Nutritive Value of Eight Hybrid Sorghum Grains and Three Hybrid Corns Compared in All-concentrate Rations

Part I
Hybrid Sorghum and Corn Characteristics and Methods Used to Nutritionally Evaluate Them

R. L. McCollough

Introduction

In 1971, Kansas produced 234 million bushels of sorghum grain worth $217,000,000, second only to Texas. Most of it is used as an energy source in livestock rations. Since the introduction of hybrid sorghum grain in 1956, yield has increased 25%.

Many genetic characteristics of parent varieties can be combined to produce a desirable hybrid. Some grain characteristics under genetic control include: white or yellow endosperm; red, white, or brown pericarp; all waxy (100% amylopectin) or normal (25% amylose, 75% amylopectin) starch in the endosperm; and corneous or floury endosperm. With different combinations of those genetic characteristics, different hybrids may vary markably from one another on pericarp color and endosperm characteristics. Presently, yield per acre is the main criterion used to evaluate hybrids, so the effect of genetic characteristics on nutritional value of hybrid grain fed to livestock needs to be studied. This project compared the nutritional value of genetically different hybrid sorghums and corns fed to steers.

Material and Methods

During the spring of 1970, eight hybrid sorghums and three hybrid corns were planted under similar conditions of fertilization, planting, and harvesting on irrigated river bottom ground. About 12 acres of each hybrid were planted except that shortage of seed of Funk 3135 (2/3 waxy) limited it to 2 acres. About 1000 bushels of each other hybrid was harvested and stored separately until fed. Descriptive characteristics of each are given in table 10.

Grains were dry rolled and incorporated into all-concentrate rations formulated to meet minimum NRC requirements for both the feeding and digestion trials (table 11). Each steer received 1 pound per head per day of soybean meal (44% crude protein) added during the last 56 days in an unsuccessful attempt to improve gains. Proximate analysis and gross energy data are shown in table 12 for the hybrids; in table 13 for the rations. Mineral composition of the hybrids is given in table 14.

Table 12 shows that crude protein of BR-1023 was the highest (14.08%). Although ether extract was the highest for high oil corn, high lysine corn had 5.65 compared with 3.66% for regular corn. NFE was lowest for BR-1023 (78.27%) and high oil corn (78.13%); highest for E-57 (83.47%). Gross energy was highest for high oil corn (4.742 kcal/gm); BR-1023 with 4.734 kcal/gm was next, while regular corn and 2/3 waxy sorghum had the lowest, 4.439 and 4.406 kcal/gm, respectively. There was essentially no difference in mineral contents of hybrids (table 14).

Yield data (bushels/acre) were collected for each hybrid. The only difference in yield among hybrids was high lysine corn yielding significantly less than other corns.

The nutritional values of 11 different hybrid grains were studied during the winter of 1970-1971. Angus steers (139 head averaging 728 pounds) were randomly allotted by weight to nine treatments, 15 head per treatment. We had only enough high lysine corn and 2/3 waxy sorghum grain to feed two steers per treatment in individually sheltered lots. With the other nine grains, 10 head were group fed in 2 pens of 5 each in nonsheltered concrete lots. Five head per treatment were individually fed in concrete, sheltered lots open to the south.

Feedlot performance data collected from 15 head per treatment are summarized in Part II. The digestion data collected from the individually fed cattle are discussed in Part III.

In vitro gas production by Diazyme 160 (Miles Laboratories) and rumen fluid was measured for each of 11 hybrids grain (3 corns and 8 sorghums). We attempted to correlate feed efficiency and digestible energy with *in vitro* gas production. In no case were the regression values significant.

Table 10. Description of eight hybrid sorghum grains and three hybrid corns fed winter, 1970-1971.

Hybrid	Abbrev. in text	Pericarp color	Endosperm description
Funk's G-766W[a]	(G-766W)	White	Yellow
Acco R-109[a]	(R-109)	Red bronze	Yellow
DeKalb E-57[a]	(E-57)	Red	Yellow
Northrup King 222[a]	(NK-222)	Red bronze	Yellow
Nc+ RS-671	(RS-671)	Red	White
Acco 1023	(BR-1023)	Dark red	White (Bird Resistant)
Asgrow Jumbo-C	(Jumbo-C)	Red	White
Funk's 2438	(High oil corn)	Yellow corn	High oil corn
Hulting X9770	(Regular corn)	Yellow corn	Yellow dent corn
Funk's 3135	(2/3 waxy)	Red	White 2/3 waxy[b]
Funk's 24554	(High lysine corn)	Yellow corn	High Lysine opaque 2 corn (Floury endosperm)

[a]Used in previous trials.

[b]Waxy refers to the amylopectic type of starch; 2/3 of the contribution of waxy gene from waxy parents.

Table 11. Composition of all-concentrate ration, 1970-1971 feeding trial.

Ingredients	% of ration as fed
Sorghum grain or corn	97.74
Dicalcium phosphate	1.15
Trace mineral premix[a]	.05
Salt	1.00
Vitamin A (1,000 IU/head/day)	.02
Chorotetracycline (80 mg/head/day)	.04

[a]Premix contained 10% iron, 1% copper, 0.1% cobalt, 0.3% iodine, 5% zinc, 10% magnesium, 14% calcium.

Table 12. Proximate analyses of sorghum hybrids and corn hybrids, summer, 1970. Dry matter basis.

Hybrid	Endosperm	Crude protein (%)	Ether extract (%)	Crude fiber (%)	Ash (%)	Nitrogen-free extract (%)	Gross energy Kcal/gm
G-766W	Y[a]	10.75	3.15	1.76	1.94	82.40	4.635
R-109	Y	11.05	2.85	1.64	1.75	82.70	4.635
E-57	Y	10.71	2.32	1.70	1.80	83.47	4.668
NK-222	Y	12.40	2.34	1.51	1.70	82.05	4.608
RS-671	W[b]	11.80	2.45	1.96	1.97	81.82	4.517
BR-1023	WBR[c]	14.08	3.09	2.40	2.16	78.27	4.734
Jumbo-C	W	11.82	2.84	1.49	1.56	82.29	4.516
High oil corn		12.22	5.65	2.20	1.80	78.13	4.742
Regular corn		10.70	3.66	2.21	1.79	81.64	4.439
2/3 waxy	W 2/3[d]	11.96	2.85	2.91	2.12	80.16	4.406
High lysine corn		10.91	5.22	2.41	1.96	79.49	4.484

[a]Yellow endosperm, [b]White endosperm, [c]Bird resistant, [d] 2/3 waxy genotype for parents.

Table 13. Proximate Analyses of Sorghum Grain and Corn, Complete Ration, Winter 1970-1971. Dry Matter Basis - with 1 pound 44% SBM, per Head per Day.

		%					
Hybrid	Endosperm	Crude protein	Ether extract	Crude Fiber	Ash	Nitrogen-free extract	Gross energy Kcal/gm
G-766W	Y[a]	12.45	2.60	2.42	4.04	77.96	4.436
R-109	Y	12.61	2.51	2.13	3.80	79.06	4.429
E-57	Y	11.68	2.36	2.25	3.80	79.90	4.406
NK-222	Y	13.53	2.14	2.03	4.27	78.02	4.365
RS-671	W[b]	13.50	2.96	2.14	3.99	76.99	4.577
BR-1023	WBR[c]	15.02	2.37	2.81	4.16	75.66	4.525
Jumbo-C	W	12.52	2.39	1.92	3.42	79.87	4.580
High oil corn		13.51	5.78	2.51	2.45	74.81	4.580
Regular corn		12.62	3.58	2.64	3.65	77.51	4.486
2/3 waxy	w 2/3[d]	12.89	2.49	3.33	3.89	77.38	4.512
High lysine corn		12.45	4.61	2.59	4.21	76.14	4.545

[a]Yellow endosperm
[b]White endosperm
[c]Bird resistance
[d]2/3 waxy genotype from parents.

Table 14. Mineral Content of Hybrid Sorghums, Summer, 1970. Dry Matter Basis.

Hybrid	Endosperm	%P	%Ca	PPM Fe	PPM Mg	PPM Mn	PPM Zn
G-776W	Y[a]	.383	.029	55.91	1366	8.15	26.85
R-109	Y	.345	.036	70.31	1442	7.62	22.04
E-57	Y	.380	.043	60.72	1723	8.67	22.34
NK-222	Y	.327	.029	58.60	1441	11.66	20.09
RS-671	W[b]	.301	.035	66.23	1382	11.23	70.34
BR-1023	WBR[c]	.376	.037	66.21	1413	11.14	76.67
Jumbo-C	W	.308	.044	74.04	1539	11.08	70.43
High oil corn		.382	.026	64.39	1456	10.50	77.32
Regular corn		.367	.031	68.67	1388	10.20	34.16
2/3 waxy	W 2/3[d]	.373	.077	79.79	1898	12.05	67.85
High lysine corn		.358	.026	58.38	1335	8.62	74.49

[a]Yellow endosperm
[b]White endosperm
[c]Bird resistant
[d]2/3 waxy genotype from parents