IRRIGATION SORGHUM SILAGE PERFORMANCE TRIAL, 2006

PRODUCTION TECHNOLOGY CROPS

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

PT 2006-13 December 2006 Vol. 18, No.13

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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 being more drought tolerant than corn requires less water, 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 silages 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 where 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 2006 harvest for earlier hybrids was delayed due to rainfall, therefore 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 7, 2006
- Harvest dates: October 6, 2004
- Previous crop: Soybean
- Soil type: Richfield Clay Loam
- Soil Test: N: 25 lbs/ac P: 18 K: 978 pH: 7.8
- Fertilizer applied: N: 200 lbs/ac P: 40 lbs P_2O_5/ac K: 0
- Herbicide: Cinch ATZ Lite @ 2.0 qt/ac (Preemergence)
- Tillage Strip-till
- Irrigation: Sprinkler 1 inch in June and 2 inches in July and September
- Rainfall:

May	June	July	Aug.	Sep.	Total
2.16	2.34	2.05	4.06	1.19	11.80

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 or 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.
- **NEl (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

In 2006 growing conditions were ideal with abundant rainfall, therefore only 5 inches of irrigation was required. This was less than that required by corn. All hybrids were harvested at the same time due to delays from rainfall and corn plots being harvested. Although harvest was delayed, none of the hybrids were too dry for the ensiling process to occur.

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 calculated by multiplying lbs DM/acre and %IVTD.

The nutrient profiles of the various hybrids are reported in Table 3. Crude protein, calcium, and phosphorus concentration are not reported, because no significant differences were found among hybrids. Crude protein ranged from 7.1 to 8.9%, with a mean of 7.8. Calcium and phosphorus concentrations ranged from 0.27 to 0.38% and 0.09 to 0.11% respectively. Mean concentrations for calcium and phosphorus were 0.31 and 0.10%, respectively.

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, Justin Stauffer, Tony Mills, and Eddie Pickard. Their efforts are greatly appreciated.

Table 1. Characteristics of Sorghum Silage Hybrids in OPREC Performance Trial, 2006.

Company Brand Name	Hybrid Designation	Sorghum Type	Maturity Days	Males 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 BMR	Sudan	180	PS	Yes
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
Seed Resource	FS 515 HQ	Forage	107	No	No
Seed Resource	BMR 106	Forage	107	No	Yes
Seed Resource	SS 204 BMR	Sorg X Sud	87	No	Yes
Seed Resource	SS 206 BMR	Sorg X Sud	87	No	Yes
NC+ Hybrids	NC+ Nutri-Choice II	Forage	90	Fertile	No
NC+ Hybrids	NC+ Nutri-Cane II	Sorgo	80	Yes	No
Sorghum Partners Inc	Sordan Headless	Sorg X Sud	NA	Photo	No
Sorghum Partners Inc	Trudan Headless BMR	Sud X Sud	NA	Photo	Yes
Sorghum Partners Inc	NK 300	Hybrid Forage	90	No	No
Sorghum Partners Inc	HIKANE II	Hybrid Forage	90	No	No

Table 2. Ensilage Yields and and harvest parameters for OPREC Sorghum Silage Performance Trial, 2006.

Company Brand Name	Entry Designation	Yield lbs/ac DM	Invitro % DM lbs/ac	Yield Tons/ac Ensilage	Plant Population plants/ac	Harvest Moisture	Lodging %
NC+ Hybrids	NC+ Nutri-Choice II	14,450	10,120	20.6	58,000	0.71	2
Sorghum Partners Inc	Trudan Headless BMR	14,250	9,990	24.3	40,400	0.61	1
Walter Moss Seed Co., Ltd.	Mega Green	15,170	9,880	21.7	61,300	0.76	1
Seed Resource	FS 515 HQ	13,540	9,780	22.4	63,400	0.64	1
Sorghum Partners Inc	NK 300	13,110	9,500	18.7	55,200	0.70	1
NC+ Hybrids	NC+ Nutri-Cane II	12,780	9,330	18.3	50,700	0.66	2
Walter Moss Seed Co., Ltd.	SU-2-LM	12,640	8,510	18.1	56,200	0.69	1
Walter Moss Seed Co., Ltd.	Millenium BMR	10,920	8,330	15.6	46,100	0.71	3
Sorghum Partners Inc	Sordan Headless	12,500	8,310	17.9	49,100	0.74	1
Sorghum Partners Inc	HIKANE II	11,180	7,960	16.0	49,500	0.69	2
Seed Resource	SS 204 BMR	9,720	7,080	13.9	50,100	0.63	2
Walter Moss Seed Co., Ltd.	4Ever Green BMR	8,840	6,760	12.6	35,600	0.76	1
Seed Resource	SS 206 BMR	9,060	6,660	15.0	48,800	0.64	1
Walter Moss Seed Co., Ltd.	Mega Green BMR	8,500	6,290	14.1	41,400	0.77	2
Walter Moss Seed Co., Ltd.	38 Special BMR	7,930	5,440	11.3	49,900	0.71	2
Seed Resource	BMR 106	6,770	5,160	9.7	66,700	0.66	2
	Mean	11,340	8,070	16.9	51,400	0.69	2
	C.V.%	19.7	19.7	15.3	11.1	11.6	----
	L.S.D.	3,730	2,660	4.3	9,600	0	----

Table 3. Ensilage Quality OPREC Sorghum Silage Performance Trial, 2006.

Company Brand Name	Entry Designation	Lbs Milk/ ton DM	ADF %	NDF %	Lignin %	TDN %	Energy Values (Mcal/lb)		
							Lact.	Maint.	Gain
Seed Resource	BMR 106	2,360	36.4	54.5	4.5	61.0	0.58	0.57	0.31
Walter Moss Seed Co., Ltd.	Millenium BMR	2,300	41.0	58.9	4.8	61.0	0.56	0.56	0.31
Walter Moss Seed Co., Ltd.	4Ever Green BMR	2,260	43.7	64.2	5.2	60.3	0.51	0.55	0.29
Seed Resource	SS 206 BMR	2,180	40.5	59.8	5.0	59.0	0.54	0.54	0.28
Sorghum Partners Inc	NK 300	2,180	38.5	55.7	5.4	57.7	0.55	0.52	0.27
Walter Moss Seed Co., Ltd.	Mega Green BMR	2,160	42.7	64.6	5.1	59.7	0.51	0.54	0.28
NC+ Hybrids	NC+ Nutri-Cane II	2,100	37.8	53.5	5.5	57.7	0.55	0.52	0.26
Seed Resource	FS 515 HQ	2,090	38.9	57.7	5.7	56.7	0.52	0.50	0.25
Sorghum Partners Inc	Trudan Headless BMR	2,050	43.8	60.2	4.9	57.7	0.52	0.52	0.27
NC+ Hybrids	NC+ Nutri-Choice II	1,990	43.4	62.2	5.7	56.0	0.49	0.49	0.24
Sorghum Partners Inc	HIKANE II	1,970	40.3	56.3	5.7	55.7	0.52	0.49	0.24
Seed Resource	SS 204 BMR	1,930	41.3	60.1	5.3	55.0	0.50	0.48	0.23
Walter Moss Seed Co., Ltd.	38 Special BMR	1,890	44.9	63.6	6.5	53.7	0.47	0.46	0.21
Walter Moss Seed Co., Ltd.	SU-2-LM	1,850	44.9	62.3	6.9	52.7	0.46	0.44	0.49
Sorghum Partners Inc	Sordan Headless	1,820	45.2	63.7	6.2	52.7	0.46	0.44	0.19
Walter Moss Seed Co., Ltd.	Mega Green	1,720	46.0	66.5	6.4	51.3	0.42	0.41	0.17
	Mean	2,050	41.8	60.2	5.6	56.7	0.51	0.50	0.25
	C.V.%	7.6	6.6	5.3	12.1	4.3	6.6	7.6	14.2
	L.S.D.	260	4.6	5.3	1.1	4.1	0.06	0.06	0.06