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SORGHUM - DROUGHT YEAR FORAGE OF CHOICE?

UCCE field trials evaluate yield, agronomic traits, water use and nutritional quality

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California forage growers and dairy producers are facing tough choices this season regarding forage production. With little to no surface water, and uncertain water supply from existing wells, planting corn for silage may not be an option. Among summer annual forages, corn is valued for superior yields of high energy silage for dairy cows. But corn also requires much higher water and nutrient inputs.

So, what about sorghum? Sorghum for silage production falls into three main categories: grain sorghum (milo), forage sorghum, and sorghum-sudangrass hybrids. Of the three types, forage sorghums are most commonly used for silage. There are many different varieties of forage sorghum, each with specific attributes, including conventional, Brown Mid-Rib (BMR), photoperiod sensitive and brachytic dwarf with or without the BMR trait. The water savings potential and nutritional attributes of forage sorghums have been studied extensively in the Texas panhandle. That research has shown forage sorghums can produce silage yields similar to corn, with adequate nutritional quality, while using 30% less water. This suggests sorghum is a crop with promise in the parched San Joaquin Valley. To help growers and dairy producers assess the potential value of sorghum, UC advisors and specialists have conducted field trials in recent years.

What are the differences between sorghum types, and how do they compare to corn silage? Selecting grain type sorghum, which has a much bigger and heavier grain head compared to a forage type, could potentially boost the energy value of the resulting silage without sacrificing yield/acre. We investigated this possibility in a field trial on a commercial dairy with the objective of comparing yield and nutritive value of a grain type and a forage type sorghum. Following is a brief summary of the results. A more detailed report can be found at: http://sorghum.ucanr.edu/

Yield - At harvest, the forage sorghum was taller, and produced 25% higher yields than the grain sorghum (Table 1). Both the grain and forage sorghum had lower yields relative to average values for corn silages grown in the area.

Table 1. Relative Yields of Forage and Grain Type Sorghums and Irrigation Events compared to Corn Silage

Type	Brand	Plant Height (ft)	% DM at harvest	Tons/Acre at 30% DM	No. of Irrigations (planting to harvest)
Grain	HyTest 850	5.3	28.9	22.8	3
Forage	SorgoMax FS 403	8.6	26.2	28.4	3
Corn silage	Average values	12.5	32.0	30.0	8

Nutrient profile - The grain type sorghum had a lower level of structural fiber and a sharply higher level of starch, compared to the forage type, as would be expected due to its larger seed head (Table 2). The grain type nutrient profile was similar to corn silages grown in the San Joaquin Valley.

Table 2. Chemical Composition of Sorghums and Corn Silage on 100% Dry Matter Basis

Type	Brand	ADF	NDF	Lignin	CP	Starch
Grain	HyTest 850	29.1	45.7	7.6	9.1	23.1
Forage	SorgoMax FS 403	32.3	49.1	8.0	8.6	16.8
Corn silage	Average values	30.8	48.0	2.9	7.9	25.0

Notes: ADF and NDF are measures of the amount of structural fiber in plants. Lignin is an indigestible part of structural fiber which is in both ADF and NDF. Structural fiber is only partly digested by cattle, and only in the rumen. CP is a measure of protein level of the plant material whereas starch is essentially fully digested by the cattle in either the rumen or small intestines.

Digestibility **-**While the *in vitro* estimate of fiber digestion ($dNDF_{30}$) did not differ between sorghum types (Table 3), the values were sharply lower than for corn silages and this is reflected in the much lower estimates of net energy (NEl) of both sorghums *versus* corn silage. This difference, especially for the grain sorghum which had a similar gross nutrient profile as corn silage, is partly due to the lower digestion of fiber, but likely also reflects the small sorghum seeds, many of which will escape crushing during harvest, as well as not be fully digested by cattle. Thus more sorghum starch will appear in feces than from corn silage with its larger kernel size.

Table 3. *In vitro* Digestibility and Fermentation, as well as Calculated Energy Values of Sorghums and Corn Silage

Type	Brand	$dNDF_{30}$ (% of NDF)	Gas-4h (ml/g DM)	Gas-24h (ml/g DM)	NEl based on 24 h gas (Mcal/lb DM)	NEl based on $dNDF_{30}$ (Mcal/lb DM)	TDN (% of DM)
Grain	HyTest 850	30.1	5	256	0.59	0.56	63
Forage	SorgoMax FS 403	31.8	11	256	0.56	0.54	61
Corn silage	Average values	48.0	61	229	0.67	0.65	69

Notes: $dNDF_{30}$ is a bench top estimate of the digestibility of NDF in the rumen of high producing dairy cows. Gas produced at 4 h using a bench top technique reflects the digestion of the most rapidly digested fractions of the plant whereas that at 24 h is a reflection of the digestibility of DM in the rumen of high producing dairy cows. NE can be calculated from both dNDF30 as well as 24 h gas, and both are shown here. The TDN (total digestible nutrients) values allow a quick comparison to the values of alfalfa hays.

What sorghum type is best to replace corn silage for lactating dairy cows - grain or forage? The energy value of the forage variety was lower than for the grain variety, but the difference was very small and is unlikely to be of sufficient magnitude to overcome the sharply higher yield of the forage variety. High yield will be particularly important in the current drought conditions when all feeds will be at a premium. However this forage sorghum had a much poorer nutrient profile than did corn silage, and feeders can expect lower intakes of TMR and lower animal performance when it is substituted for corn silage unless compensatory changes are made in the ration formulation. We evaluated only one conventional variety of forage sorghum in this trial. Among the many commercially available forage sorghums, there is enormous diversity. To see how other sorghums performed in UC field trials, visit the UC ANR sorghum website: http://sorghum.ucanr.edu/. There you will find forage data and production manuals for both grain and forage sorghum.

Consider drought tolerance – From planting (July 3) to harvest (Oct 18), only three irrigations were applied to the sorghum in this field trial. Corn in the surrounding areas would require about 8 irrigations. Where water is limited, or if there is a desire to conserve or reallocate available water, forage sorghum may be a viable alternative to corn silage.