The Influence of Variety on Nutritive Characteristics of Grain Sorghum

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Story in Brief

The nutritive characteristics of eight varieties of finely ground grain sorghum representing four seed classes (Waxy, Waxy-BR, Normal, Normal-BR) (BR = bird resistant) were studied utilizing *in vitro* dry matter disappearance (DMD) and *in vitro* gas production (GP) procedures. All grains were finely ground through a 20-mesh screen. Waxy sorghums were generally higher in DMD and GP than Normal-BR sorghum varieties. Sorghum from the Waxy-BR and Normal seed classes were intermediate in value. Significant differences, however, were also observed within Waxy and Normal-BR seed classes. These studies show there are significant differences in nutritive characterisitics due to variety when sorghum grains are finely ground.

Introduction

During recent years, drought conditions, water conservation, high production costs, insects, diseases, etc. have caused a shift in grain production to less corn and more sorghum in the Southern Great Plains. Sorghum, therefore, is a major feed grain for cattle in this area. One of the greatest problems with grain sorghum is its highly variable and generally lower feeding value in relation to corn. For these reasons among others, sorghum is generally discriminated against by cattle feeders. Some variability may be due to environmental conditions during growth and maturation of the grain.

Previous studies have indicated that sorghum variety or endosperm type can also account for some of the variation. Hibberd *et al.* (1978) suggested that varieties of grain sorghum differed in nutritive characteristics as evidenced by *in vitro* dry matter disappearance studies for grains grown in two consecutive crop years. The purpose of this study was to further evaluate the nutritive characteristics of several grain sorghum varieties grown in Year 3.

Materials and Methods

Eight varieties of grain sorghum representing four different seed classes were grown and harvested under dryland conditions at the Perkins Agronomy Research Station. This crop represented the third of three consecutive crops of grain sorghum studied at this station. Descriptive characteristics and classification of the grain sorghum varieties are presented in Table 1. The varieties were classified by seed class which differentiates between waxy or normal (nonwaxy) endosperm and bird resistant (brown seed coat) or non-bird resistant grains.

Prior to evaluation, all grain samples were finely ground through a 20-mesh screen in a laboratory Wiley mill. Chemical composition of the grain samples was determined using conventional procedures. Total starch content was determined according to the procedure outlined by Macrae and Armstrong (1968). *In vitro* dry matter disappearance (DMD) was obtained utilizing strained rumen fluid from a concentrate-fed steer. Percent DMD was determined by difference after a 24-hr incubation.

In vitro gas production (GP) studies were performed as a measure of starch availability of the grains. Commercial baker's yeast and an enzyme solution (amyloglucosidase) were placed in 50 ml erlenmeyer flasks along with the grain sample. Gas

Table 1. Descriptive characteristics and classification of sorghum grains (Year 3).

Variety	Seed coat color	Endosperm characteristics			Classification
		Color	Hardness	Waxy or normal	
Dwarf Redlan	Red	White	Intermediate	Waxy	
73BCT 1122-2	Red	Yellow	Intermediate	Waxy	Waxy
73BCT 1126	White	Yellow	Intermediate	Waxy	
73BCT 1133-2	Brown	Yellow	Intermediate	Waxy	Waxy-BR
Redlan Normal	Red	White	Intermediate	Normal	Normal
Soft Endo	Brown	White	Soft	Normal	
Darset	Brown	White	Intermediate	Normal	Normal-BR
ROKY 78	Brown	Yellow	Intermediate	Normal	

Table 2. Chemical composition of whole grains %.

	Protein	Ether Extract	Ash	Starch
Waxy				
Dwarf Redlan	11.50[a]	2.70	1.56	79.5[a]
1122	12.61[b]	1.55	1.54	74.5[a]
1126	16.30[c]	1.67	2.24	66.6[b]
Waxy-BR				
1133	12.02[d]	1.69	1.84	75.7[a]
Normal				
Redlan	13.78[e]	2.72	1.64	77.1[a]
Normal-BR				
Soft Endo	13.76[e]	2.88	1.57	72.0[a,b]
Darset	11.40[a]	1.30	1.55	79.0[a]
ROKY	11.66[a]	2.48	1.30	77.8[a]
Overall average	12.88			75.26

[a,b,c,d,e]Means with different superscripts are significantly different (P<.05).

production was measured as ml of gas produced per gram of dry matter via an inverted buret recovery system. Results were subjected to an analysis of variance according to Steel and Torrie (1960), and differences were determined using Tukey's HSD protected by a preliminary F test.

Results and Discussion

The chemical compositon of the whole grains is presented in Table 2. Crude protein content varied significantly among varieties within the Waxy seed class, ranging from 16.30 percent for 1126 to 11.50 percent for Dwarf Redlan. Significant differences were also noted among the other varieties with protein content ranging from 11.40 percent for Darset (Normal-BR) to 13.7 percent for Redlan (Normal). Starch content was statistically similar across all varieties (72.0 to 79.5 percent), except for the Waxy 1126 (66.6 percent) being significantly lower (P<.05) than the others. This variety was the highest in protein and the lowest in starch.

Figure 1 illustrates 24-hr DMD values. The Normal-BR varieties all showed statistically similar DMD (46.2 to 49.1 percent) values (P>.05), but were significantly lower (P<.05) than the other varieties. The other varieties ranged from 61.6 percent for Dwarf Redlan Waxy to 54.7 percent for the Waxy-BR variety 1133. Others were intermediate, but significant.

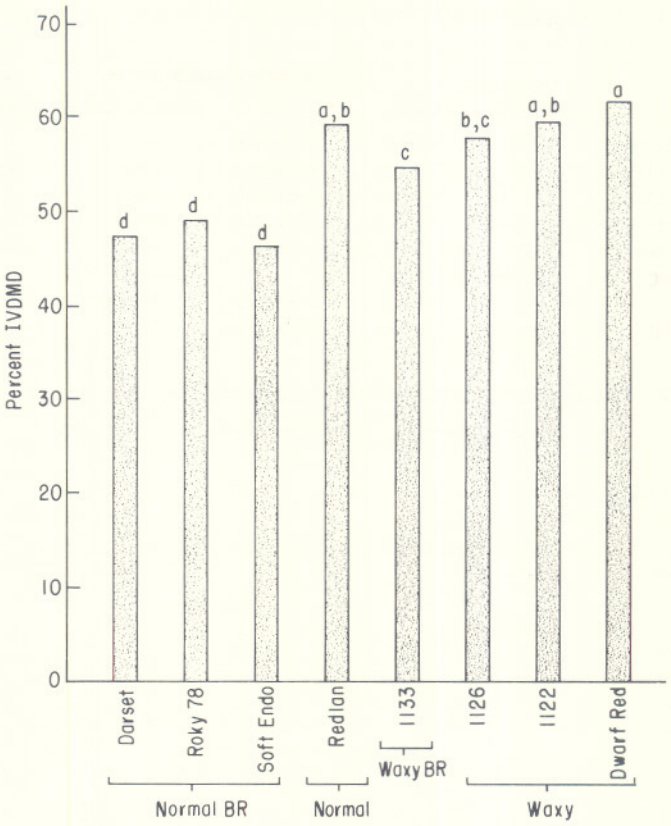

Figure 1. 24-hour DMD of finely ground grain sorghum (Year 3).

In vitro gas production data (Figure 2) also suggests differences in starch availability by variety. Starch availability for two of three Normal-BR varieties (Darset and ROKY 78) was significantly lower ($P<.05$) than for the other varieties tested. The Dwarf Redlan and 1122 Waxy varieties showed the highest GP ($P<.05$). The Waxy-BR and Normal varieties were generally intermediate and different from Waxy and Normal-BR. The lower value observed for 1126 may be a reflection of its lower starch and higher protein content. Interestingly, one of the Normal-BR varieties (Soft Endo) showed a GP value as statistically high as the two best Waxy varieties (Dwarf Redlan and 1122). The elevated GP value for the Soft Endo (although BR) is probably due to a weaker endosperm structure associated with the soft endosperm. The high starch availability of the Waxy-BR is probably due to the effect of the waxy endosperm mediated slightly by the effect of the brown seed coat.

The nutritive value of the grains studied in Year 3 reflect patterns similar to those observed in two previous years. The DMD values reflect differences primarily related to Waxy versus Nonwaxy endosperm and brown versus non-brown seed coats. This classification system appears to account for a large proportion of the variability among varieties. The GP values follow a similar pattern but appear to be mediated, to some extent, by other factors such as endosperm hardness.

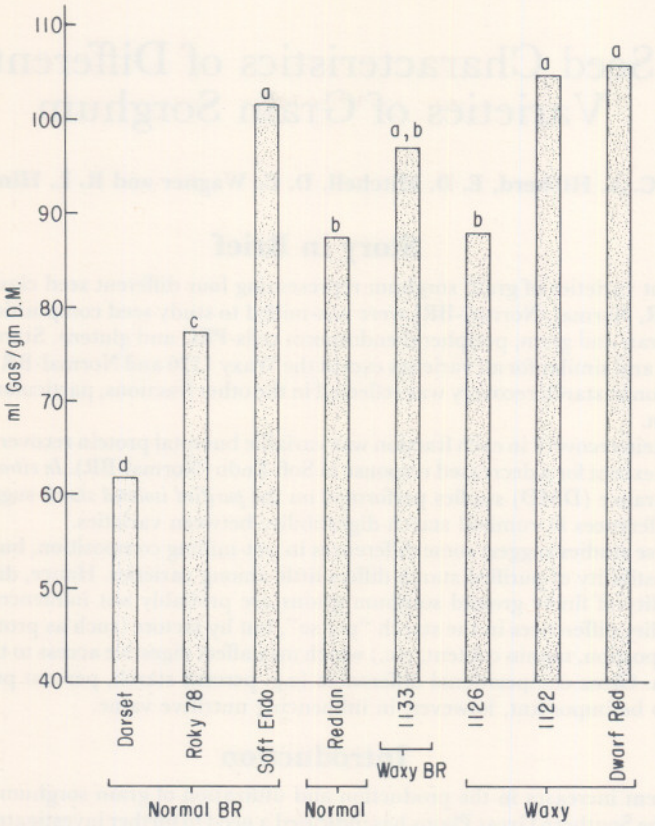

Figure 2. 12-hour gas production of finely ground grain sorghum (Year 3).

The improved nutritive characteristics observed for the Waxy Bird Resistant 1133 is indicative of some of the potential genetic benefits which are possible in upgrading sorghum varieties for nutritive value while maintaining certain desirable agronomic features such as bird resistance. Significant differences in digestibility between sorghum varieties may partially explain the variations observed in feeding value of this grain. Environmental conditions during growth and processing effects before feeding may aggravate or mediate varietal effects although such theories have not been adequately considered. In brief, the effect of variety appears to be an important variable in determining the nutritive value of grain sorghum.

Literature Cited

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