Final Report
UC-ANR
2018 Field Research on Sorghum Forages for the California Dairy Industry

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Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is known for its inherent drought tolerance. Reduced water allocations due to Sustainable Groundwater Management Act planning or drought have spurred renewed interest in forage sorghums as a potential consideration for silage production. The San Joaquin Valley of California is home to a multi-billion dollar dairy industry. Use of sorghum as a crop for silage has received mixed reviews. Reliable production of high quality forage remains a primary goal of dairy opertors when growing forage. Sugarcane Aphid (SCA) was again a problem pest after appearing in California for the first-time two years ago. Data herein represent forage trials planted at the Kearney Agricultural Research and Extension (KARE) Center, the Westside Research and Extension (WREC) Center and at the UC Davis Research Farm (UC Davis).

Methods and Materials

Five seed companies provided a total of 46 hybrids, which 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. Irrigation was applied using furrow irrigation at Kearney and a combination of overhead sprinklers and flood irrigation at the Westside Center and at the Davis Farm. Fertility applications followed similar recommendation for forage sorghums for the region. The 2018 growing season was drier than the previous year, with rainfall totals from January through May at approximately 75% of normal for all trial locations. Trials at Kearney, Westside and Davis were irrigated as needed and according to ET demands of the crop at the various locations. The first planting at KARE received a preplant irrigation of 5.17 inches on April 23, 2018 and a total of 16.09 inches of applied irrigation. The second planting at KARE received a preplant irrigation of 6.19 inches on May 21, 2018 and a total of 24.07 inches of applied irrigation. Rainfall totals from January through May 1, 2018 prior to the first planting at KARE were 5.59 inches with no additional rainfall prior to the second planting on June 14th. No rainfall was recorded throughout either growing season.

Rainfall totals from January through June prior to planting at WREC were 3.9 inches, while no rainfall was recorded throughout the growing season. At WREC, a total of 3.5 inches was

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delivered between June 22 and July 2 using sprinklers to ensure good stand establishment. An additional 15.1 inches was applied by furrow irrigation over the course of the season. In total, 18.6 inches of irrigation were applied in the 2018 season. Rainfall totals from January through June 11 prior to planting at UC Davis were 8.82 inches, while 0.08 inches fell throughout the growing season. The trial was irrigated to match ET demand. Trials were harvested approximately 100 days after planting.

Other cultural practices and study information:

Trial Location:	KARE Planting 1 and 2, Parlier
Cooperator:	UC-ANR
Previous Crop:	Winter forage (Oats)
Soil Type:	Hanford sandy loam
Plot Size:	Four, 30 inch rows by 20 ft
Replications:	3
Study Design:	Split-Plot
Planting Date:	May 1 and June 14, 2018
Planting Rate:	100,000 seed $acre^{-1}$
Seed Method:	Almaco 4 row plot planter
Fertilizer:	92 lbs N ac^{-1} 46-0-0, 11 lbs N ac^{-1} and 52 lbs PO^{3-} ac^{-1} 11-52-0, and 200 lbs K_2O ac^{-1} 0-0-50 applied pre-planting on April 30 for 1st planting and June 14 for 2nd planting
Herbicide:	Dual Magnum at 1.3 pints per ac^{-1} as a pre-plant
Pesticide:	Sivanto 14 fl oz ac^{-1} with Latron 1956 at 5 oz ac^{-1} July 13 for 1st planting and August 1 for 2nd planting
Irrigation:	See narrative above
Silage Harvest Date:	Plots harvested with Wintersteiger Cibus S forage chopper on August 10 and September 17, 2018

Trial Location:	Westside Research and Extension Center, Five Points
Cooperator:	UC-ANR
Previous Crop:	Barley (December 2016-April 2017)
Soil Type:	Panoche clay loam
Plot Size:	Four, 30 inch rows by 17 ft
Replications:	3
Study Design:	Split-Plot
Planting Date:	June 21, 2018
Planting Rate:	100,000 seed $acre^{-1}$
Seed Method:	Almaco 4 row plot planter
Fertilizer:	100 lbs N $acre^{-1}$ N-P-K 46-0-0 on July 17
Herbicide:	Dual Magnum 24 oz/ac as pre-emergent on June 8, 2018, Clarity 8oz and Prowl-H_20 at 32 oz ac^{-1} on July 17
Pesticides:	Sivanto Prime 14oz ac^{-1} on August 21, August 31 and September 13
Irrigation:	Sprinklers for stand establishment, gated pipe furrow irrigation subsequent irrigations – see narrative for amounts
Silage Harvest Date:	September 27, 2018

Trial Location:	UC Davis Research Station, Davis
Cooperator:	UC-ANR
Previous Crop:	Safflower
Soil Type:	Yolo loam
Plot Size:	Four, 30 inch rows by 20 ft
Replications:	3
Study Design:	Split-Plot
Planting Date:	June 11, 2018
Planting Rate:	100,000 seed $acre^{-1}$
Seed Method:	Wintersteiger Self Propelled Drill Planter
Fertilizer:	18 lbs N ac^{-1} 8-28-6 on June 11, 82 lbs N ac^{-1} 8-28-6 on July 12.
Herbicide:	Dual Magnum as pre-plant
Irrigation:	See above narrative
Silage Harvest Date:	Plots harvested with Wintersteiger Cibus S forage chopper September 25, 2018

Data Collected:

1. Plant stands
2. Plant height (ft) at silage harvest
3. Lodging at silage harvest. Percent of fallen or significantly leaning plants per plot.
4. Moisture content at harvest.
5. Forage (silage) yield. The middle two rows of each plot were harvested with a Wintersteiger Cibus S forage chopper. Yields are reported at 65% moisture in tons/acre.
6. Nutrient analysis: Samples were collected from the forage chopper in the field, weighed and then placed in forced air Gruenberg oven (Model T35HV216, Williamsport, PA) at 50º C until dried. These sub-samples were sent to Dairyland Laboratory, Inc, Arcadia, WI for analysis.

7. Key Nutrient Analysis Definitions
    a. Crude Protein: 6.25 times % total nitrogen
    b. ADF: % acid detergent fiber; constituent of the cell wall includes cellulose and lignin; inversely related to energy availability
    c. NDF: neutral detergent fiber; cell wall fraction of the forage
    d. Lignin: percent estimated lignin present
    e. Starch: estimated starch content
    f. Fat: estimated fat content
    g. NDFd30: neutral detergent fiber digestibility over 30 hours
    h. NDFd240: neutral detergent fiber digestibility over 240 hours
    i. RFV: relative feed value is an index for comparing forages based on digestibility and intake potential. RFV is calculated from ADF and NDF. An RFV of 100 is considered the average score and represents alfalfa hay containing 41% ADF and 53% NDF on a dry matter digestibility.
    j. RFQ: relative feed quality is an index for comparing forages calculated from TDN and DMI. An RFQ of 100 is considered the average score and represents fully mature alfalfa.
    k. Milk lbs/ton: A projection of potential milk yield per ton for forage dry matter.

Data were analyzed using the SAS statistical package.

Results

A summary of yield, agronomic traits and nutritional analyses are reported by types of forage sorghums grown in the all locations in Table 1. See Tables 2 and 3 for a comparison of the different hybrids agronomic, yield, and nutritional characteristics.

Table 1. Summary of key forage characteristics by type of forage grown at three locations, Kearney (2 planting dates), West Side, and Davis in 2018.

Sorghum Type[1]	% Lodging @ Harvest[2]	Tons/ac @65% Moist.[2]	% Crude Protein[2]	% ADF[2]	% NDF[2]	% Lignin[2]	% NDF D30[2]	% NDF D240[2]	Milk lbs/ton DM[2]	Relative Feed Quality (RFQ)[2]
BMR (21)	16.07 b	20.40 a	9.14 b	38.0 b	56.2 b	3.57 b	53.0 b	69.65 b	2539.6 a	104.67 a
NonBMR (23)	13.93 b	21.36 a	8.98 b	37.4 b	55.8 b	4.20 a	47.5 c	65.24 c	2524.7 a	95.60 c
PSBMR (2)	41.25 a	18.06 b	10.19 a	41.5 a	60.0 a	3.45 b	57.9 a	73.56 a	2312.2 b	101.22 b
Trial Avg.	16.08	20.79	9.10	37.84	56.17	3.88	50.39	67.57	2522.3	99.90

[1]Number in parenthesis is the number of hybrids in each sorghum type. BMR = brown midrib; PS = Photoperiod sensitive.
[2]Means followed by the same letter do not significantly differ using LSD (P=0.05)

Similar to previous reports, lodging can be a major issue for forage sorghums. Lodging ranged from 0.0 to 80.0% (Table 2). The photoperiod sensitive brown midrib hybrids (PSBMRs) had significantly more lodging than the other forage types (Table 1).

Lodging was significantly different among three of the four sites. The lowest lodging % occurred at the first planting of the KARE trial and WREC. The highest lodging occurred at the second planting of KARE (Table 2). The first planting at KARE was the first week of May and this may be the optimum time to plant forage sorghums to reduce lodging issues that can happen under ideal, hot growing conditions here in the valley. However, WREC was planted last and also had low lodging while also having the tallest plants and producing significantly higher forage yields than the other sites, so other factors may be important.

Forage yields for the trials ranged from a high of 27.7 to 14.6 tons acre^{-1} with an average of 20.8 tons acre^{-1} (see Tables 1 and 2). Although the first planting of KARE had the lowest yields (Table 2), it had the highest potential lbs of milk per dry ton and the highest Relative Forage Quality (RFQ) and Relative Feed Value (RFV) (Table 3). The non-PS forages were slightly more productive in tons ac^{-1} than their counterparts (Table 1).

Digestibility as measured by ADF, NDF, 30 and 240 hours NDFd was significantly higher in the PSBMR sorghums, though they had lower lbs of milk per dry ton than the other two, and the regular BMRs had the highest RFQ (Table 1).

The top 10 hybrids were ranked in this study by taking those hybrids with the greatest yields and eliminating those hybrids that lodged by more than 10% (Table 4). Of these hybrids, yield ranged from a low of 21.1 tons acre^{-1} with Dyna-Gro Dual Forage SCA to a high of 27.8 tons acre^{-1} with Dyna-Gro FX18835SS (X).

For many producers, yield is the greatest factor in their selection of sorghum forages. Table 5 highlights the top yielding hybrids that produced more than 20.0 tons acre^{-1} of yield. The highest

yielding forage sorghum was FX18835SS (X)from Dyna-Gro at 27.8 tons acre^{-1} followed by Scott Seed Co 542/43 at 27.6 tons acre^{-1}. As in past years, lodging was associated with some of the highest yielding forage sorghums.

Discussion

This was the eighth year that a wide range of forage sorghums (46), both commercial and experimental, were evaluated for both yield and quality parameters in large replicated trials (KARE and WREC). It was the third year of trials at UC Davis. The sites received more rainfall in 2017 than in recent years. Yet, the 2018 winter was drier. This underscored the need to maximize irrigation and fertilizer use efficienciencies. Given the limited amount of irrigation used in these studies, the low inputs and high yields, the potential does exist in sorghum forages to save both water and fertilizer. Water and fertilizer are both costly inputs in the production of forages in the state. Forage selection should be a combination of factors that optimize quality, yield and standability (lodging resistance) and will require additional management of feed rations to optimize the potential of these forage crops to be utilized as forages for dairy animals.

Table 2. 2018 comparisons of sorghum forage hybrids and locations for agronomic characteristics and yield at KARE, WREC, and UC Davis by seed company.

Hybrid Information[1]					Agronomic Measurements		
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% Lodging**	**Height (cm)**	**Ton ac^{-1} 65% Moist**
ADV S6504	Advanta/Alta	F	PS	Y	53.8 c	259.3 d-f	19.5 j-p
AF7401	Advanta/Alta	F		Y	0.0 j	152.4 r-u	19.6 j-o
AF8301	Advanta/Alta	F	M	N	3.8 j	169.3 n-r	24.3 b
XF033	Advanta/Alta	F		N	0.0 j	173.8 m-q	23.1 b-f
XF372	Advanta/Alta	F		N	0.0 j	147.1 u-v	19.9 h-o
XF378	Advanta/Alta	F		N	7.5 i-j	131.5 v	18.2 n-q
15FB0051	Chromatin/Sorghum Partners	F		Y	3.3 j	258.2 d-f	20.0 g-o
NK300	Chromatin/Sorghum Partners	F	ME	N	0.0 j	158.5 p-u	23.5 b-c
Sordan 79	Chromatin/Sorghum Partners	F		N	69.2 a-b	276.3 b-c	18.7 m-p
SP3808SB BMR	Chromatin/Sorghum Partners	F		Y	0.0 j	196.1 j-l	20.9 c-n
SP4555	Chromatin/Sorghum Partners	F	M	Y	80.0 a	248.9 e-g	15.7 q-r
SPX56216	Chromatin/Sorghum Partners	F	F	Y	21.7 f-i	247.7 f-h	20.1 g-o
SS2876	Chromatin/Sorghum Partners	F	F	Y	12.9 h-j	258.1 d-f	23.3 b-e
705F	Dyna-Gro	F	ME	N	0.8 j	173. m-q	22.6 b-h
Danny Boy BMR	Dyna-Gro	F	M	Y	27.1 e-h	289.3 b	21.0 c-m
Dual Forage SCA	Dyna-Gro	D	MF	N	0.0 j	149.5 s-u	21.1 c-m
F74FS23 BMR	Dyna-Gro	F	M	Y	15.0 g-j	233.7 g-i	19.5 j-p
F76FS77 BMR	Dyna-Gro	F	MF	Y	0.0 j	168.3 o-r	20.5 e-n
Fullgraze BMR	Dyna-Gro	F	MF	Y	20.8 f-i	266.2 c-d	20.3 f-o
FX18130	Dyna-Gro	F	E	Y	0.0 j	185.8 l-n	21.4 c-m
FX18152	Dyna-Gro	F	E	Y	0.0 j	184.1 l-o	19.6 j-o
FX18311 (X)	Dyna-Gro	F	M	N	37.1 d-e	262.5 c-f	20.7 d-n
FX18317 (X)	Dyna-Gro	F	M	N	27.9 e-h	264.7 c-e	22.5 b-i

Table 2. continued.

Hybrid Information[1]					Agronomic Measurements		
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% Lodging**	**Height (cm)**	**Ton ac^{-1} 65% Moist**
FX18340 (X)	Dyna-Gro	F	M	N	75.4 a	252.3 d-f	14.6 r
FX18811 X	Dyna-Gro	F	M	N	33.8 d-f	252.6 d-f	21.9 b-k
FX18835SS (X)	Dyna-Gro	F	MF	N	2.5 j	321.0 a	27.7 a
FX18843SS BMR (X)	Dyna-Gro	F	MF	Y	48.8 c-d	292.9 b	22.1 b-j
FX18851 BMR	Dyna-Gro	F	M	Y	0.0 j	160.0 p-u	19.0 l-p
FX18878 BMR	Dyna-Gro	F	ME	Y	59.2 b-c	257.3 d-f	17.5 o-q
GX16921	Dyna-Gro	D	MF	N	0.0 j	145.8 u-v	20.3 f-n
Super Sile 20	Dyna-Gro	F	MF	N	26.3 e-h	263.5 c-f	20.9 c-n
Super Sile 30	Dyna-Gro	F	ME	N	37.9 d-e	231.5 h-i	21.5 c-l
310x45	Richardson	F	ML	N	0.0 j	187.2 k-m	20.1 g-o
319x122	Richardson	F	E	N	0.0 j	150.7 r-u	20.3 f-n
366x73	Richardson	F	ME	N	1.7 j	164.3 p-t	19.8 i-o
503/15	Scott Seed Co	F	ML	N	0.0 j	148.5 t-u	21.9 b-k
506/10	Scott Seed Co	F	L	Y	0.0 j	157.8 p-u	19.2 k-p
506/44	Scott Seed Co	F	PS	Y	28.8 e-g	225.3 i	16.7 p-r
506/51	Scott Seed Co	F	M	Y	7.9 i-j	206.4 j	19.6 j-o
514/10	Scott Seed Co	F	L	Y	4.2 j	172.0 m-q	20.0 h-o
522/42	Scott Seed Co	F	M	N	0.0 j	203.8 j-k	22.8 b-g
528/10	Scott Seed Co	F	L	Y	0.0 j	165.4 p-s	20.8 c-n
528/15	Scott Seed Co	F	ML	N	0.0 j	159.1 p-u	23.5 b-d
528/45	Scott Seed Co	F	L	Y	0.0 j	174.3 m-p	20.5 e-n
542/43	Scott Seed Co	F	L	Y	24.6 e-h	319.7 a	27.6 a
545/50	Scott Seed Co	F	L	N	0.0 j	157.3 q-u	20.2 g-o

Table 2. continued.

Hybrid Information[1]					Agronomic Measurements		
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% Lodging**	**Height (cm)**	**Ton ac^{-1} 65% Moist**
Means					**16.1**	**209.7**	**20.8**
CV					**115.2**	**9.7**	**16.1**
Location							
KARE1					**11.4 c**	**165.5 d**	**16.6 d**
KARE2					**24.2 a**	**224.7 b**	**22.4 b**
UC Davis					**19.1 b**	**211.9 c**	**20.7 c**
WREC					**9.4 c**	**237.7 a**	**23.3 a**

[1]Hybrid information provided by seed companies. Under type, F=Forage sorghum, D=Dual Forage/grain sorghum. Under Maturity, E=Early, F=Full, ME=Medium Early, MF=medium Full, M=Medium, ML=Medium Late, L=Late, PS=Photoperiod Sensitive.
[2]Means followed by the same letter do not significantly differ using LSD (P=0.05)

Table 3. 2018 comparisons of sorghum forage hybrids and locations for nutrient composition and calculations at KARE, WREC, and UC Davis by seed company.

Hybrid Information[1]					Nutrient Composition & Calculations[2]					
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% Crude Protein**	**% ADF**	**% NDF**	**% Lignin**	**% Starch**	**% Fat**
ADV S6504	Advanta/Alta	F	PS	Y	9.99 a-e	41.8 a-b	59.6 c-d	3.33 q-u	0.1 q	2.0 e-k
AF7401	Advanta/Alta	F		Y	9.66 c-h	39.5 d-h	57.3 d-k	3.27 r-u	0.7 q-p	2.2 b-e
AF8301	Advanta/Alta	F	M	N	8.45 j-p	37.2 i-o	56.2 h-n	4.35 c-e	6.9 e-f	1.8 m-q
XF033	Advanta/Alta	F		N	9.14 e-m	37.2 i-o	56.4 g-n	4.32 c-f	5.5 f-j	1.9 k-p
XF372	Advanta/Alta	F		N	10.25 a-d	37.8 g-m	55.9 i-o	3.11 t-u	1.9 l-q	2.3 a-d
XF378	Advanta/Alta	F		N	10.86 a	38.1 f-k	55.7 j-o	3.76 j-o	5.7 f-i	1.9 i-n
15FB0051	Chromatin/Sorghum Partners	F		Y	9.59 c-i	40.0 b-e	57.9 d-j	3.45 o-t	0.3 q	2.1 e-k
NK300	Chromatin/Sorghum Partners	F	ME	N	8.96 f-n	36.8 j-p	55.6 j-p	4.30 c-f	10.2 c-d	1.9 l-q
Sordan 79	Chromatin/Sorghum Partners	F		N	8.77 h-o	38.3 e-k	56.8 f-l	4.78 a-b	8.1 d-e	1.9 j-o
SP3808SB BMR	Chromatin/Sorghum Partners	F		Y	9.36 d-i	39.2 e-h	57.0 e-k	3.17 s-u	1.3 n-q	2.1 d-h
SP4555	Chromatin/Sorghum Partners	F	M	Y	9.11 e-m	35.5 o-s	50.9 u-w	3.94 f-l	11.4 b-c	2.2 b-f
SPX56216	Chromatin/Sorghum Partners	F	F	Y	9.93 b-e	39.7 c-f	58.3 c-h	3.72 k-o	1.2 n-q	2.0 e-k
SS2876	Chromatin/Sorghum Partners	F	F	Y	7.95 o-q	36.6 k-q	54.1 n-r	3.70 l-q	6.9 e-f	2.0 h-l
705F	Dyna-Gro	F	ME	N	8.84 h-o	37.2 i-o	55.9 i-o	4.36 c-e	7.5 e-f	1.8 o-q
Danny Boy BMR	Dyna-Gro	F	M	Y	8.82 h-o	41.0 a-d	59.3 c-e	3.71 k-q	0.6 q	1.9 k-p
Dual Forage SCA	Dyna-Gro	D	MF	N	9.40 d-i	34.8 r-u	51.6 t-v	4.48 a-d	15.0 a	2.0 g-l
F74FS23 BMR	Dyna-Gro	F	M	Y	8.96 f-n	37.2 i-o	54.0 n-s	2.99 u	2.9 k-p	2.2 c-g
F76FS77 BMR	Dyna-Gro	F	MF	Y	9.62 c-h	38.7 e-i	58.2 c-i	3.54 m-s	2.0 l-q	2.1 e-j
Fullgraze BMR	Dyna-Gro	F	MF	Y	8.80 h-o	38.8 e-i	57.6 d-k	3.90 g-m	2.1 l-q	1.9 k-p
FX18130	Dyna-Gro	F	E	Y	8.68 i-o	33.3 u	48.6 w-x	3.10 t-u	12.0 b-c	2.3 a-c

Table 3. continued.

Hybrid Information[1]					Nutrient Composition & Calculations[2]					
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% Crude Protein**	**% ADF**	**% NDF**	**% Lignin**	**% Starch**	**% Fat**
FX18152	Dyna-Gro	F	E	Y	8.95 f-n	33.5 t-u	48.4 x	3.03 u	12.4 b-c	2.3 a-b
FX18311 (X)	Dyna-Gro	F	M	N	8.21 m-p	37.9 g-l	55.5 k-p	3.88 h-n	6.8 e-g	1.8 m-q
FX18317 (X)	Dyna-Gro	F	M	N	8.43 k-p	36.2 l-r	53.8 o-t	3.71 k-p	7.4 e-f	2.0 e-k
FX18340 (X)	Dyna-Gro	F	M	N	8.84 h-o	35.2 p-t	51.8 s-v	3.34 p-u	11.1 b-c	2.0 f-k
FX18811 X	Dyna-Gro	F	M	N	8.06 n-q	39.8 c-f	58.7 c-g	4.01 e-k	1.1 o-q	1.9 k-p
FX18835SS (X)	Dyna-Gro	F	MF	N	7.28 q	41.4 a-c	62.2 a-b	4.83 a	1.8 l-q	1.7 q
FX18843SS BMR (X)	Dyna-Gro	F	MF	Y	8.81 h-o	38.5 e-i	57.6 d-k	3.81 i-o	3.5 i-m	2.0 h-m
FX18851 BMR	Dyna-Gro	F	M	Y	10.73 a-b	37.2 i-o	55.8 j-o	3.10 t-u	0.1 q	2.4 a
FX18878 BMR	Dyna-Gro	F	ME	Y	8.32 m-p	34.9 q-u	52.1 r-v	2.98 u	4.7 g-k	2.2 b-f
GX16921	Dyna-Gro	D	MF	N	9.34 d-k	36.1 m-r	53.6 o-t	4.44 b-d	12.0 b-c	1.9 i-n
Super Sile 20	Dyna-Gro	F	MF	N	8.41 l-p	39.4 d-h	58.6 c-g	4.27 c-g	3.3 j-n	1.8 n-q
Super Sile 30	Dyna-Gro	F	ME	N	8.22 m-p	39.5 d-g	59.3 c-e	4.62 a-c	3.0 k-o	1.8 o-q
310x45	Richardson	F	ML	N	8.87 g-o	37.7 h-n	56.6 g-m	4.45 a-d	5.8 f-h	1.9 l-q
319x122	Richardson	F	E	N	9.55 c-i	33.9 s-u	50.0 v-x	4.25 c-h	16.3 a	2.0 g-l
366x73	Richardson	F	ME	N	9.38 d-j	35.7 o-s	53.0 q-u	4.19 d-i	10.7 b-c	2.1 e-j
503/15	Scott Seed Co	F	ML	N	9.40 d-i	36.0 n-r	53.2 p-u	4.39 c-e	12.6 b	2.0 e-k
506/10	Scott Seed Co	F	L	Y	9.87 b-f	38.9 e-i	58.6 c-g	3.50 n-s	1.4 m-q	2.1 e-i
506/44	Scott Seed Co	F	PS	Y	10.37 a-c	41.3 a-c	60.3 b-c	3.56 l-r	0.2 q	2.0 f-k
506/51	Scott Seed Co	F	M	Y	9.66 c-h	38.9 e-i	57.6 d-k	3.61 l-r	3.8 h-l	2.0 f-k

Table 3. continued.

Hybrid	Company	Type	Maturity	BMR	% Crude Protein	% ADF	% NDF	% Lignin	% Starch	% Fat
514/10	Scott Seed Co	F	L	Y	9.58 c-i	36.6 k-q	54.6 l-q	2.99 u	2.2 l-q	2.4 a
522/42	Scott Seed Co	F	M	N	8.79 h-o	38.8 e-i	59.2 c-e	4.45 a-d	3.4 j-n	1.8 p-q
528/10	Scott Seed Co	F	L	Y	9.79 c-g	38.5 e-i	59.3 c-e	4.12 d-j	0.9 o-q	2.1 e-j
528/15	Scott Seed Co	F	ML	N	9.12 e-m	35.5 o-s	54.3 m-r	3.90 g-m	6.9 e-f	2.1 e-i
528/45	Scott Seed Co	F	L	Y	9.31 e-l	39.3 d-h	59.1 c-f	4.17 d-i	1.0 o-q	1.9 i-n
542/43	Scott Seed Co	F	L	Y	7.60 p-q	42.2 a	63.9 a	4.81 a-b	0.5 q	1.8 n-q
545/50	Scott Seed Co	F	L	N	10.04 a-e	38.6 e-i	59.3 c-e	4.31 c-f	1.5 m-q	2.0 g-l
Means **CV**					**9.10** **12.32**	**37.84** **0.64**	**56.17** **5.05**	**3.88** **11.93**	**5.23** **50.95**	**2.01** **9.53**
Location										
KARE1					**10.12 a**	**35.44 c**	**54.57 c**	**3.52 d**	**5.91 a**	**2.12 a**
KARE2					**9.20 b**	**38.05 b**	**56.30 b**	**3.71 c**	**3.99 b**	**2.14 a**
UC Davis					**7.69 c**	**39.67 a**	**58.06 a**	**4.22 a**	**4.52 b**	**1.88 b**
WREC					**9.37 b**	**38.24 b**	**55.78 b**	**4.10 b**	**6.50 a**	**1.89 b**

Table 3. continued.

Hybrid Information[1]				Nutrient Composition & Calculations[2]					
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% K**	**% S**	**Milk Lbs ton-1**	**Rel. Feed Value**	**Rel. Forage Quality**
ADV S6504	Advanta/Alta	F	PS	Y	2.50 a	0.138 a-b	2292.3 s	88.11 q-t	114.62 b-d
AF7401	Advanta/Alta	F		Y	2.15 b-c	0.127 b-f	2450.5 m-r	94.46 k-r	113.64 b-e
AF8301	Advanta/Alta	F	M	N	1.49 j-m	0.109 i-m	2467.4 l-q	99.65 g-n	115.65 b-c
XF033	Advanta/Alta	F		N	1.53 j-m	0.103 k-m	2488.8 j-p	100.30 g-k	119.21 a-b
XF372	Advanta/Alta	F		N	2.14 b-c	0.135 a-c	2556.4 g-n	99.61 g-n	124.39 a
XF378	Advanta/Alta	F		N	1.97 c-e	0.129 b-d	2440.3 m-r	100.89 g-k	124.21 a
15FB0051	Chromatin/Sorghum Partners	F		Y	2.02 b-e	0.125 c-g	2399.3 p-s	93.33 l-r	111.75 b-f
NK300	Chromatin/Sorghum Partners	F	ME	N	1.58 i-l	0.106 j-m	2486.4 k-p	101.26 g-k	83.27 t-v
Sordan 79	Chromatin/Sorghum Partners	F		N	1.30 m-o	0.108 j-m	2440.4 m-r	97.36 i-o	111.54 c-g
SP3808SB BMR	Chromatin/Sorghum Partners	F		Y	2.08 b-d	0.115 f-k	2505.8 i-p	95.64 j-p	109.26 c-h
SP4555	Chromatin/Sorghum Partners	F	M	Y	1.46 j-m	0.113 g-l	2617.2 c-j	112.42 c-d	86.49 s-u
SPX56216	Chromatin/Sorghum Partners	F	F	Y	1.95 c-f	0.128 b-e	2418.8 o-s	92.83 n-r	76.60 v
SS2876	Chromatin/Sorghum Partners	F	F	Y	1.60 i-l	0.106 j-m	2696.8 b-f	104.75 e-h	83.06 u-v
705F	Dyna-Gro	F	ME	N	1.54 j-m	0.111 h-m	2481.4 k-p	101.95 f-j	105.25 f-k
Danny Boy BMR	Dyna-Gro	F	M	Y	2.02 b-e	0.117 e-j	2383.7 p-s	89.73 p-s	101.06 i-m
Dual Forage SCA	Dyna-Gro	D	MF	N	1.39 l-n	0.115 f-k	2684.8 b-g	113.56 b-c	100.25 i-m
F74FS23 BMR	Dyna-Gro	F	M	Y	1.85 d-h	0.110 h-m	2568.5 f-m	103.92 f-i	104.01 g-l
F76FS77 BMR	Dyna-Gro	F	MF	Y	2.05 b-e	0.122 d-h	2449.3 m-r	94.34 k-r	103.74 h-l

Table 3. continued.

Hybrid Information[1]				Nutrient Composition & Calculations[2]					
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% K**	**% S**	**Milk Lbs ton-1**	**Rel. Feed Value**	**Rel. Forage Quality**
Fullgraze BMR	Dyna-Gro	F	MF	Y	2.00 b-e	0.114 g-l	2484.0 k-p	94.97 k-q	101.70 h-m
FX18130	Dyna-Gro	F	E	Y	1.40 l-n	0.113 g-l	2869.8 a	121.41 a	100.77 i-m
FX18152	Dyna-Gro	F	E	Y	1.50 j-m	0.121 d-i	2845.8 a	121.17 a	100.64 i-m
FX18311 (X)	Dyna-Gro	F	M	N	1.62 h-l	0.103 l-m	2583.1 e-l	100.26 g-l	102.70 h-m
FX18317 (X)	Dyna-Gro	F	M	N	1.56 i-l	0.108 j-m	2709.3 c-e	105.65 d-g	102.66 h-m
FX18340 (X)	Dyna-Gro	F	M	N	1.68 g-j	0.112 h-m	2715.2 b-d	110.88 c-e	102.43 h-m
FX18811 X	Dyna-Gro	F	M	N	1.71 f-j	0.107 j-m	2375.4 p-s	92.00 o-s	107.04 d-j
FX18835SS (X)	Dyna-Gro	F	MF	N	1.05 o	0.101 m	2337.3 q-s	85.14 s-t	103.84 h-l
FX18843SS BMR (X)	Dyna-Gro	F	MF	Y	1.52 j-m	0.115 f-j	2530.5 h-o	95.70 j-p	106.62 e-j
FX18851 BMR	Dyna-Gro	F	M	Y	2.23 b	0.147 a	2610.7 d-k	100.08 g-m	76.51 v
FX18878 BMR	Dyna-Gro	F	ME	Y	1.61 h-l	0.108 j-m	2768.2 a-b	113.38 b-c	107.78 d-i
GX16921	Dyna-Gro	D	MF	N	1.51 j-m	0.115 f-k	2603.3 d-k	105.93 d-g	99.77 j-n
Super Sile 20	Dyna-Gro	F	MF	N	1.71 f-j	0.105 j-m	2398.9 p-s	93.04 n-r	103.22 h-m
Super Sile 30	Dyna-Gro	F	ME	N	1.41 l-n	0.105 j-m	2411.9 o-s	91.72 o-s	103.01 h-m
310x45	Richardson	F	ML	N	1.45 k-m	0.107 j-m	2425.8 o-r	98.27 h-o	98.88 k-o
319x122	Richardson	F	E	N	1.38 l-n	0.125 c-g	2742.8 a-c	119.07 a-b	97.45 l-p
366x73	Richardson	F	ME	N	1.60 h-l	0.122 d-h	2631.2 c-i	108.44 c-f	98.03 k-p
503/15	Scott Seed Co	F	ML	N	1.52 j-m	0.121 d-i	2627.3 c-i	108.42 c-f	90.81 p-t
506/10	Scott Seed Co	F	L	Y	2.13 b-c	0.124 c-g	2459.2 l-r	93.29 m-r	96.74 l-q

Table 3. continued.

Hybrid Information[1]				Nutrient Composition & Calculations[2]					
Hybrid	**Company**	**Type**	**Maturity**	**BMR**	**% K**	**% S**	**Milk Lbs ton-1**	**Rel. Feed Value**	**Rel. Forage Quality**
506/44	Scott Seed Co	F	PS	Y	2.69 a	0.143 a	2330.5 r-s	87.62 r-t	89.53 q-u
506/51	Scott Seed Co	F	M	Y	2.00 b-e	0.125 c-g	2433.3 n-r	95.03 j-q	88.19 r-u
514/10	Scott Seed Co	F	L	Y	1.95 c-f	0.130 b-d	2625.5 c-i	103.31 f-i	95.84 m-r
522/42	Scott Seed Co	F	M	N	1.60 h-l	0.107 j-m	2416.7 o-s	92.55 o-r	92.05 o-s
528/10	Scott Seed Co	F	L	Y	1.92 c-g	0.127 b-f	2505.3 i-p	92.60 o-r	92.20 n-s
528/15	Scott Seed Co	F	ML	N	1.58 i-l	0.112 h-m	2639.3 b-h	105.81 d-g	92.00 o-s
528/45	Scott Seed Co	F	L	Y	1.80 e-i	0.116 f-j	2425.0 o-r	92.05 o-s	92.18 n-s
Means **CV**					**1.73** **17.73**	**0.116** **12.08**	**2522.3** **6.22**	**99.71** **8.37**	**99.90** **9.22**
Location									
KARE1					**1.69 b**	**0.126 a**	**2663.9 a**	**105.29 a**	**109.69 a**
KARE2					**1.75 b**	**0.117 b**	**2559.0 b**	**99.02 b**	**100.47 b**
UC Davis					**1.62 c**	**0.109 d**	**2440.8 c**	**93.78 c**	**93.58 c**
WREC					**1.84 a**	**0.113 c**	**2423.0 c**	**100.62 b**	**95.72 c**

[1]Hybrid information provided by seed companies. Under type, F=Forage sorghum, D=Dual Forage/grain sorghum. Under Maturity, E=Early, F=Full, ME=Medium Early, MF=medium Full, M=Medium, ML=Medium Late, L=Late, PS=Photoperiod Sensitive.
[2]Means followed by the same letter do not significantly differ using LSD (P=0.05)

Table 4. Top hybrids in the 2018 UC Sorghum Forage Trials based on yield and lodging[1].

Hybrid	Company	Type	Maturity	BMR	% Lodging	Ton ac-1 65% Moist	% Crude Protein	240 hr NDFd	Milk Lbs ton-1	Rel. Forage Quality
FX18835SS (X)	Dyna-Gro	F	MF	N	2.5	27.8	7.28	65.0	2337.3	76.60
AF8301	Advanta/Alta	F	M	N	3.75	24.3	8.45	63.6	2467.4	88.19
NK300	Chromatin/Sorghum Partners	F	ME	N	0.0	23.5	8.96	63.3	2486.4	92.18
528/15	Scott Seed Co	F	ML	N	0.0	23.5	9.12	66.6	2639.3	103.01
XF033	Advanta/Alta	F		N	0.0	23.1	9.14	64.8	2488.8	92.00
522/42	Scott Seed Co	F	M	N	0.0	22.8	8.79	65.8	2416.7	87.08
705F	Dyna-Gro	F	ME	N	0.8	22.6	8.84	63.7	2481.4	90.81
503/15	Scott Seed Co	F	ML	N	0.0	21.9	9.40	62.4	2627.3	100.25
FX18130	Dyna-Gro	F	E	Y	0.0	21.4	8.68	66.6	2869.8	124.21
Dual Forage SCA	Dyna-Gro	D	MF	N	0.0	21.1	9.40	60.2	2684.8	102.43

[1]The top hybrid list was derived by taking those hybrids with the highest yields and eliminating those hybrids that lodged by more than 10%.

Table 5. Top yielding hybrids that yielded over 20.0 tons acre^{-1} averaged over the UC Forage Trials in 2018.

Hybrid	Company	Type	Maturity	BMR	% Lodging	Ton ac^{-1} 65% Moist	240 hr NDFd	Milk Lbs ton-1	Rel. Forage Quality
FX18835SS (X)	Dyna-Gro	F	MF	N	2.5	27.7	65.0	2337.3	76.60
542/43	Scott Seed Co	F	L	Y	24.6	27.6	66.3	2338.3	76.51
AF8301	Advanta/Alta	F	M	N	3.8	24.3	63.6	2467.4	88.19
NK300	Chromatin/Sorghum Partners	F	ME	N	0.0	23.5	63.3	2486.4	92.18
528/15	Scott Seed Co	F	ML	N	0.0	23.5	66.6	2639.3	103.01
SS2876	Chromatin/Sorghum Partners	F	F	Y	12.9	23.3	67.1	2696.8	105.25
XF033	Advanta/Alta	F		N	0.0	23.1	64.8	2488.8	92.00
522/42	Scott Seed Co	F	M	N	0.0	22.8	65.8	2416.7	87.08
705F	Dyna-Gro	F	ME	N	0.8	22.6	63.7	2481.4	90.81
FX18317 (X)	Dyna-Gro	F	M	N	27.9	22.5	67.2	2709.3	106.62
FX18843SS BMR (X)	Dyna-Gro	F	MF	Y	48.8	22.1	69.7	2530.5	99.77
FX18811 X	Dyna-Gro	F	M	N	33.8	21.9	68.0	2375.4	89.53
503/15	Scott Seed Co	F	ML	N	0.0	21.9	62.4	2627.3	100.25
Super Sile 30	Dyna-Gro	F	ME	N	37.9	21.5	64.7	2411.9	83.27
FX18130	Dyna-Gro	F	E	Y	0.0	21.4	66.6	2869.8	124.21
Dual Forage SCA	Dyna-Gro	D	MF	N	0.0	21.1	60.2	2684.8	102.43
Danny Boy BMR	Dyna-Gro	F	M	Y	27.1	21.0	70.9	2383.7	97.45
Super Sile 20	Dyna-Gro	F	MF	N	26.3	20.9	66.2	2398.9	86.49
SP3808SB BMR	Chromatin/Sorghum Partners	F		Y	0.0	20.9	72.1	2505.8	109.26
528/10	Scott Seed Co	F	L	Y	0.0	20.8	69.2	2505.3	95.84
FX18311 (X)	Dyna-Gro	F	M	N	37.1	20.7	66.6	2583.1	98.03
528/45	Scott Seed Co	F	L	Y	0.0	20.5	68.7	2425.0	92.20
F76FS77 BMR	Dyna-Gro	F	MF	Y	0.0	20.5	72.0	2449.3	103.74
GX16921	Dyna-Gro	D	MF	N	0.0	20.3	63.4	2603.3	98.88

Table 5. continued.

Hybrid	Company	Type	Maturity	BMR	% Lodging	Ton ac-[1] 65% Moist	240 hr NDFd	Milk Lbs ton-1	Rel. Forage Quality
319x122	Richardson	F	E	N	0.0	20.3	60.2	2742.8	107.04
Fullgraze BMR	Dyna-Gro	F	MF	Y	20.8	20.3	69.1	2484.0	96.74
545/50	Scott Seed Co	F	L	N	0.0	20.2	68.9	2420.1	92.05
310x45	Richardson	F	ML	N	0.0	20.1	64.2	2425.8	87.84
SPX56216	Chromatin/Sorghum Partners	F	F	Y	21.7	20.1	71.1	2418.8	101.06
15FB0051	Chromatin/Sorghum Partners	F		Y	3.3	20.0	71.6	2399.3	102.70
514/10	Scott Seed Co	F	L	Y	4.2	20.0	72.7	2625.5	115.65

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