

## **SORGHUM GRAIN FOR LACTATING DAIRY COWS**

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### **Summary**

Forty-seven Holstein cows in early lactation were utilized to evaluate the effects of supplementing concentrate diets of sorghum grain on milk production, milk composition, somatic cell count, and body condition. At 21 d postpartum, cows were randomly assigned to receive four concentrate diets consisting of 1) corn, 2) sorghum, 3) sorghum plus 1 lb tallow, and 4) sorghum plus wheat in a 70:30 ratio. All concentrates were combined with chopped alfalfa hay in a total mixed diet and fed twice daily. Treatments included a 7-day preliminary period and a 16-week experimental period.

Cows fed the sorghum plus tallow diet produced 14% more milk than cows fed either corn or sorghum alone and 10% more than cows fed the 70:30 sorghum plus wheat diet. Milk fat was unaffected by diet, although cows receiving the sorghum plus wheat diet tended to produce milk with less fat (3.3% vs 3.5% for the other diets). Body weight and body condition tended to be higher for cows fed the sorghum plus wheat combination. The addition of tallow or wheat to grain sorghum-based diets appears to improve its value for high-producing cows.

### **Introduction**

Sorghum grain has received limited attention by dairy researchers, even though its supply is plentiful. Sorghum grain is often used in diets for cows in mid and late lactation but is uncommon in early lactation diets. The restricted use of sorghum grain in dairy cattle diets is primarily due to its rumen fermentation characteristics, low energy value, and low digestibility relative to corn grain.

In early lactation, milk production increases faster than dry matter intake, creating a negative energy balance as evidenced by extensive body weight loss. Restricted energy intake during this period depresses peak milk yield and total lactation yield. Body tissue support of lactation is a temporary mechanism and must be replaced by increased nutrient intake within 60 to 90 d postpartum, if high production is to be maintained. Nutrient intake during early lactation is limited by appetite but can be somewhat enhanced by increasing the nutrient density and digestibility of the diet.

Grain sorghum is relatively low in net energy and total tract digestibility of nitrogen and starch and lowers ruminal degradation of starch relative to corn. These characteristics contribute to the lower feeding value observed for sorghum grain versus corn. The long-term approach to improving grain sorghum for use by the dairy cow involves changes in its genetic makeup. Short term improvements can be accomplished by the use of complementary dietary components. Wheat-sorghum grain combinations, for example, offer promise because wheat starch is highly degradable in the rumen.

Tallow is relatively inexpensive and can be successfully used to increase the energy density of lactating cow diets, as long as fat in the diet does not exceed 5% of the total ration dry matter.

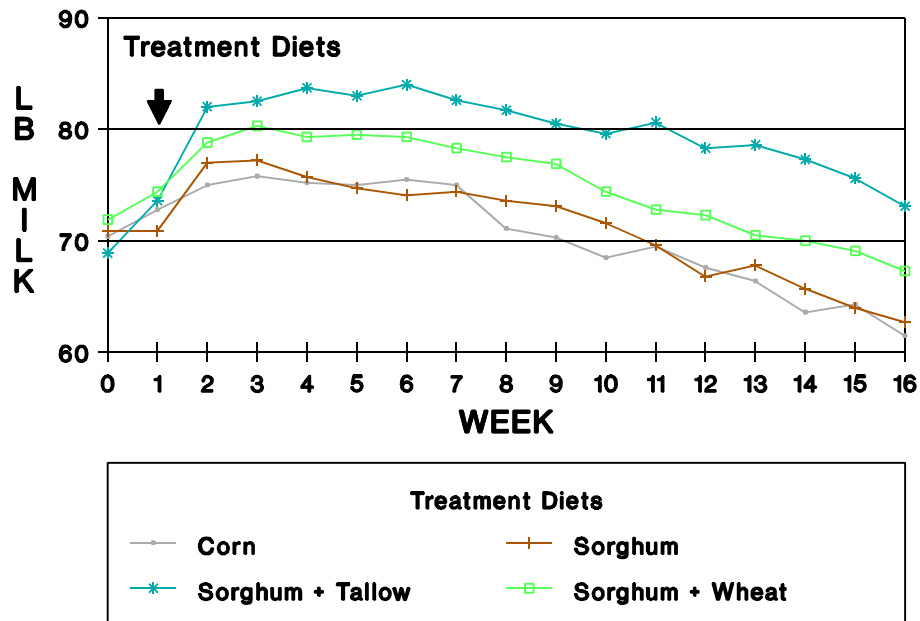
### **Procedures**

Forty-seven Holstein cows were used in a lactation study at the Kansas State University dairy unit to compare the effects of four different concentrate diets on milk production, milk composition, somatic cell count, and body condition. Cows were randomly assigned to four groups at 21 d postpartum and group-fed a total mixed diet of chopped alfalfa hay plus the experimental concentrate diet. The concentrates were 1) corn, 2) sorghum grain, 3) sorghum grain plus 1 lb tallow, and 4) sorghum grain plus wheat in a 70:30 ratio. Diets were isonitrogenous and isocaloric. Cows were fed twice daily, 40% of the diet in the a.m. and 60% in the p.m. for a period of 16 wk. A 7-day preliminary period was used to obtain data for covariate analysis. Cows were weighed on two consecutive days at the beginning and end of the study and once weekly during the study. Body composition scores were recorded weekly. Individual milk weights were recorded daily, and milk samples (a.m.+p.m.) were collected weekly for analysis of milk fat, protein, lactose, total solids, and somatic cell (SCC).

### **Results and Discussion**

Cows fed grain sorghum plus tallow produced 14% more milk (Table 1) than cows receiving corn or grain sorghum alone and 10% more than cows fed the 70% sorghum plus 30% wheat concentrate. Because all diets were calculated to be isocaloric and isonitrogenous, it appears that the increased production realized by adding tallow to grain sorghum resulted from an over-evaluation of the energy value of grain sorghum and/or a positive physiological effect of fat relative to milk production. Potentially, dietary fat would not stimulate insulin production to the degree obtained by dietary starch; thus, fat would not be as lipogenic as starch. This would increase the availability of energy to the mammary gland, thus enhancing milk production. Conversely, only a slight increase in milk production was observed when wheat was added to a grain sorghum-based concentrate. Wheat supplies rumen soluble starch and increases glucogenic precursors, which should stimulate insulin production and enhance lipogenesis in adipose tissue. The net effect should be a decrease in percentage milk fat and an increase in body weight. In effect, cows fed the sorghum-wheat mixture did gain more and produced slightly more milk with slightly less milk fat.

Results from this study suggest that the value of grain sorghum for high-producing dairy cows may be enhanced by adding tallow or wheat. However, the addition of wheat had a negative impact on milk fat production. This effect may be overcome by supplementing the grain sorghum-wheat mixture with tallow. This three-way combination offers the potential to enhance milk production over the grain sorghum-tallow combination. The next experiment will examine this potential.



**Figure 1. Milk Production.**

**Table 1. Treatment Effect on Milk Yield, Milk Composition, and Body Condition**

Parameter	Treatments				SE <sup>c</sup>
	Corn	Sorghum	Sorghum-Tallow	Sorghum-Wheat	
Milk yield <sup>a</sup>	71.1	71.2	81.2	73.5	2.98
4% fat-corrected milk <sup>a</sup>	65.5	65.2	74.8	66.5	3.25
Wt change <sup>b</sup> , lb	65.7	89.9	70.7	102.4	21.8
Avg body score	2.81	2.72	2.70	2.90	.05
Milk composition					
Fat, %	3.50	3.49	3.51	3.36	.09
Protein, %	3.07	3.00	2.99	3.03	.03
Lactose, %	4.94	4.92	4.94	4.94	.04
Total solids, %	12.33	12.16	12.18	12.07	.15
SCC (× 1000)	136	200	164	84	105

<sup>a</sup>lb/cow/d.

<sup>b</sup>Scale 1 to 5.

<sup>c</sup>Standard error.