University of California ANR Grain and Forage Sorghum Variety Trials – *September, 2022*

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Full sorghum variety trial reports for this and prior years are available at: https://sorghum.ucanr.edu

Grain Sorghum Variety Trials

Sorghum [*Sorghum bicolor* (L.) Moench] is the fifth most important cereal crop globally, ranking in total production behind rice, maize, wheat, and barley. Sorghum is not new to California, however, having been first introduced to the state in the late 1800's as a drought tolerant forage for animal feed. Forage sorghums, which tend to use less water than other forage crops, received some renewed interest from growers within the past decade because of multiple periods of extended drought and limited irrigation water issues facing forage producters. Grain sorghum cultivars possess many of the same characteristics in terms of ability to tolerate periods of reduced water availability but still produce an economic crop, making it a viable option particularly during years when growers are trying to make difficult decisions about which crops to fully irrigate when water supplies are limited. Sorghum has also proved to be a useful rotation crop in some annual cropping systems, both in reducing weed populations (particularly forage sorghum) and in reducing disease pressure. In the mid-1960's, yields in CA were approximately double the national sorghum yields at 70 bu acre^{-1}or 3920 lbs acre^{-1}. Hybrid grain sorghums had only been introduced to the United States in the late 1950's and only started to have a real impact on yields in the late 1960's. Modern grain sorghum cultivars that are well-managed under irrigated conditions have substantially higher yields, and this can be an important factor when considering if it can be economically feasible as a crop choice. The University of California Agriculture and Natural Resources (ANR) began sorghum grain hybrid evaluation trials in 2016, and this report presents data from three field trial locations in 2021. In 2021, seed companies provided 17 commercial grain sorghum hybrids for fully irrigated studies. At all locations, irrigation amounts were estimated to meet estimated crop evapotranspiration (ETc) demand. Fertilizer applications followed regional recommendations for grain sorghum, adjusted for beginning residual soil nitrate-N levels measured in the upper 24 inches of the soil profile. Planting dates, harvest dates and grain yield averages are shown below.

Trial Site	Planting Date	Harvest Date
Kearney REC	June 10	November 1
West Side REC	June 8	November 2
UC Davis Farm	May 17	November 30

Table 1. Various agronomic and yield characteristics for grain sorghum hybrids (averages for each site shown for 3 trial locations in California in 2021, Kearney, WestSide, and UC Davis Farm locations.

Hybrid Information			Grain Yield bu ac^{-1}		
Entry	**Company**	**Hybrid**	**Kearney**	**West Side**	**UC Davis**
1	Dyna-Gro	M59GN94	95.4	124.7	186.4
2	Dyna-Gro	M60GB31	94.4	123.7	192.1
3	Dyna-Gro	GX20973X	110.5	103.5	195.8
4	Dyna-Gro	M63GB78	102.9	157.4	198.4
5	Dyna-Gro	GX20998X	107.9	135.6	197.8
6	Dyna-Gro	M67GB87	91.0	130.7	191.7
7	Dyna-Gro	GX20970X	123.9	156.4	192.1
8	Dyna-Gro	GX21965X	102.7	154.5	202.8
9	Dyna-Gro	M71GR91	114.1	142.4	196.3
10	Dyna-Gro	M72GB71	107.3	144.9	197.6
11	Sorghum Partners	SP74M21	119.3	138.7	181.0
12	Sorghum Partners	SP7715	135.6	160.8	168.3
13	Sorghum Partners	SPSA308**	111.2	138.5	**
14	Sorghum Partners	SPSC344**	117.7	136.6	**
15	Sorghum Partners	SPSA411**	133.8	185.4	**
16	Sorghum Partners	NK8828	101.9	149.9	169.1
17	Sorghum Partners	SP68M57	106.1	130.7	192.7

	Means		**109.9**	**142.0**	**190.1**
	CV		**11.2**	**10.8**	**7.1**

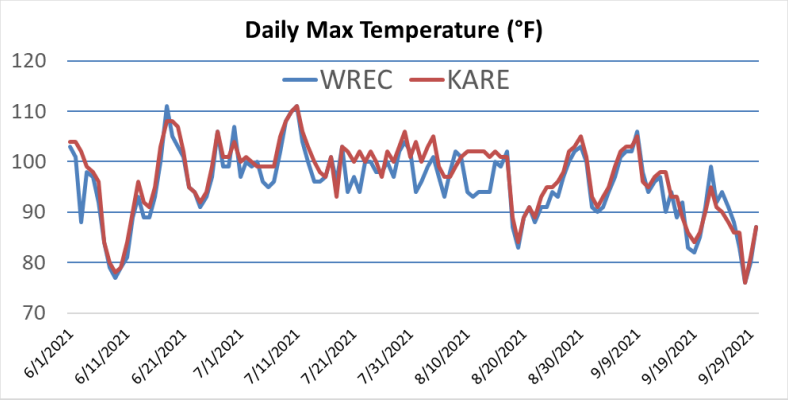
** these entries were not included at some sites due to limited access to seed at planting time.

Forage Sorghum Variety Trials

Sorghum [Sorghum bicolor (L.) Moench] is known for including many biotypes, encompassing a wide range of biomass yield potential, crop feed quality and composition, in biotypes that vary greatly in plant height, photoperiod response, and presence or absence of grain heads. In addition, the inherent ability of many types of sorghum to remain productive even when subjected to repeated water deficits can be of significant value in regions where periodic droughts are experiences or where difficult decisions need to be made regarding where to direct limited irrigation water supplies. Potential for reduced water allocations when components of California's Sustainable Groundwater Management Act are implemented, and periods of atmospheric drought have spurred renewed interest in forage sorghums as potential alternative silage crops for the multi-billion dollar dairy industry in the San Joaquin Valley of California. Reliable production of high quality forage remains a primary goal of dairy opertors when growing forage. Interest in use of sorghum as a livestock feed crop for dairy operations still received mixed reviews, so there continues to be a need for public information on yield potential and agronomic performance and quality of available commercial forage sorghums. Data herein represents forage trials planted in 2021 at the Kearney Agricultural Research and Extension (KARE) Center near Parlier, CA, and at the West Side Research and Extension (WREC) Center near Five Points, CA.

Six seed companies provided a total of 48 hybrids for the 2021 UC-ANR Forage sorghum variety trials. Descriptions of the cultural practices and site characteristics of the test sites are shown at the end of this section. Entries in the trials included "traditional" forage sorghums and brown mid-rib (BMR) derivatives of both traditional and photoperiod sensitive (PS) sorghums. Hybrids were planted in a randomized block design in four row plots planted on 30-inch raised beds and were analyzed as a split-plot design. Overhead sprinklers (linear move sprinkler system) were used to irrigate the plots at Kearney (KARE) site for the first 6 weeks of the irrigation season, with supplemental furrow irrigation applied during the remaining season as needed to meet full crop irrigation water needs during warmer weather, higher evapotranspiration periods. A combination of overhead sprinklers (linear move sprinkler system) during the first 4 weeks after emergence and furrow irrigation for the remaining irrigation season was also used at the West Side REC site (WREC). Fertilizer applications followed similar recommendation for forage sorghums for the region.

The following chart show the daily high temperatures and daily solar radiation levels experienced at the WREC and KARE test sites in 2021 during the June to September period. Notable are the multiple periods of fairly extreme daily high temperatures that were experienced in late June and mid-July, and again in the late August / early September periods.



A summary of yield, agronomic traits and a selection of nutritional analysis values are reported (Table 2) by types of forage sorghums (BMR versus non-BMR, and Brachytic versus non-Brachytic). Values shown represent the entries included in plantings done at Kearney REC site (both planting dates), plus the UC West Side REC site. When sorted according to trait groups, the main differences seen were: (1) reduced lodging % in the non-BMR group and Brachytic groupings; (2) lower lignin % in the BMR and Brachytic groupings. Lodging in general in these three tests was unusually low in the 2021 field trials at these sites, so differences in lodging associated with the BMR trait, for instance, were less than observed in some other years. The lower average lodging values and lower lignin % in the Brachytic entries in the tests were not necessarily linked just to the brachytic trait, since the number of brachytic entries was small (five) and four of the five brachytic entries were also BMR.

Table 2. Summary of average values for some key forage cultivar characteristics associated with BMR or brachytic traits, averages across entries with those traits that were included in three trial locations in 2021 (Kearney REC – 2 planting dates, plus West Side REC). This evaluation only includes cultivars for which we were provided with information about these traits, and only those entries that were received in time to be grown at the 3 sites shown. Values shown are averages, statistics not run for these trait groups.

Type of trait	Lodging (%)	Yield (T/ac @ 65% moisture	Crude Protein (%)	ADF (%)	NDF (%)	Lignin (%)	NDF_{d30}	NDF_{d240}	Milk (lbs/Ton)	RFQ
BMR (16)	7.88	21.73	7.47	34.05	53.05	3.81	53.58	68.04	2757	122.76
Non-BMR(21)	3.81	21.81	8.05	32.85	50.79	4.29	48.94	65.26	2814	120.91
Brachytic (5)	0.00	20.84	8.19	32.84	50.53	3.59	52.69	67.19	2815	129.64
Non-Brachytic (38)	5.42	21.25	7.80	33.32	51.71	4.19	50.27	66.11	2791	120.49

[1]Number in parenthesis is the number of hybrids fitting into these trait characteristic groups.

Summaries for Highest Yielding Entries. For many producers, yield is the greatest factor in their selection of sorghum forages. Table 3 shows the top 25 hybrids in terms of yields in this study. The entries were ranked by: (a) taking those hybrids that were included in the trials at all three locations (KARE1, KARE2, WREC) with highest yields of over 20.0 ton acre-1 in 2021 field studies, and (b) only including those hybrids that had lodging of less than 20% when averaged across three sites. Of these hybrids, yields in T/ac adjusted to 65% moisture content ranged from 20.3 to 29.1 T/acre, with the highest three being F72FS05 from Dyna-Gro (29.1 T/ac), X54243 from Scott Seed (28.7 T/ac) and Fullgraze II from Dyna-Gro (28.5 T/ac). Some limited nutritional analysis data is also provided in Table 3 (full reports available at the website noted on page 1 include other nutritional analyses from all entries in the variety trials).

Table 3. Top 25 yielding hybrids that had average yields (across 3 sites, KARE 1, KARE 2, WREC) of over 20.0 tons $acre^{-1}$ in forage sorghum variety trials in 2021 (only includes entries that had lodging of less than 20% when averaged across the three sites).

Hybrid	Company	Type	Maturity	BMR	% Lodging	Ton ac^{-1} 65% Moist	240 hr NDFd	Milk Lbs ton-1	Rel. Forage Quality
F72FS05	Dyna-Gro	F	ME	N	0 f	29.06 a	68.73 b-h	2779.22 j-o	113.42 k-q
X54243	Scott Seed	F	L	Y	0 f	28.67 a,b	66.22 g-n	2216.44 v	75.15 u
Fullgraze II	Dyna-Gro	F	MF	N	0 f	28.47 a,b	67.81 d-i	2345.00 u,v	81.18 t,u
Super Sile 20	Dyna-Gro	F	MF	N	12 b-d	26.12 a-c	66.94 e-,	2557.11 r-t	98.50 r-s
CP3681 AT	Croplan	F	ML	N	0 f	25.12 a-d	68.70 b-h	2734.00 l-q	110.01 m-r
5 Star	Dyna-Gro	F	ME	N	1 f	25.05 a-d	64.57 k-o	2967.67 c-i	124.64 f-l
NK300	Sorghum Partners	F	ME	N	9 b-f	24.14 b-e	64.02 m-p	3058.78 b-f	137.87 c-f
X5221037	Scott Seed	F	L	Y	0 f	23.72 c-f	64.29 l-o	3110.89 b-d	141.47 b-d
Danny Boy II BMR	Dyna-Gro	F	M	Y	16 b	23.54 c-g	68.69 c-h	2458.22 t-u	104.71 o-s
CP3731 BMR Leafy	Croplan	F	L	Y	0 f	23.45 c-h	68.45 c-h	2876.67 g-m	133.28 c-g
X5061037	Scott Seed	F	L	Y	0 f	23.14 c-i	67.09 e-l	3051.67 b-g	145.95 b,c
Dynagraze II BMR	Dyna-Gro	F	ME	Y	5 c-f	22.72 c-j	69.61 a-e	2747.56 l-q	111.65 l-r
Super Sile 30	Dyna-Gro	F	ME	N	7 b-f	22.57 c-j	66.46 f-n	2591.56 p-t	103.42 p-s
F72FS25 BMR	Dyna-Gro	F	M	Y	0 f	22.31 c-j	72.23 a	2480.00 s-u	112.81 k-q
19038	Gayland Ward	F		N	0 f	22.24 c-k	67.22 d-k	2477.83 s-u	98.75 r,s
PEARL	Mojo	F	ML	N	0 f	22.13 c-k	60.17 r,s	3223.33 a,b	152.53 b
CP3501	Croplan	F	M	N	0 f	22.09 c-k	63.22 o-q	2947.56 d-j	127.30 e-j
19042	Gayland Ward	F		N	0 f	21.63 c-m	68.12 d-h	2342.33 u,v	92.05 s,t
X52053	Scott Seed	F	ML	N	0 f	21.44 d-m	66.19 h-n	2932.44 e-k	128.77 d-i
FX21815	Dyna-Gro	F	ME	N	1 f	20.91 d-m	62.52 o-r	3057.22 b-f	145.46 b,c
FX21865	Dyna-Gro	F	MF	N	0 f	20.90 d-m	70.06 a-d	2766.33 k-p	125.71 f-k
SP 3904 BD BMR	Sorghum Partners	F	M	Y	0 f	20.85 d-m	71.32 a-c	2590.89 q-t	115.33 j-p
F70FS91 BMR	Dyna-Gro	F	E	Y	13 b,c	20.62 d-m	67.52 b-j	3012.33 c-h	140.57 b-d
F71FS72 BMR	Dyna-Gro	F	E	Y	0 f	20.28 e-m	63.95 n-p	3084.00 b-e	145.51 b,c
Sweet Ton MS	Dyna-Gro	F	MF	N	2 e,f	20.03 e-m	66.35 g-n	2851.33 h-m	116.34 h-p

[1]Hybrid information provided by seed companies. Under type, F=Forage sorghum. Under Maturity, E=Early, F=Full, ME=Medium Early, MF=medium Full, M=Medium, ML=Medium Late, L=Late, PS=Photoperiod Sensitive.