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2016 Sorghum Hybrid Performance
Trials in Eastern Colorado

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SORGHUM HYBRID PERFORMANCE TRIALS IN EASTERN COLORADO, 2016
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The 2016 Colorado grain sorghum crop is estimated at 19.89 million bushels, 10% lower than the 2015 sorghum crop of 22.00 million bushels. The 2015 and 2016 sorghum crops are the first and second largest crops in the past 10 years, respectively. The second highest sorghum production this year was due to the second highest harvested acres, 390,000 acres, for the last 10 years. The grain yield this year was estimated at 51.0 bu/acre, which was 4.0 bu/acre less than last year, but 16.1 bu/acre more than the 10 year average. As the production and yield levels indicate, conditions in Eastern Colorado for 2016 were generally wetter than normal. Sorghum silage statistics are not published during the current year; however, Colorado sorghum silage statistics are available for last year. In 2015, 140,000 tons of sorghum silage was produced. The average yield was 14.0 tons/acre from 10,000 harvested acres. (USDA and National Agricultural Statistics Service, Colorado Field Office, 2016).

This publication is a progress report of the sorghum hybrid performance trials conducted by the Department of Soil and Crop Sciences at Colorado State University, Colorado Agricultural Experiment Station (AES), and Colorado State University Extension. The grain sorghum trials were conducted at three sites in eastern Colorado: Akron, Burlington, and Walsh. Forage sorghum trials were conducted at Rocky Ford (irrigated) and at Walsh (dryland).

Tests are partially funded by entry fees paid by commercial firms. Commercial seed representatives interested in entering sorghum hybrids in any of the trials should contact Jerry Johnson, phone (970) 491-1454, email Jerry.Johnson@colostate.edu; or Kevin Larson, phone (719) 324-5643, email Kevin.Larson@colostate.edu for further details. Names and addresses of firms submitting entries in 2016 are shown in Table 1. Each firm selected entries for testing and furnished seed for the trials. AES researchers selected closed-pedigree hybrids as standards of comparison.

Summary tables for weather data (CoAgMet and NOAA, 2016), soil analysis (Soil, Plant and Water Testing Laboratory, Colorado State University), fertilization, and available soil water graphs derived from gypsum block readings are provided for certain trial locations. Other information, where available, was included: site description, irrigation, pest control, field history, and pertinent comments.

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Table 1.--Entrants in the 2016 Colorado Sorghum Performance Trials.

Brand	Entered by
ALTA SEEDS	Advanta US, 2001 E. 1 st St., P.O. Box 2420, Hereford, TX 79045
BLADE	Ceres, Inc., 1535 Rancho Conejo Blvd., Thousand Oaks, CA 91320
CHS, INC	CHS, Inc., 5500 Cenex Drive, Inver Grove Heights, MN 55077
CROPLAN	Winfield Solutions LLC, P.O. Box 64589, St. Paul, MN 55164
DEKALB	Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167
DYNA-GRO SEED	Crop Production Services, Inc., 3005 Rocky Mountain Ave, Loveland, CO 80538
GAYLAND WARD SEED	Gayland Ward Seed Co. Inc., 4395 US Hwy 60, Hereford, TX 79045
HEARTLAND GENETICS	Heartland Genetics, LLC, 1853 Howard Lane, Beloit, KS 67420
PAWNEE BUTTES	Pawnee Buttes Seed, Inc., P.O. Box 100, 605 25 th St., Greeley, CO 80632
SORGHUM PARTNERS/ CHROMATIN	Chromatin, Inc., 1301 East 50 th St., Lubbock, TX 79404
SUDAX	Forage Genetics International, PO Box 339, Nampa, ID 83653
SUMMER SELECT	La Crosse Seed, 2541 Commerce St., La Crosse, WI 54603
WALTER MOSS SEED CO.	Walter Moss Seed Co., P.O. Box 21114, Waco, TX 76702

Growing Degree Days for sorghum were calculated from planting through first freeze using a maximum of 111°F and a minimum of 50°F for threshold temperatures (Peacock and Heinrich, 1984). They are calculated by averaging daily high and low temperatures and subtracting the base temperature of 50°F from the average. When daily temperatures are less than 50°F, 50°F is used, when temperatures are above 111°F a maximum temperature of 111°F is used:

$$\frac{(\text{Daily Minimum Temp.} + \text{Daily Maximum Temp.})}{2} - 50^{\circ}\text{F}$$

Experimental Methods and Evaluations

Trials were planted with a four-row cone planter and harvested with a modified, self-propelled John Deere 4420 combine equipped with a four-row row-crop head to enhance harvest of lodged tillers. Sorghum forage was cut and chopped with a single row John Deere 8 silage cutter.

Days to Emergence. Seedling emergence was determined as the number of days after planting until approximately half of the seedlings become visible down a planted row.

50% Bloom. Number of days after planting until half of the main heads had pollinating florets. Number of days to half bloom provides a good measure of relative maturity between hybrids.

50% Maturity. Number of days after planting until half of the kernels in half of the main heads reached physiological maturity, i.e., the black layer becomes visible at the base of the kernel.

Plant Height. Plant height was measured in inches from the soil to the tip of the main head.

Lodging. The percentage of tillers with broken basal stems or broken peduncles or were leaning more than a 45 degree angle were considered lodged. Since the combine was equipped with a row crop head, most of the leaning tillers were harvested.

Harvest Density. Plant population in plants per acre was counted prior to harvest.

Test Weight. Test weight was determined using a hand-held bushel weight tester. A low test weight indicates that a hybrid did not fully mature prior to the first freeze or that it suffered environmental stress, such as a water deficiency.

Grain Yield. The grain yield in bushels per acre was adjusted to 14 percent moisture content.

Yield as a % of Test Average. Yield as a percentage of test average provides a comparison between yields within a trial and allows easy comparisons among years, irrespective of annual growing conditions.

Forage Yield. Forage yield in tons per acre was adjusted to 70% moisture content. A representative sample of fresh silage was oven-dried at 167°F (75°C) until there was no more weight loss, and then yields were adjusted to 70% moisture content.

Stem Sugar. The sugar content (Brix), expressed as a percent, in the stem of forage sorghums at harvest was measured with a hand refractometer.

Available Soil Water

Available soil water was measured by placing gypsum blocks at 6, 18, 30, and 42 inches below the soil surface. Electrical resistance readings were made weekly or biweekly. Resistance readings vary with the amount of soil water present. Using resistance readings, available soil water was determined by extrapolating from soil water depletion curves for each particular soil type.

Statistical Method

Trials were planted in a randomized complete block design with four replications. No less than three replications were harvested. Analysis of variance was applied to the results and the least significant difference (LSD) was computed at $\alpha = 0.20$ or 0.30 for all trials. Analysis of variance and regression were performed with CoStat Statistical Software a product of Cohort Software, Berkeley, California.

Acknowledgements

We are appreciative to the staffs at the Central Great Plains Research Station at Akron, Arkansas Valley Research Center, and Plainsman Research Center at Walsh for their assistance in conducting these trials. We would like to extend a special thank you to Tim Stahlecker, grower-cooperator, for his assistance with the Burlington trial.

References

- National Agricultural Statistics Service, Colorado Field Office. 2016. Colorado agricultural statistics 2016. USDA, NASS, CDA. 60p.
- NOAA, May-October, 2016. Climatological data, Colorado. vol. 120, no.5-10. NOAA, Dept. of Commerce, NWS, NESDIS, NCDC.
- Peacock, J.M. and G.M. Heinrich. 1984. Light and temperature response in sorghum. pp. 143-158. In: Agrometeorology of Sorghum and Millet in the Semi-Tropics: Proceedings of the International Symposium. November 15-20, 1982. India, ICRISAT, WMO.
- USDA, National Agricultural Statistics Service, Colorado Field Office. November 9, 2016. News release, crop production – November 2016. USDA, NASS. 2p.

Dryland Grain Sorghum Performance Trial at Burlington, 2016

COOPERATOR: Tim Stahlecker.

PURPOSE: To identify high yielding hybrids under dryland conditions with 2700 sorghum heat units in a loam soil.

PLOT: Four rows with 30 in. row spacing, 35 ft. long. SEEDING DENSITY: 43,600 seed/ac. PLANTED: June 8. HARVESTED: November 14.

PEST CONTROL: Pre-emergence herbicide: Sequence 48 oz/ac. Post emergence herbicide: Huskie 13 oz/ac, Atrazine 0.75 lb/ac, 2,4-D amine. Cultivation: None. Insecticides: None.

SOIL: Satanta-Sampson loam.
FERTILIZER: Nitrogen 40 lb/ac.

FIELD HISTORY: Last Crop: Wheat.

FIELD PREPARATION: No-till.

COMMENTS: Early growing conditions were good however, symptoms resembling iron deficiency appeared on the leaves in July. Foliar iron was applied and it seemed to help, but some symptoms persisted – especially on varieties more susceptible to iron deficiency. Plant stands were reduced in the more impacted areas. Most of the hybrids appeared to mature later than anticipated.

Summary: Growing Season Precipitation and Temperature
Burlington, Kit Carson County.^a

Month	Rainfall	GDD ^b	>90 F	>100 F	DAP ^c
	In		-----no. of days-----		
June	1.88	596	19	1	22
July	1.33	823	23	4	53
August	0.73	673	13	0	84
September	1.22	542	9	0	114
October	0.00	84	0	0	121
Total	5.06	2718	64	5	121

^aGrowing season from June 8 (planting) to October 7 (harvest).

^bGDD: Growing Degree Days for sorghum.

^cDAP: Days After Planting.

2016 Dryland Grain Sorghum Hybrid Performance Trial at Burlington

Brand	Hybrid	Grain		Test Weight	Harvest	Plant Height	Maturity Group ^b	Grain Color
		Yield ^a	Yield		Plant Population			
		bu/ac	% of test avg.	lb/bu	plants/ac	in		
Sorghum Partners	SP 34A19	63.2	149	55.7	19,502	41	ME	Bronze
Sorghum Partners	KS310	61.6	145	59.8	18,783	41	E	Bronze
Dyna-Gro Seed	GX16667	56.8	134	56.5	19,447	42	M	Bronze
Dyna-Gro Seed	GX16957	51.2	121	58.0	19,169	39	E	Bronze
Dekalb	DKS29-28	47.9	113	58.4	17,116	38	E	Bronze
Chromatin, Inc	CHR0L0163	47.1	111	59.2	15,520	41	E	Bronze
Alta Seeds	AG1101	43.6	103	59.1	18,010	37	E	Red
Sorghum Partners	SP 31A15	43.5	102	58.4	19,048	41	E	Bronze
Dyna-Gro Seed	GX16988	42.9	101	59.7	20,050	44	E	Bronze
Dekalb	DKS28-05	40.6	96	60.6	21,136	44	E	Bronze
Alta Seeds	AG1201	32.8	77	58.1	16,490	36	E	Bronze
Alta Seeds	AG2115	29.6	70	57.8	13,989	45	M	Red
Dyna-Gro Seed	M58GR24	29.0	68	59.2	14,562	47	E	Red
Alta Seeds	AG1203	23.4	55	58.0	12,320	43	ME	Bronze
Dyna-Gro Seed	M60GB31	23.0	54	58.2	10,478	38	ME	Bronze
Average		42.4		58.4	17,041	41		

^cLSD (P<0.30)

6.0

^aYields adjusted to 14% moisture and hybrids ranked by yield within maturity group.

^bMaturity Group: E=early; ME=medium-early; M=medium.

^cIf the difference between two varieties yields equals or exceeds the LSD value, there is a 70% chance the difference is significant.

Dryland Grain Sorghum Hybrid Performance Trial at Walsh, 2016

COOPERATOR: Plainsman Agri-Search Foundation, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under dryland conditions with 3000 sorghum heat units in a silt loam soil.

PLOT: Four rows with 30 in. row spacing, 50 ft. long. SEEDING DENSITY: 43,600 seed/a. PLANTED: June 6. HARVESTED: October 28 and 31.

PEST CONTROL: Preemergence Herbicides: Atrazine 1lb/a, S-Metolachlor 21 oz/a, Glyphosate, 32 oz/a; 2,4-D, 0.5 lb/a, Banvel 5 oz/a. Post Emergence Herbicides: Huskie 16 oz/a, Atrazine 0.75 lb/a, AMS 1 lb/a. Cultivation: None. Insecticides: Transform for sugarcane aphids.

FIELD HISTORY: Previous Crop: Wheat. FIELD PREPARATION: Strip-till.

COMMENTS: Planted in good soil moisture for seed germination and plant stand. Weed control was very good. Light infestation of sugarcane aphids, which were controlled by Transform. The growing season precipitation was above average. June, July and August were wet and September was dry. Hybrids at this site had to recover from minor hail damage. Grain yields and test weights were excellent.

SOIL: Richfield silt loam for 0-8" and silt loam 8"-24" depths from soil analysis.

Summary: Growing Season Precipitation and Temperature Walsh, Baca County.^a

Month	Rainfall	GDD ^b	>90 F	>100 F	DAP ^c
	In		-----no. of days-----		
June	3.23	659	21	0	24
July	3.88	898	24	6	55
August	3.68	741	14	0	86
September	0.17	611	10	0	116
October	0.01	106	0	0	123
Total	10.97	3015	69	6	123

^aGrowing season from June 6 (planting) to October 7 (first freeze, 26 F).

^bGDD: Growing Degree Days for sorghum.

^cDAP: Days After Planting.

Summary: Soil Analysis of Plant Available Nutrients.

Depth	pH	Salts	OM	N	P	K	Zn	S
		mmhos/cm	%	-----ppm-----				
0-8"	8.0	0.5	2.4	15	4.7	393	0.9	9.3
8"-24"				13				
Comment	Alka	VLo	Hi	Hi	Lo	VHi	Lo	Lo
Iron was low.								

Summary: Fertilization.

Fertilizer	N	P ₂ O ₅	Zn	S
	-----lb/a-----			
Recommended	0	20	2	20
Applied	50	20	0	0
Yield Goal: 40 bu/a.				
Actual Yield: 85 bu/a.				

**Available Soil Water
Dryland Grain Sorghum, Walsh, 2016**

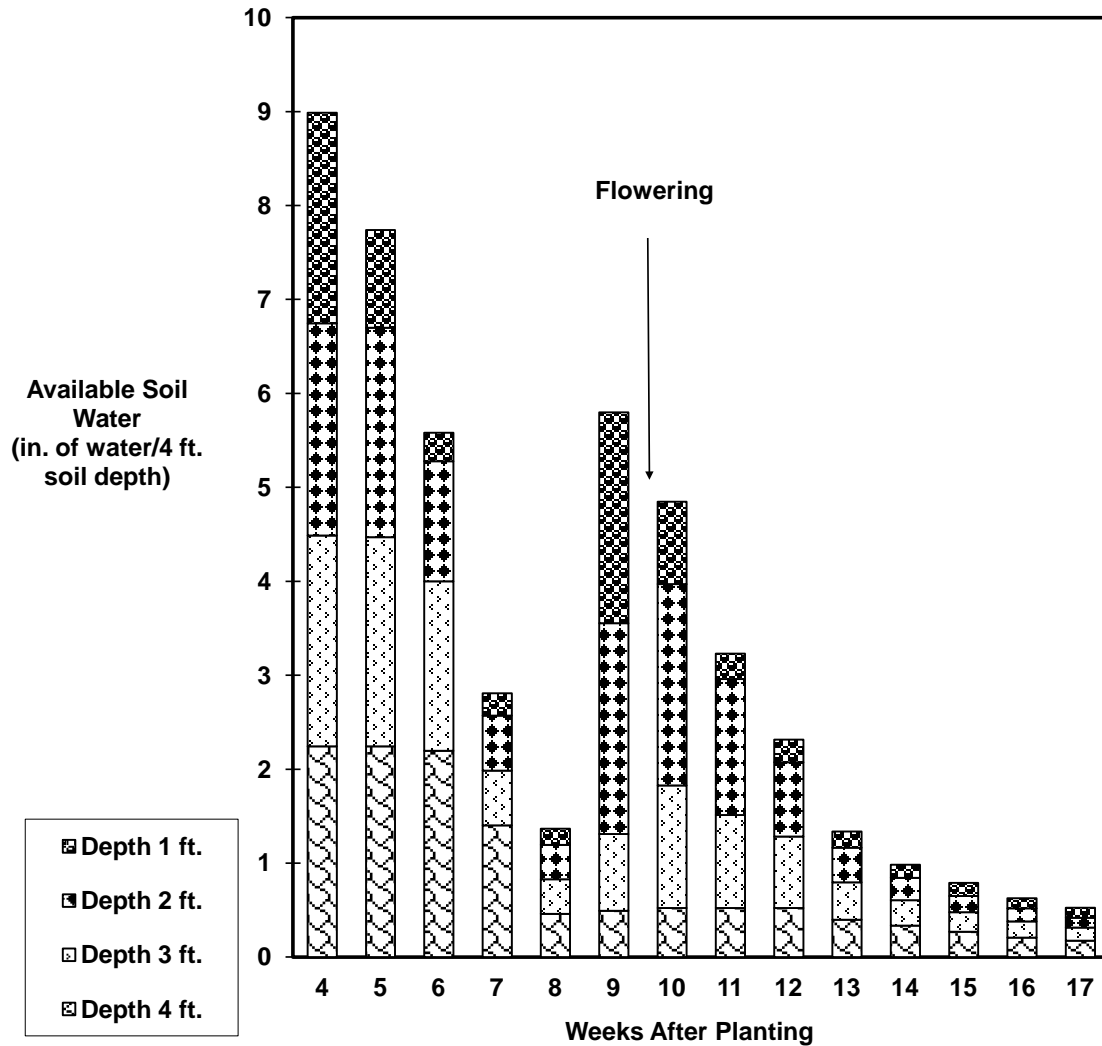


Fig. 1. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 10.97 in. Any increase in available soil water between weeks is from rain.

2016 Dryland Grain Sorghum Hybrid Performance Trial at Walsh.

Source	Hybrid	Yield	Yield	Test	Lodging	Harvest	Plant	50%	GDD ^b	50%	Maturity
		Grain	Percent of	Weight		Plant	Height	Bloom	Mature	Group ^c	
		Yield ^a	Average	lb/bu	percent	Population	in	days		days	
		bu/ac	percent	lb/bu	percent	plants/ac	in	after		after	
								planting		planting ^d	
Alta Seeds	AG1203	112.2	132	60.8	0	25,200	48	68	1914	112	ME
Heartland Genetics	HG44-R	103.2	121	59.7	0	28,700	42	67	1894	114	ME
Gayland Ward Seed	9135	102.5	120	60.6	1	25,900	46	71	1982	118	M
Dyna-Gro Seed	M60GB31	101.6	119	61.1	0	27,100	47	68	1914	114	ME
Gayland Ward Seed	8022	99.5	117	58.1	1	24,400	50	77	2119	123	ML
Gayland Ward Seed	9139	95.1	112	61.3	2	23,200	49	68	1914	113	ME
Gayland Ward Seed	8019	93.3	110	57.4	6	28,300	47	77	2119	121	ML
Sorghum Partners	KS585	92.7	109	61.0	0	29,800	45	73	2035	120	M
Dekalb	DKS29-28	91.7	108	60.8	0	26,700	39	60	1710	106	E
Dyna-Gro Seed	GX16667	89.6	105	58.5	2	30,200	52	76	2096	123	ML
Dyna-Gro Seed	GX16988	89.5	105	59.5	0	27,900	45	63	1780	107	ME
Gayland Ward Seed	9076	86.1	101	58.1	13	23,600	53	74	2063	119	M
Gayland Ward Seed	9059	85.8	101	59.8	0	27,500	50	67	1894	112	ME
Sorghum Partners	SP 34A19	85.6	101	58.7	0	35,600	41	65	1835	111	ME
Sorghum Partners	KS310	85.0	100	60.7	0	29,800	43	63	1780	109	ME
Dekalb	DKS28-05	84.8	100	59.9	0	31,400	43	60	1710	107	E
Gayland Ward Seed	9138	84.6	99	61.2	2	22,900	54	69	1936	115	ME
Heartland Genetics	HG23-R	84.0	99	60.8	0	30,600	40	62	1754	107	ME
Alta Seeds	AG2115	83.6	98	59.6	0	27,100	45	71	1982	118	M
Sorghum Partners	SP 31A15	80.5	95	59.6	0	23,600	42	64	1807	111	ME
Dyna-Gro Seed	M58GR24	80.1	94	59.9	5	23,600	48	60	1710	105	E
Dyna-Gro Seed	GX16957	79.9	94	60.8	0	27,100	35	59	1680	105	E
Alta Seeds	AG1201	77.7	91	59.3	0	24,800	37	62	1754	106	ME
Dyna-Gro Seed	M71GR75	77.5	91	56.2	6	28,300	61	79	2168	HD	ML
Sorghum Partners	SP 33S40	77.0	90	61.2	0	24,400	46	61	1732	107	E
Gayland Ward Seed	9134	76.6	90	60.7	10	25,200	52	73	2035	120	M
Sorghum Partners	Chrolo163	75.3	88	60.5	0	16,700	44	66	1867	113	ME
Alta Seeds	AG1101	64.9	76	60.2	0	24,800	33	56	1589	100	E
Heartland Genetics	HG18-R	64.6	76	60.8	0	25,200	39	58	1649	103	E
Sorghum Partners	SP 3303	49.7	58	60.4	1	19,800	42	61	1732	109	E
Average		85.1		59.9	2	26,300	45	67	1872	112	ME
^a LSD (P<0.20)		7.6			2						

^aYields adjusted to 14% moisture.

^bGDD: Growing degree days to 50% bloom date.

^cMaturity Group: E=early; ME=medium-early; M=medium; ML=medium late.

^dDays after planting or seed maturation. HD = hard dough.

^eIf the difference between two varieties yields equals or exceeds the LSD value, there is a 95% (at P<0.05) or 80% (at P<0.20) chance the difference is statistically significant.

Table 4. Summary: Dryland Grain Sorghum Hybrid Performance Trials at Walsh, 2014-2016.

Brand	Hybrid	Maturity Group ^a	Grain Yield					Yield as % of Test Average				
			2014	2015	2016	2-Year Avg	3-Year Avg	2014	2015	2016	2-Year Avg	3-Year Avg
Alta Seeds	AG1203	ME	54	38	112	75	68	111	98	132	121	119
Alta Seeds	AG1201	ME	55	44	78	61	59	114	112	91	98	103
Alta Seeds	AG1101	E	44	41	65	53	50	91	104	76	85	88
Dekalb	DKS29-28	E	--	37	92	64	--	--	95	108	104	--
Alta Seeds	AG2115	M	--	42	84	63	--	--	107	98	101	--
Dekalb	DKS28-05	E	--	34	85	59	--	142	130	130	96	--
Average			48	39	85	62	57					

^aMaturity Group: E=early; ME=medium early; M=medium.
 Grain Yields were adjusted to 14.0% seed moisture content.

Drip Irrigated Grain Sorghum Hybrid Performance Trial at Walsh, 2016

COOPERATOR: Plainsman Agri-Search Foundation, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under subsurface drip irrigated conditions with 3000 sorghum heat units in a silt loam soil.

PLOT: Four rows with 30 in. row spacing, 50 ft. long. SEEDING DENSITY: 87,100 seed/a. PLANTED: June 7. HARVESTED: October 28.

PEST CONTROL: Preemergence Herbicides: Atrazine 1lb/a, S-Metolachlor 21 oz/a, Glyphosate, 32 oz/a; 2,4-D, 0.5 lb/a, Banvel 5 oz/a. Post Emergence Herbicides: Huskie 16 oz/a, Atrazine 0.75 lb/a, AMS 1 lb/a. Cultivation: None. Insecticides: Transform for sugarcane aphids.

Irrigation: Eight subsurface drip irrigations, totaling 10.6 in/a.

Summary: Growing Season Precipitation and Temperature Walsh, Baca County.^a

Month	Rainfall	GDD ^b	>90 F	>100 F	DAP ^c
	In		-----no. of days-----		
June	3.23	640	21	0	23
July	3.88	898	24	6	54
August	3.68	741	14	0	85
September	0.17	611	10	0	115
October	0.01	106	0	0	122
Total	10.97	2996	69	6	122

^aGrowing season from June 7 (planting) to October 7 (first freeze, 26 F).

^bGDD: Growing Degree Days for sorghum.

^cDAP: Days After Planting.

FIELD HISTORY: Previous Crop: Sunflower. FIELD PREPARATION: No-till.

COMMENTS: Planted in good soil moisture for seed germination and plant stand. Weed control was good. Light infestation of sugarcane aphids, which were controlled by Transform. The growing season precipitation was above average. June, July and August were wet and September was dry. Hybrids at this site had to recover from severe hail damage. Grain yields and test weights were good.

SOIL: Richfield silt loam for 0-8" and silt loam 8"-24" depths from soil analysis.

Summary: Soil Analysis of Plant Available Nutrients.								
Depth	pH	Salts	OM	N	P	K	Zn	S
		mmhos/cm	%	-----ppm-----				
0-8"	7.8	0.6	2.3	24	6.1	444	0.5	11.5
8"-24"				13				
Comment	Alka	VLo	VHi	VHi	Lo	VHi	Lo	Lo
Iron was low.								

Summary: Fertilization.				
Fertilizer	N	P ₂ O ₅	Zn	S
	-----lb/a-----			
Recommended	0	40	2	20
Applied	150	20	0.3	0
Yield Goal: 80 bu/a.				
Actual Yield: 98 bu/a.				

Available Soil Water Subsurface Drip Irrigated Grain Sorghum, Walsh, 2016

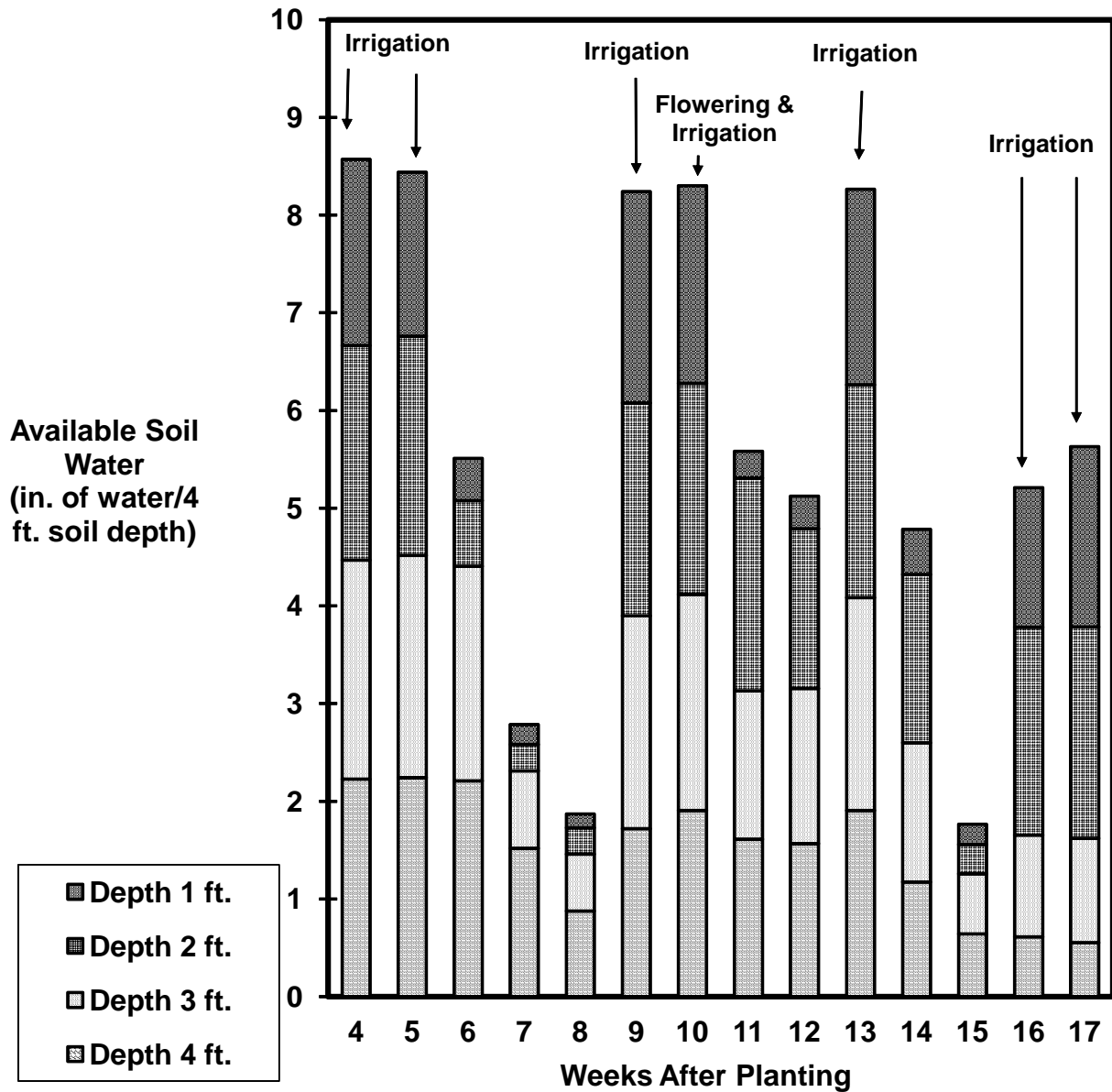


Fig. 2. Available soil water in drip irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 10.97 in. Any increase in available soil water between weeks not attributed to irrigation is from rain

2016 Subsurface Drip Irrigated Grain Sorghum Hybrid Performance Trial at Walsh.

Source	Hybrid	Grain Yield ^a	Yield		Lodging	Harvest Plant Population	Plant Height	50% Bloom	GDD ^b	50% Mature	Maturity Group ^c
			Percent of Trial Average	Test Weight							
		bu/ac	percent	lb/bu	percent	plants/ac	in	days after planting		days after planting ^d	
Dyna-Gro Seed	GX16988	101.1	119	58.9	18	41,000	49	61	1754	106	E
Dyna-Gro Seed	GX16957	84.0	99	59.8	0	40,300	40	57	1649	103	E
Sorghum Partners	SP 33S40	70.6	83	60.0	3	32,900	46	61	1754	107	E
Sorghum Partners	SP 3303	59.0	69	60.0	8	33,700	41	59	1710	108	E
Alta Seeds	AG1203	120.1	141	61.0	5	41,400	48	66	1894	112	ME
Sorghum Partners	SP 34A19	104.6	123	58.7	9	42,200	44	63	1807	109	ME
Alta Seeds	AG1201	80.7	95	57.8	1	36,400	37	62	1780	108	ME
Sorghum Partners	KS585	117.6	138	61.6	12	38,000	48	69	1957	115	M
Dyna-Gro Seed	M60GB31	115.0	135	60.2	2	44,900	48	68	1936	115	M
Alta Seeds	AG2115	107.5	126	58.4	22	44,500	47	67	1914	113	M
Dekalb	DKS38-16	101.6	119	59.4	19	45,300	54	70	1983	117	M
Dekalb	DKS51-01	111.6	131	59.7	10	41,400	51	72	2035	119	ML
Dyna-Gro Seed	M71GR75	105.1	124	57.2	22	46,500	63	77	2142	HD	ML
Dyna-Gro Seed	GX16667	95.1	112	56.7	8	32,900	59	78	2168	HD	ML
Average		98.1		59.2	10	40,100	48	66	1892	113	ME

^eLSD (P<0.20)

11.4

7

^aYields adjusted to 14% moisture and hybrids ranked by yield within maturity group.

^bGDD: Growing degree days to 50% bloom date.

^cMaturity Group: E=early; ME=medium-early; M=medium; ML=medium late.

^dDays after planting or seed maturation. HD = hard dough.

^eIf the difference between two varieties yields equals or exceeds the LSD value, there is a 95% (at P<0.05) or 80% (at P<0.20) chance the difference is statistically significant.

Dryland Forage Sorghum Performance Trial at Walsh, 2016

COOPERATOR: Plainsman Agri-Search Foundation, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under dryland conditions with 3100 sorghum heat units in a silt loam soil.

PLOT: Four rows with 30 in. row spacing, 50 ft. long. SEEDING DENSITY: 69,700 seed/a. PLANTED: June 6. HARVESTED: October 18.

PEST CONTROL: Preemergence Herbicides: Atrazine 1 lb/a, S-Metolachlor 21 oz/a, Glyphosate 32 oz/a, 2,4-D 0.5 lb/a, Dicamba 5 oz/a. Post Emergence Herbicides: Huskie 16 oz/a, Atrazine 0.75 lb/a, AMS 1 lb/a. Cultivation: None. Insecticides: Transform for sugarcane aphids.

FIELD HISTORY: Previous Crop: Wheat. FIELD PREPARATION: Strip-till.

Summary: Growing Season Precipitation and Temperature Walsh, Baca County.^a

Month	Rainfall	GDD ^b	>90 F	>100 F	DAP ^c
	In		-----no. of days-----		
June	3.23	659	21	0	24
July	3.88	898	24	6	55
August	3.68	741	14	0	86
September	0.17	611	10	0	116
October	0.01	106	0	0	123
Total	10.97	3015	69	6	123

^aGrowing season from June 6 (planting) to October 18 (harvest).

^bGDD: Growing Degree Days for sorghum.

^cDAP: Days After Planting.

COMMENTS: Planted in good soil moisture for seed germination and plant stand. Weed control was very good. Light infestation of sugarcane aphids, which were controlled with an application of Transform. The growing season precipitation was above average. June, July and August were wet and September was dry. Hybrids at this site had to recover from minor hail damage. Forage yields were good.

SOIL: Richfield silt loam for 0-8" and silt loam 8"-24" depths from soil analysis.

Summary: Soil Analysis of Plant Available Nutrients.

Depth	pH	Salts	OM	N	P	K	Zn	S
		mmhos/cm	%	-----ppm-----				
0-8"	8.1	0.5	2.5	13	3.9	365	0.9	8.5
8"-24"				13				
Comment	Alka	VLo	VHi	Mod	Lo	VHi	Lo	Lo
Iron was marginal.								

Summary: Fertilization.

Fertilizer	N	P ₂ O ₅	Zn	S
	-----lb/a-----			
Recommended	100	20	2	20
Applied	50	20	0	0
Yield Goal: 8 tons/a.				
Actual Yield: 11.6 tons/a.				

**Available Soil Water
Dryland Forage Sorghum, Walsh, 2016**

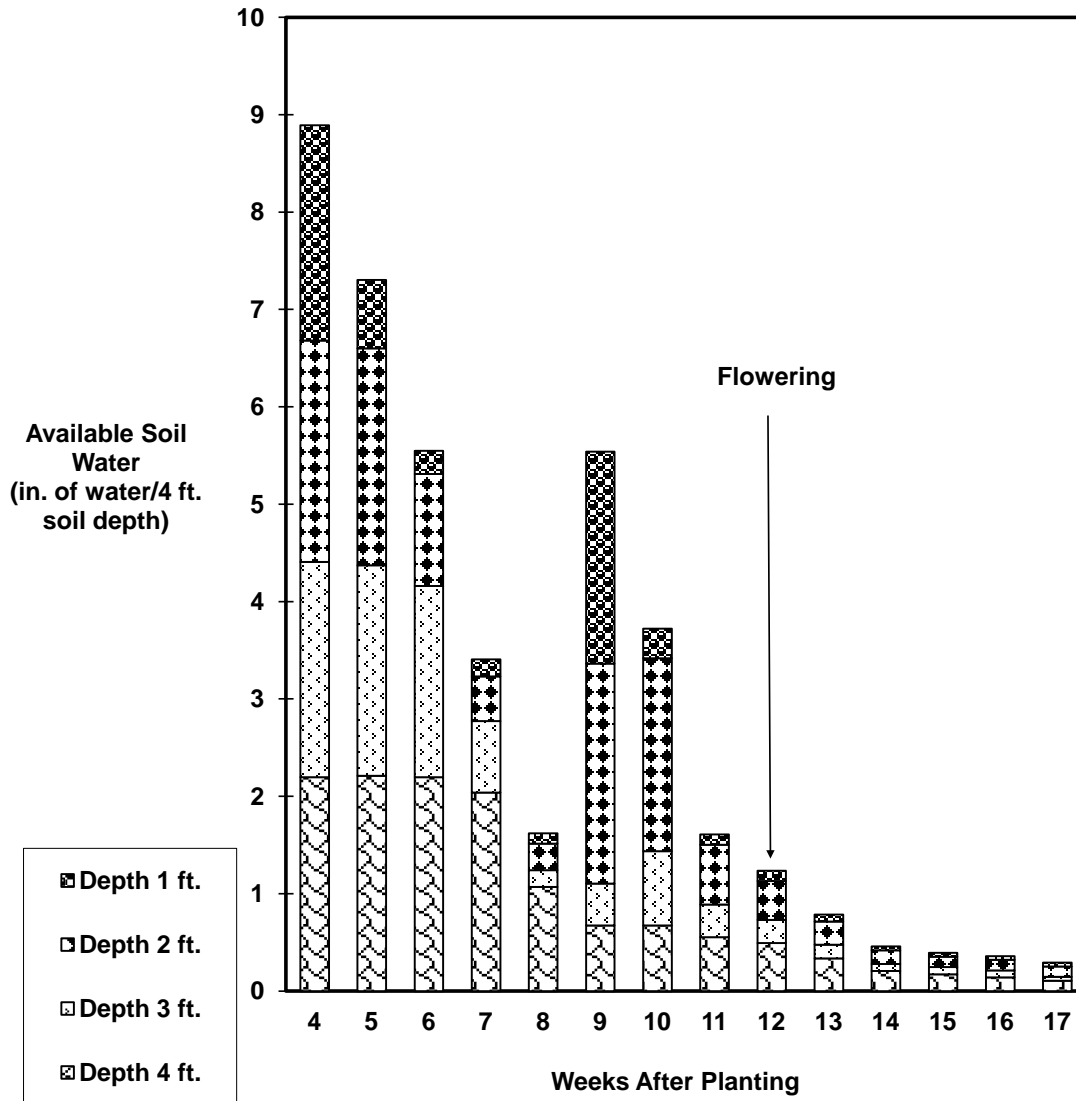


Fig. 3. Available soil water in dryland forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 10.97 in. Any increase in available soil water between weeks is from rain.

2016 Dryland Hybrid Forage Sorghum Performance Trial at Walsh

Brand	Hybrid	Forage		Stem Sugar	Harvest Density	Plant Height	Plant Lodging	Days to Boot	Relative Maturity ^b	Forage Type ^c	Traits
		Yield ^a tons/ac	Yield % of test avg.								
Blade	F4C207	15.7	135	11.0	34.5	86	8	73	M	FS	-
Sorghum Partners	Sordan Headless	14.3	123	11.9	38.7	99	0	Veg	PS	SS	-
Sudax	331 BMR	14.3	123	13.0	30.2	58	0	92	L	FS	BMR
Croplan	BMR 3411	14.2	122	15.5	29.0	97	0	84	ML	FS	BMR
Summer Select	FS 95 BMR BD	14.1	121	7.8	41.4	80	40	79	M	FS	BMR-6, BD
CHS, Inc.	HighYield	13.6	116	11.2	24.0	109	0	87	L	SS	-
Sorghum Partners	Hikane II	13.4	115	7.3	29.0	96	4	63	ME	FS	-
Sorghum Partners	SP1615	13.1	113	11.2	30.6	86	0	Veg	PS	FS	-
CHS, Inc.	HighYield BMR	12.2	105	12.2	29.8	95	1	95	L	SS	BMR
CHS, Inc.	HighYield BMR Dwarf	12.0	103	4.4	29.4	83	5	68	ME	SS	BMR
Sorghum Partners	SP4105	11.5	99	14.5	45.3	64	0	Veg	PS	SS	BMR
Sorghum Partners	Millex32	10.8	93	9.9	19.4	83	0	54	E	Millet	-
Blade	F4C204	10.6	91	17.7	34.5	93	1	64	ME	FS	-
Croplan	BMR 3561	10.5	91	12.3	34.9	85	0	73	M	FS	BMR
Croplan	BMR 3631	10.3	89	12.5	30.6	69	0	89	ML	FS	BMR
Blade	S4B230	10.2	87	7.8	31.0	107	0	64	ME	FS	BMR
Sudax	EXP1601	9.2	79	14.4	27.1	96	0	70	ME	FS	-
Mycogen Seeds	2V709 (corn)	8.3	71	10.6	21.7	78	0	64	ME	Corn	-
Sorghum Partners	SP4555	7.9	68	14.8	37.6	89	35	57	E	FS	-
Sorghum Partners	Millex BMR	6.5	56	11.1	7.4	85	0	79	M	Millet	BMR
Average		11.6		11.6	30.3	87	5	74			

^eLSD (P<0.20)

1.4

^aYields are adjusted to 70% moisture content based on oven-dried samples.

^bRelative Maturity: E=early; ME=medium-early; M=medium; ML=medium-late; L=late; PS=photoperiod sensitive.

^cForage Type: FS=forage sorghum; S=sudangrass; SS=sorghum sudangrass; Millet=hybrid pearl millet.

^dTraits: BD=brachytic dwarf; BMR=brown mid-rib; BMR-6=one of the three main brown mid-rib genes.

^eIf the difference between two varieties yields equals or exceeds the LSD value, then they are significantly different with less than 20% probability that the difference is due to random error.

2016 Dryland Hybrid Forage Sorghum Performance Trial Feed Quality at Walsh

Brand	Hybrid ^a	Forage Type ^b	RFQ	CP	ADF	NDF	NDFD	IVTDMD	TDN	Net Energy		
										Main.	Gain	Lact.
										MCal/lb		
Blade	F4C207	FS	147	11.8	32.6	62.3	62	74.6	65.4	0.68	0.41	0.67
Sorghum Partners	Sordan Headless	SS	146	7.7	30.1	54.3	63	76.4	68.2	0.72	0.44	0.71
Sudax	331 BMR	SS	149	11.0	32.4	61.6	63	75.2	65.7	0.68	0.41	0.68
Croplan	BMR 3411	FS	145	11.6	33.4	63.0	64	75.8	64.5	0.66	0.40	0.66
Summer Select	FS 95 BMR BD	FS	152	11.4	32.6	63.6	64	74.3	65.4	0.68	0.41	0.67
CHS, Inc.	HighYield	SS	140	10.4	34.6	62.6	57	70.2	63.1	0.64	0.38	0.65
Sorghum Partners	HiKane II	FS	162	12.8	29.8	58.7	64	77.0	68.6	0.72	0.45	0.71
Sorghum Partners	SP1615	FS	145	9.4	30.4	57.0	59	73.9	67.9	0.71	0.44	0.70
CHS, Inc.	HighYield BMR	SS	141	10.3	32.6	62.7	62	75.6	65.3	0.68	0.41	0.67
CHS, Inc.	HighYield BMR Dwarf	SS	142	12.1	33.4	64.8	62	74.7	64.5	0.66	0.40	0.66
Sorghum Partners	SP4105	SS	159	7.7	32.7	56.1	68	78.7	65.3	0.67	0.41	0.67
Sorghum Partners	Millex32	Mil	136	19.8	28.7	58.6	66	77.2	69.9	0.74	0.47	0.72
Blade	F4C204	FS	144	12.3	31.6	62.5	59	72.9	66.5	0.69	0.42	0.69
Croplan	BMR 3561	FS	156	14.5	31.3	59.8	68	78.3	66.8	0.70	0.43	0.69
Croplan	BMR 3631	FS	162	11.8	31.5	61.4	67	77.2	66.7	0.69	0.42	0.69
Blade	S4B230	SS	139	13.5	32.8	63.1	59	72.3	65.2	0.67	0.41	0.67
Sudax	EXP1601	SS	156	12.6	31.5	62.2	67	78.0	66.6	0.69	0.42	0.69
Mycogen Seeds	2V709 (corn)	Corn	132	14.5	32.2	63.3	61	74.4	65.8	0.68	0.41	0.68
Sorghum Partners	SP4555	FS	176	15.0	28.2	56.2	70	79.4	70.4	0.75	0.47	0.73
Sorghum Partners	Millex BMR	Mil	143	18.3	29.3	60.0	67	77.7	69.1	0.73	0.46	0.72
Average			149	12.4	31.6	60.7	64	75.7	66.5	0.69	0.42	0.69

^aHybrids ranked according to relative feed quality score (RFQ)

^bForage Type: FS=forage sorghum; S=sudangrass; SS=sorghum sudangrass

RFQ=relative forage quality; CP=crude protein; ADF=acid detergent fiber; NDF=neutral detergent fiber; NDFD=neutral detergent fiber digestibility (48 hr); IVTDMD=in vitro total dry matter digestibility (48 hr); TDN=total digestible nutrients; Main.=maintenance; Lact.=lactation

Irrigated Forage Sorghum Hybrid Performance Trial at Rocky Ford, 2016

COOPERATOR: Arkansas Valley Research Center.

PURPOSE: To identify high yielding hybrids under irrigated conditions with 2650 sorghum heat units in a silty clay loam soil.

PLOT: Two rows with 30 in. row spacing, 35 ft. long. SEEDING DENSITY: 113,250 seed/a. PLANTED: May 25. HARVESTED: September 27.

IRRIGATION: Four furrow irrigations: total applied 24 a-in./a.

PEST CONTROL: Preemergence Herbicides: Post Emergence Herbicides: WeedMaster 16 oz/a. Cultivation: Once. Insecticides: None.

SOIL: Rocky Ford silty clay loam. FERTILIZER: N at 27 and P2O5 69 lb/ac as 18-46-0.

FIELD HISTORY: Previous Crop: Corn. FIELD PREPARATION: Disc, plow, disc, level, and furrow.

COMMENTS: Planted in adequate soil moisture for seed germination and stand establishment. Weed control was good. The growing season precipitation was above average with a wet June. The forage yields were excellent.

Summary: Growing Season Precipitation and Temperature Rocky Ford, Otero County.^a

Month	Rainfall	GDD ^b	>90 F	>100 F	DAP ^c
	In		-----no. of days-----		
May	1.80	100	0	0	6
June	2.20	726	20	2	36
July	1.68	646	26	6	67
August	1.78	670	13	0	98
September	0.51	522	9	0	125
Total	7.97	2664	68	8	125

^aGrowing season from May 25 (planting) to September 27. (harvest).

^bGDD: Growing Degree Days for sorghum.

^cDAP: Days After Planting.

2016 Irrigated Hybrid Forage Sorghum Performance Trial at Rocky Ford

Brand	Hybrid	Forage Yield ^a tons/ac	Yield % of test avg.	Stem Sugar %	Plant Height in	Lodging %	Relative Maturity ^b	Forage Type ^c	Traits ^d
Sorghum Partners	SS405	53.7	158	3.5	124	0	L	FS	-
Sorghum Partners	SP1880	51.3	151	6.0	130	0	L	FS	-
Walter Moss Seed Co.	MEGA GREEN	44.7	132	11.0	121	0	PS	SS	-
Sorghum Partners	SP1615	44.0	129	10.0	123	0	PS	FS	-
Gayland Ward Seed	Sweet Six BMR	43.6	128	13.0	105	1	ME	SS	BMR, DS
CHS, Inc.	HighYield	41.9	123	2.0	128	0	L	SS	-
Chromatin, Inc.	CHR14FB0240	41.7	123	5.5	105	2	M	FS	BMR
Summer Select	FS 95 BMR BD	40.4	119	3.0	96	6	ME	FS	BMR-6, BD
Pawnee Buttes Seed	PB Arikaree	40.2	118	9.5	112	0	L	SS	-
Sorghum Partners	Sordan Headless	39.7	117	-	128	0	PS	SS	-
Sorghum Partners	SS304	37.9	111	3.5	122	1	L	FS	-
Gayland Ward Seed	Sweet Forever BMR	37.9	111	11.0	109	0	PS	SS	BMR
Alta Seeds	AF7201	37.2	109	2.0	94	2	ME	FS	BMR-6, DS
Gayland Ward Seed	Super Sugar (delayed mat.)	37.1	109	2.0	126	0	L	SS	-
Walter Moss Seed Co.	4EVER GREEN	34.5	101	7.0	114	0	PS	FS	-
Gayland Ward Seed	EXP 10216	34.5	101	7.0	104	1	M	-	-
Sorghum Partners	NK300	34.4	101	5.5	85	1	E	FS	-
Alta Seeds	AF8301	33.7	99	2.0	83	1	M	FS	BMR
Sorghum Partners	SP2774 BMR	33.1	97	11.0	97	0	ME	FS	BMR
Sorghum Partners	SP2876	32.3	95	3.0	112	0	ME	FS	BMR
Gayland Ward Seed	GW-400 BMR (sterile)	31.7	93	7.0	102	1	ME	FS	BMR, MS
Gayland Ward Seed	Nutra-King BMR 6	31.7	93	9.0	106	2	ME	SS	BMR-6
Alta Seeds	AF7301	31.5	93	4.0	90	1	M	FS	BMR-6, MS
Sorghum Partners	Hikane II	31.2	92	4.0	108	1	M	FS	-
Gayland Ward Seed	Super Sugar	30.7	90	7.0	101	0	ME	SS	-
Sorghum Partners	Red+Top Plus BMR	30.1	89	4.0	110	1	ME	FS	BMR, MS
Gayland Ward Seed	GW-600 BMR (fertile)	29.5	87	5.0	120	2	M	FS	BMR
CHS, Inc.	HighYield BMR Dwarf	29.0	85	3.5	100	1	ME	SS	BMR
Alta Seeds	AF7401	28.0	82	6.5	76	0	L	FS	BMR-6, BD
Gayland Ward Seed	GW-2120 (sterile)	28.0	82	3.0	96	0	M	FS	MS
Chromatin, Inc.	CHR12FS0012	27.9	82	2.5	96	2	M	FS	-
Pawnee Buttes Seed	PB EXP 5143	27.8	82	1.0	90	1	L	FS	-
Sorghum Partners	SP3903 BD	25.0	74	8.5	74	0	ML	FS	BMR, BD
Pawnee Buttes Seed	PB Arapahoe	24.2	71	2.5	94	3	ME	SS	BMR
Gayland Ward Seed	Silo Pro BMR (fertile)	23.6	69	2.5	86	0	ML	FS	BMR-6, BD
Sorghum Partners	SP4105	23.6	69	6.5	99	1	PS	SS	BMR
CHS, Inc.	HighYield BMR	23.1	68	11.0	112	1	L	SS	BMR
Sorghum Partners	SP3902 BD	22.5	66	7.0	81	0	ML	FS	BMR, BD
Average		34.0		5.7	104	1			

^aLSD (P<0.20)

4.8

^aYields are adjusted to 70% moisture content based on oven-dried samples.

^bRelative maturities are provided by the companies. E=early; ME=medium-early; M=medium; ML=medium-late; L=late; PS=photoperiod sens

^cForage Type: FS=forage sorghum; SS=sorghum sudangrass.

^dTraits are provided by the companies. Dashes mean no traits are present or information isn't available. BD=brachytic dwarf; BMR=brown mid-rib; BMR-6=one of the three main brown mid-rib genes; DS=dry stalk; MS=male sterile.

^eIf the difference between two varieties yields equals or exceeds the LSD value, then they are significantly different with less than 20% probability that the difference is due to random error.

2016 Irrigated Hybrid Forage Sorghum Performance Trial Feed Quality at Rocky Ford

Brand	Hybrid ^a	Forage Type ^b	Net Energy							
			RFV	CP	ADF	NDF	TDN	Main.	Gain	Lact.
			index	percent					MCal/lb	
Sorghum Partners	NK300	FS	174	7.6	28.3	35.6	67.4	0.71	0.43	0.70
Gayland Ward Seed	Silo Pro BMR (fertile)	FS	171	8.1	26.6	37.1	67.9	0.71	0.44	0.70
Gayland Ward Seed	Nutra-King BMR 6	SS	163	8.8	29.8	37.6	67.0	0.70	0.43	0.69
Alta Seeds	AF8301	FS	162	6.9	29.6	37.8	67.0	0.70	0.43	0.69
Gayland Ward Seed	Super Sugar	SS	160	8.0	30.5	38.0	66.7	0.70	0.43	0.69
Pawnee Buttes Seed	PB EXP 5143	FS	151	8.5	30.9	39.9	66.6	0.69	0.42	0.69
Sorghum Partners	SS405	FS	151	7.4	31.4	39.7	66.5	0.69	0.42	0.69
Chromatin, Inc.	CHR12FS0012	FS	145	7.4	31.4	41.4	66.4	0.69	0.42	0.69
Alta Seeds	AF7401	FS	141	8.8	31.3	42.7	66.5	0.69	0.42	0.69
Chromatin, Inc.	CHR14FB0240	FS	141	6.9	32.8	41.7	66.0	0.68	0.42	0.68
Sorghum Partners	SS304	FS	140	7.8	32.8	42.1	66.0	0.68	0.42	0.68
Gayland Ward Seed	GW-2120 (sterile)	FS	138	7.6	33.4	42.5	65.9	0.68	0.41	0.68
Summer Select	FS 95 BMR BD	FS	135	8.7	32.8	43.7	66.0	0.68	0.42	0.68
Sorghum Partners	SP3902 BD	FS	135	9.0	31.9	44.3	66.3	0.69	0.42	0.68
Alta Seeds	AF7301	FS	130	8.7	33.3	45.2	65.9	0.68	0.41	0.68
Sorghum Partners	SP3903 BD	FS	130	8.5	32.3	45.6	66.2	0.69	0.42	0.68
Pawnee Buttes Seed	PB Arapahoe	SS	129	6.7	33.6	45.4	65.8	0.68	0.41	0.68
Alta Seeds	AF7201	FS	128	8.1	33.0	46.0	66.0	0.68	0.42	0.68
Gayland Ward Seed	GW-400 BMR (sterile)	FS	127	8.4	35.0	45.2	65.3	0.67	0.41	0.67
CHS, Inc.	HighYield BMR Dwarf	SS	123	6.9	34.6	47.0	65.5	0.68	0.41	0.67
Sorghum Partners	Red+Top Plus BMR	FS	117	7.5	36.4	48.2	64.9	0.67	0.40	0.67
Gayland Ward Seed	Super Sugar (delayed mat.)	SS	117	6.2	37.5	47.4	64.6	0.66	0.40	0.66
Sorghum Partners	SP2876	FS	116	6.9	37.1	48.3	64.7	0.67	0.40	0.67
CHS, Inc.	HighYield	SS	115	6.4	37.7	48.3	64.5	0.66	0.40	0.66
Sorghum Partners	SP2774 BMR	FS	112	6.5	37.1	49.8	64.7	0.67	0.40	0.67
Gayland Ward Seed	GW-600 BMR (fertile)	FS	111	7.1	37.3	50.2	64.6	0.66	0.40	0.67
Sorghum Partners	Hikane II	FS	109	6.4	38.7	50.1	64.2	0.66	0.39	0.66
Gayland Ward Seed	EXP 10216	-	103	6.5	38.6	53.3	64.2	0.66	0.39	0.66
Gayland Ward Seed	Sweet Forever BMR	SS	102	6.4	39.5	52.9	63.9	0.65	0.39	0.66
Gayland Ward Seed	Sweet Six BMR	SS	102	7.9	39.6	52.8	63.9	0.65	0.39	0.66
CHS, Inc.	HighYield BMR	SS	101	8.3	39.8	53.1	63.9	0.65	0.39	0.66
Sorghum Partners	SP1880	FS	95	6.3	41.8	55.4	63.3	0.64	0.38	0.65
Walter Moss Seed Co.	4EVER GREEN	FS	93	8.0	41.7	56.3	63.3	0.64	0.38	0.65
Pawnee Buttes Seed	PB Arikaree	SS	88	6.4	44.4	57.3	62.5	0.63	0.37	0.64
Sorghum Partners	SP4105	SS	83	9.3	44.9	60.7	62.3	0.63	0.37	0.64
Sorghum Partners	Sordan Headless	SS	81	8.3	46.1	61.2	61.9	0.62	0.36	0.64
Sorghum Partners	SP1615	FS	80	6.6	46.1	62.0	61.9	0.62	0.36	0.63
Walter Moss Seed Co.	MEGA GREEN	SS	75	6.0	48.2	63.4	61.3	0.61	0.35	0.63
Average			123	7.5	36.0	47.6	65.0	0.67	0.40	0.67

^aHybrids ranked according to relative feed value index score (RFV).

^bForage Type: FS=forage sorghum; S=sudangrass; SS=sorghum sudangrass.

All analyses results are dry basis values. RFV=relative feed value; CP=crude protein; ADF=acid detergent fiber; NDF=neutral detergent fiber; TDN=total digestible nutrients; Main.=maintenance; Lact.=lactation.