BULLETIN 546 • MAY 7, 1971 • 1970-1971 PROGRESS REPORT • 58th ANNUAL

CATTLEMEN'S DAY

DEPARTMENT OF ANIMAL SCIENCE & INDUSTRY

KANSAS AGRICULTURAL EXPERIMENT STATION

KANSAS STATE UNIVERSITY, MANHATTAN

FLOYD W. SMITH, DIRECTOR

FRIDAY, MAY 7, 1971

"DR. RUFUS F. COX DAY"

8:00 a.m. Weber Hall Arena

Registration—Exhibits
(Coffee and donuts served)

10:00 a.m. Weber Hall Arena

Dr. Don L. Good, Head, Department of Animal Science and Industry, KSU, presiding

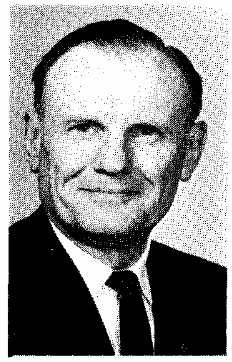
- Welcome
  Dr. Floyd W. Smith, Director, Kansas Agricultural Experiment Station, KSU
- Status of Livestock Pollution in Kansas
  Dr. Keith Huston, Assistant Director, Kansas Agricultural Experiment Station, KSU
- Buffered Environment for Livestock
  Dr. David R. Ames, Department of Animal Science and Industry, KSU
- Prefabrication of Beef Cuts in the Future
  Dr. Harold J. Tuma, Department of Animal Science and Industry, KSU
- Current Nutrition Research
  Dr. Calvin L. Drake, Department of Animal Science and Industry, KSU
- Cowherd Research
  Dr. Robert R. Schalles, Department of Animal Science and Industry, KSU
- Remarks
  Mr. Fred C. Germann, President, Kansas Livestock Association, Dwight, Kansas

12:00 noon Weber Hall Arena

Lunch: Smoked, round-roast

1:00 p.m. Weber Hall Arena

- Recognition of Rufus F. Cox
  Dr. Glenn H. Beck, Vice President for Agriculture, KSU
- Introduction of Guest Speaker
  Dr. James A. McCain, President, Kansas State University
- Trends in the Beef Cattle Industry
  Dr. H. M. Briggs, President, South Dakota State University



Dr. Briggs became the 13th president of South Dakota State University June 4, 1958, after serving as dean of Agriculture and director of the Agricultural Experiment Station at the University of Wyoming. He has been associated with the livestock industry, agricultural education and research activities all his life. He is a member of the Animal Nutrition Committee of the National Research Council, the College Feed Survey, and several experiment station committees. He has served as secretary, vice-president, and president of the American Society of Animal Production, on the Executive Committee of the National Institute of Animal Agriculture, and on the Board of Governors of the Agricultural Hall of Fame. A recognized authority in livestock judging, Dr. Briggs has judged at most of the major livestock shows in the United States. He is the author of a textbook, Modern Breeds of Livestock, and of 40 scientific papers.

2:00 p.m. Beef Cattle Research Center

Tour of the Beef Cattle Center (about 2 miles north, at end of College Avenue)

6:30 p.m. Kansas State Union Ballroom

Block and Bridle Banquet for parents and visiting stockmen

FOR THE LADIES

Thursday, May 6, 1971

6:30 p.m. Bluemont Room, KSU Union

Kansas Cow Belles Dinner
Reservations by May 3 to:
Mrs. Don L. Good
2027 Sunnymeade Road
Manhattan, Kansas 66502

Friday, May 7, 1971

10:00 a.m. Weber Hall, Staff Memorial Library

Coffee for visiting ladies

11:00 a.m. Weber Hall, Room 107

Program—Mary Jo Huseman, Home Economist, Kansas State Board of Agriculture, Topeka

CONTENTS

1971 Cattleman's Day

dedicated to

DR. RUFUS F. COX

Rufus F. Cox was born June 13, 1901, near Altus, in southwestern Oklahoma. At the age of six he moved, with his parents, to a ranch in the Texas Panhandle near Wheeler. He attended the local grade school and high schools at Clinton, Oklahoma and Waco, Texas. He attended Oklahoma A & M College from 1919 to 1923, where he received a B.S. in Agriculture, majoring in Animal Husbandry.

As an undergraduate, Rufus was a member of the livestock judging teams coached by the famous Dean Blizzard. Oliver S. Wilham, President Emeritus of Oklahoma State University, and Rufus were members of the same judging team at Oklahoma A & M.

After teaching Vocational Agriculture in Oklahoma Rufus attended Iowa State College from 1924 to 1925 where he was awarded the Masters Degree in Science with a major in Animal Breeding and a minor in Veterinary Physiology. His Ph.D. is in Animal Husbandry with minors in Veterinary Physiology, Economics and Farm Management from Cornell University.

He served the New Mexico Agricultural Experiment Station as an assistant animal husbandman from 1926 to 1930 before joining the Animal Husbandry staff at Kansas State University, where he advanced to full professor in 1941, and to Head of the Department in 1950. He served in that capacity until 1966.

Dr. Cox took leave during the summers of 1936, 1937, 1938 and 1943 to serve on the Extension staff at the University of Kentucky.

Rufus received a special appointment in 1943 with the War Food Administration, Office of Distribution, Washington, D.C. and later served as special advisor and consultant to the American Food Grain Council in overseas assignments in Japan and Korea, in addition to serving as a consultant with U. S. AID in India. He has established an international reputation as a sound authority on livestock.

In 1955, Oklahoma A & M College selected him as a Distinguished Alumnus and hung his portrait in the Animal Husbandry Hall of Fame on their campus at Stillwater.

Rufus has judged all classes of livestock but particularly sheep and cattle at major livestock shows and expositions throughout the United States. The Little American Royal honored him in 1966 and in 1967 the Federal Land Bank honored Rufus Cox for his outstanding contribution to American Agriculture.

Dr. Cox pioneered research work on the ratio of roughages to concentrate in ruminant rations. He instigated the lamb feeding and wheat pasture grazing tests at the Garden City Experiment Station and data from these tests have been used and have proven profitable to the sheep industry throughout the world. Dr. Cox was in charge of the sheep research and managed the Department's flocks before 1950. He is author of many publications relating to breeding, feeding, and managing sheep.

Students in the College of Agriculture, in 1940 and 1948, voted Dr. Cox the Outstanding Teacher in the College. He taught such courses as Sheep Production, Animal Breeding, Livestock Production and Management, Livestock Judging, Principles of Animal Husbandry Experimentation, as well as other courses relating to the livestock and meat industry.

From 1950 to 1966, the Department of Animal Husbandry expanded greatly in facilities, staff, and student enrollment. Dr. Cox and his staff planned the teaching, research and extension facility which houses the present Department of Animal Science & Industry.

The staff almost doubled during his administration and undergraduate enrollment in the department more than doubled from 1962 to 1966.

Dr. Rufus Cox is a member and Honorary Fellow of the American Society of Animal Science. He is a member of The Board of Governor's American Royal Livestock Show, Sigma Xi, Gamma Sigma Delta, Alpha Zeta; he is also a lifetime Honorary Member of the Kansas Livestock Association and the Kansas Hereford Association.

Rufus has made major contributions to the various purebred breed associations by planning programs, giving talks, demonstrations, and serving as consultant on research projects and other important industry business. He has been Chairman of the Show Committee of the Wichita Jr. Livestock Show for many years. Many progressive ideas were incorporated in the show and later used by major shows and expositions throughout the United States.

Members of the Animal Science & Industry staff, the Administration of the College of Agriculture and of Kansas State University, as well as the members of the Kansas Livestock Association and other livestock organizations in the state deem it a privilege and honor to dedicate the 1971 Cattleman's Day Program to Rufus F. Cox in recognition of his forty-one years of outstanding service to the livestock and meat industry in Kansas.

K S U

Voluntary Salt Intake By Feedlot Steers

L. H. Harbers and L. C. Warren

Because it is a standard practice, adding salt to livestock rations has not received much attention in the past several years. Salt is universally added at 0.5% of the diet, but studies here in the early 50's showed salt needs of cattle are related to dietary roughage levels.

Using feedlot manure as a fertilizer as part of a pollution study here, showed that salt (sodium content) limits the amount of manure that can be used. The amount of sodium in manure is related to dietary intake; more manure could be used as a fertilizer if its sodium content were lower. A recent study by Smith, Roth, and Schalles (Bulletin 536, 1970, p. 19) indicated cattle on a high concentrate ration could perform as well without salt as with 0.5% salt in the ration.

Twenty steers were maintained in individual feeding stalls for two 4-week periods of a finishing study. Voluntary salt consumption data obtained then are reported.

Results

Salt intake data (gms./steer/day) are presented in table 1. During the first period animals received four energy levels; during the second, they received five. As energy level increased salt intake decreased. Less salt was necessary in period 2 than period 1, indicating that salt intake is related to concentrate (energy) level.

Data in parentheses indicate the amount of salt that theoretically would have been consumed, had it been fed at 0.5% of the diet. Except in the first period, when energy levels of 35.46, 36.86 and 37.95 megcal./100 lbs. NE_p were fed, 0.5% salt would have been an excess amount.

Correlation coefficients of salt intake per day with body weight, gain, and feed intake (table 2) indicate that salt consumption is not related to any of these measurements.

Additional studies are needed to determine what portion of voluntary salt intake is of nutritional importance to animals fed high concentrate diets.

Table 1 . Salt Consumption By Steers Fed Indicated Levels of Energy

Energy level	Salt consumption (gms./head/day) Voluntary	Theoretical	Energy in ration (megcal/100 lb.) NE_m	NE_p
		Finishing period 1		
1	86	(61)	55.52	35.46
2	77	(64)	58.29	36.86
3	68	(63)	59.75	37.95
4	45	(64)	61.20	39.04
		Finishing period 2		
1	52	(60)	65.74	42.86
2	57	(60)	68.50	44.63
3	46	(57)	70.00	45.44
4	39	(61)	71.41	46.35
5	21	(58)	74.18	48.03

Table 2 . Correlation Coefficients of Voluntary Salt Intake On Steer Weight, Gain, and Feed Intake

Measurements	Correlation coefficient
$(\text{Body weight})^{1.0}$	+.036
$(\text{Body weight})^{.75}$	+.006
Feed intake	+.125
Weight gain	+.125

K S U

Control of Feed Intake in Ruminants Continuous Rumen Infusion Studies (Project 802)

J. C. Parks, K. S. Lusby and B. E. Brent

Since the requirement of animals for net energy for maintenance (NEm) is influenced largely by weight of the animal, feed efficiency and animal performance improve rapidly as feed intake surpasses maintenance requirements. Once that constant "overhead" is satisfied, remaining nutrients are available for growth and production.

The object of the study reported here was to see if ruminants are capable of digesting and metabolizing nutrient intakes in excess of what they normally consume.

Fistulated sheep were the experimental animals. The basal diet is shown in Table 3 . The ingredients were suspended in water, filtered through cheesecloth, held in suspension by continuous agitation, and continuously metered with a peristaltic infusion pump into the rumen, (through the rumen fistula). Continuous infusion was to remove the effect of "meal" eating and to establish constant conditions in the rumen. Animals were adaped to an all-concentrate ration before being switched to the liquid diet.

Results

Sheep have been maintained on the system up to 30 days. In early studies, several sheep died after rapid breathing and increased body temperature. Autopsy showed no abnormal tissues or pathological conditions. Later experience shows the trouble may have been water intoxication. Volume of liquid pumped is now held at four liters per day. The liquid diet maintains nitrogen balance, and holds blood mineral components in the normal range. Although the diet is all concentrate, and almost totally digested, rumen end-products have remained normal and rumen parakeratosis has not developed.

In future experiments, infusion rate will be increased to find out what physiological or biochemical pathways limit the ability of ruminants to utilize nutrients.

TABLE 3. Composition of Liquid Diet Infused into the Rumen

Ingredients		Amount (daily)
Corn starch		230 gm
Cane sugar		115 gm
Purified casein		50 gm
Urea		5 gm
K_2Co_3	1 1/2 H_2O	37.4 gm
CaCl		9.1 gm
Na_2HPO_4		11.9 gm
$MgCl_2$	6 H_2O	12.9 gm
NaCl		10.0 gm
$FeCl_2$	4 H_2O	780 mg
$MnSO_4$	H_2O	237 mg
$ZnSO_4$	H_2O	391 mg
Na_2MoO_4	2 H_2O	7 mg
$CoCl_2$	6 H_2O	1 mg
$CuCl_2$		34 mg
KI		1 mg
$CuK(SO_4)_2$	12 H_2O	1 mg
Vitamin A		1100 IU
Vitamin D		300 IU
Vitamin E		11 IU

Water to make 4 liters

K S U

Post-Weaning Performance of Calves as Affected By Longstem Hay and Method Feeding

E. F. Smith and L. H. Harbers

Three different rations were compared for feeding calves immediately after weaning. Desired is a ration that will reduce weaning stress, produce economical gains, and be easy to feed.

The rations are shown in Table 4. Initial weight of the calves was taken at the pasture just before weaning. The calves were transported the same day 8 miles to the Beef Cattle Research Center where they were divided into groups and started on experimental rations.

The self-fed mixture of sun cured alfalfa crumbles and rolled sorghum grain was not improved by adding prairie hay. Six of the twelve steers on that self-fed mixture without hay were treated for coccidiosis; however, with or without hay, that mixture produced better and more efficient gains than the mixture of sorghum grain, alfalfa, and prairie hay fed once each day.

TABLE 4. POST WEANING PERFORMANCE OF CALVES AS AFFECTED BY LONGSTEM HAY AND METHOD OF FEEDING
October 13 to Decmeber 5, 1970 - 52 Days

	Self-fed mixture of alfalfa crumbles and rolled sorghum grain		Self-fed mixture of alfalfa crumbles, rolled sorghum grain plus prairie hay		Rolled sorghum grain plus prairie and alfalfa hay fed daily	
	Steers	Heifers	Steers	Heifers	Steers	Heifers
Number of cattle	12	12	12	13	13	13
Initial weight pounds	398	388	409	388	450	404
Final weight	471	458	495	447	494	436
Daily gain per head	1.40	1.35	1.65	1.13	0.85	0.62
Daily feed per calf, pounds						
Mixture of 60% sun cured alfalfa crumbles and 40% rolled sorghum grain	11.8	12.7	11.8	10.1		
Prairie hay			3.2	3.3	3.9	3.3
Alfalfa hay					3.5	3.2
Rolled sorghum grain					4.5	4.5
Total Feed	11.8	12.7	15.0	13.4	11.9	11.0
Feed per pound of gain	8.4	9.4	9.1	11.8	14.0	17.7
Cost per cwt. gain (mixture @ $50.00, hay @ $25.00 & grain @ $40.00/ton)	21.00	23.50	20.38	25.90	21.48	27.53
Number of times animals treated for sickness	10	1	3	5	4	3

K S U

Feeding Value of Four Different Hybrid Sorghum Grains For Finishing Cattle

Project 567

R. L. McCollough, C. L. Drake, R. R. Schalles
G. M. Roth and K. F. Harrison

Introduction

Hybrid sorghum grain is the major source of energy in livestock finishing rations in the Midwest. In 1968, 739 million bushels of sorghum grain were produced in the United States and 620 million bushels, or 84% were fed to livestock. Kansas ranked second to Texas, producing 183 million bushels in 1968, or 30% of the quantity fed to livestock. Since hybrid sorghum grains were introduced in 1956, yield has increased 25%. Because livestock consumes 84% of the sorghum grain produced in the United States, hybrids with superior nutritive value would be advantageous.

Work in Texas[1] and Kansas[2] has suggested that a new white hybrid sorghum grain may be superior to elevator-run, red sorghum grain in nutritive value. If so, more work is needed to determine nutritive characteristics of hybrid sorghum.

This study compared a white hybrid grain sorghum (Funk's G-766W, white over yellow endosperm)[3] with three red hybrids: Acco R-109 (red over yellow endosperm)[4] DeKalb E-57 (red over white endosperm)[5] Northrup King 222A (red over yellow endosperm)[6] Comparisons were on the basis of feedlot performance and carcass characteristics. Digestibility of the same hybrids was reported in the 1969-70 Cattlemen's Day Bulletin, 536, p.41.

[1] Nishimuta, J. F., L. B. Sheerrod, and R. D. Furr, 1969. Digestibility of regular, waxy and white sorghum grain rations by sheep. Proceeding, Western Section American Society of Animal Science, 20.259.

[2] Drake, C. L. et al., 1970. White sorghum grain (Funk's G-766W) and elevator-run red sorghum grain compared for fattening cattle. K. S. U. Bulletin 536, p. 38.

[3] Seed supplied by Funk Bros, Lubbock, Texas.

[4] Seed supplied by Anderson, Calyton & Co., Belmond, Iowa.

[5] Seed supplied by DeKalb Seed Co., Lubbock, Texas.

[6] Seed supplies by Northrup, King & Co., Lubbock, Texas.

Materials and Methods

Four hybrid grain sorghums were produced under irrigation, harvested and stored near Manhattan, Kansas.

The grain was dry rolled and incorporated into isonitrogenous, all concentrate rations (12% protein, dry-matter basis). Ration composition is given in Table 7 and proximate analyses of the four hybrid grain sorghums are presented in Table 8.

During the 1969-70 winter, a 126-day feeding trial used 60 Hereford steers averaging 761 pounds. Steers were randomly allotted by weight into twelve lots of 5 head each. Ten were group-fed (nonsheltered lots) in two groups of five each, and 5 were individually fed (sheltered lots) per hybrid. The cattle were adjusted to an all-concentrate ration. Each steer was implanted with 30 mg stilbesterol. The first 6 days of the trial 3 pounds of a synthetic roughage (Ruff-tabs) were fed. Automatic waterers were available in each pen. Carcass data were obtained at slaughter.

Results and Discussion

Feedlot and carcass data are presented in Table 9. The data are based on the averages of 15 head (14 head for Acco R-109) per treatment. Five head were fed individually in sheltered pens (south side open) and ten head were fed in 2 groups of 5 in nonsheltered pens. There were no significant differences in average daily gain, feed intake, pounds of feed per pound of gain, or carcass traits (Table 9). Variation in average daily gain due to hybrid was slight; however, steers on DeKalb E-57 consumed slightly more feed. Those receiving Funk's G-766W (white) required 2.2 pounds more feed to produce a pound of gain than the average of the 3 red hybrids. Acco R-109 was used most efficiently, requiring 7.08 pounds feed per pound gain; Northrup King 222A, DeKalb E-57, and Funk's G-766W required 7.47, 7.93, and 8.48 pounds of feed per pound of gain, respectively. These data do not agree with the findings of Drake et al., 1970, K. S. Eng (personal communication), or R. G. Hinders (personal communication). All reported white grain to be used more efficiently. However, red sorghum grain of an unknown origin listed as elevator-run, red sorghum was used in their trials. In the trials reported here only known hybrids were compared.

No significant differences were found in feedlot or carcass data from sheltered (individually fed) and nonsheltered (group fed) animals. However, sheltered steers tended to gain faster and require less feed per pound of gain (Table 10); 2.26 to 2.20 average daily gain and 7.20 to 8.48 pounds of feed per pound of gain, respectively. The steers fed in sheltered lots required 1.29 pounds less feed to produce a pound of gain or a $2.56/cwt gain advantage for sheltered animals with feed prices used.

Lofgreen and Garrett's (1968) net energy tables were used to calculate expected gain for nonsheltered and sheltered steers (Table 11). Nonsheltered steers gained .65 pound per day less than calculated; sheltered steers, .13 pound per day less. Acco R-109 and Northrup King 222A fed in sheltered lots produced higher average daily gains (+.12 and +.19 pound, respectively) than calculated using Lofgreen and Garett's tables. In non-sheltered lots steers on those two hybrids gained closer to the calculated values than did steers on DeKalb E-57 or Funk's G-7666W. This indicates there may be differences in net energy for gain among hybrids. More energy was required for maintenance in nonsheltered lots. Lower gain than expected might be attributed to an all-concentrate ration during winter feeding trials.

Summary

Although data from the present study do not indicate statistical significant differences; they do indicate there may be differences among hybrids that could be of an economical advantage for finishing cattle. Acco R-109 and Northrup King 222A, which are two yellow endosperm hybrids were used more efficiently than other hybrids tested. The first seven days of the trial steers receiving Acco R-109 consumed less grain. After that consumption was essentially the same. Acco R-109 seemed to be less palatable initially. Sheltered steers gained faster and used feed more efficiently than nonsheltered steers. Feed cost was $2.56/cwt gain less for steers in sheltered lots.

Acknowledgments

Funk and Robinson Seed Company, Hutchinson Manufacturing and Grain Link Supply Company for donated equipment.

Table 7. Composition of Rations Used to Compare White and Red Hybrid Grain Sorghums in Steer-Feeding Trials

Item	% of ration	
Sorghum grain[a]	98.00	
Salt	1.00	
Trace mineral premix[b]	.05	
Urea	.5	
Limestone	.5	
Chlorotetracycline	3.5 mg/lb	
Vitamin A	1,653.00 IU/kg	751. IU/kg

[a]Grain varied with urea added to keep rations isonitrogenous at 12% protein (dry matter basis). Urea added as % of rations: Funk's G-766W, .57; Acco R-109, .62; DeKalb E-57, .70; Northrup King 222A, .23.

[b]Percentages of indicated elements in trace mineral premix: Manganese 4.4%; iron 6.6%; copper 1.32%; cobalt .23%; iodine .30%; zinc 5%; magnesium 20%; sulfur 2.7%.

Table 8. Proximate Analyses of Four Hybrid Grain Sorghums, Dry Matter Basis

Item	Sorghum hybrid			
	Funk's G-766W	Acco R-109	DeKalb E-57	Northrup King 222A
Dry matter %	84.20	84.84	84.49	84.11
Protein % (N x 6.25)	10.65	10.49	10.17	11.83
Ether extract %	3.26	3.18	2.92	3.20
Ash %	1.54	1.69	1.58	1.58
Crude fiber %	2.03	2.12	1.87	1.87
N-free extract %	82.77	82.52	83.43	81.52
Starch %	77.33	79.04	78.27	76.96
Gross energy Kcal/lb	2078.00	2054.00	2069.00	2084.00

Table 9. Performance and Carcass Data of Steers Fed All-Concentrate Rations Containing One of Four Hybrid Grain Sorghums (Winter 1969-70) Dry Matter Basis

Item	Sorghum hybrids			
	Funk's G-766W	Acco R-109	DeKalb E-57	Northrup King 222A
		Feedlot data		
No. steers	15	14[a]	15	15
Avg. initial wt., lbs.	765	760	772	758
Avg. final wt., lbs.	1042	1051	1059	1024
Avg. daily gain, lbs.	2.25	2.34	2.21	2.15
Avg. daily feed intake, lbs.	16.96	16.82	18.06	16.32
Avg. lbs feed/ lbs gain[b]	8.48	7.08	7.93	7.47
Cost/cwt gain[c]	17.04	14.23	15.94	15.01
		Carcass data		
Avg. hot carcass wt., lbs.	648	653	660	629
Avg. rig eye area, sq. in.	12.72	12.31	12.56	12.44
Avg. fat over rib eye, in.	.40	.40	.40	.37
Avg. carcass grade[d]	10.05	10.16	10.34	10.26
Avg. yield grade[e]	2.43	2.58	2.46	2.27
Avg. marbling score[f]	15.10	15.02	15.53	15.31

[a]One steer crippled and removed.
[b]Calculated by using 2 goupr-fed lots as 2 observations plus 5 individually-fed steers for 7 observations.
[c]Cost of ration $2.01/cwt.
[d]High good = 9; low choice = 10.
[e]1 = most desirable; 5 = least desirable.
[f]Small = 14; modest = 17.

Table 10. Performance Data of Nonsheltered (Group-fed) And Sheltered (Individually-fed) Steers on All-Concentrate Rations (Winter 1969-70), Dry Matter Basis

Item	Funk's G-766W	Acco R-109	DeKalb E-57	Northrup King 222A
	Nonsheltered lots			
No. steers	10	9[a]	10	10
Avg. daily gain, lbs.	2.29	2.25	2.19	1.97
Avg. daily feed intake, lbs.	20.67	17.64	18.21	16.95
Avg. lb feed/lb gain	9.01	7.84	8.37	8.71
Cost $/cwt gain[b]	18.11	15.75	16.82	17.51
			Average cost	17.14/cwt
	Sheltered lots			
No. steers	5	5	5	5
Avg. daily gain, lbs.	2.00	2.42	2.46	2.39
Avg. daily feed intake, lb.	15.48	16.49	18.01	16.07
Avg. lb feed/lg gain	7.96	6.81	7.32	6.72
Cost $/cwt gain[b]	16.00	13.69	14.71	13.51
			Average cost	14.45/cwt

[a]One cripple and removed.
[b]Cost of ration = $2.01/cwt.

Table 11. Predicted and Observed Average Daily Gains Of Sheltered and Nonsheltered Steers By Net Energy[ab]

Item	Funk's G-766W N-S[c]	Funk's G-766W S[c]	Acco R-109 N-S	Acco R-109 S	DeKalb E-57 N-S	DeKalb E-57 S	Northrup King 222A N-S	Northrup King 222A S
No. steers	10	5	9[d]	5	10	5	10	5
Avg. daily feed, lbs.	23.2	19.2	19.4	18.1	20.0	19.8	20.0	17.7
Expected avg. daily gain, lbs.	3.15	2.60	2.62	2.30	2.70	2.60	2.80	2.20
Observed avg. daily gain, lbs.	2.29	2.00	2.25	2.42	2.19	2.46	2.12	2.39
Differences in avg. daily gain, lbs.[e]	-.86	-.60	-.37	+.12	-.71	-.24	-.68	+.19

Sorghum hybrids

Average of four treatments in relation to expected daily gain nonsheltered lots = -.65 lb.
sheltered lots = -.13 lb.

[a]Lofgreen and Garrett's (1968) Net Energy Tables for une in fattening beef cattle.
[b]Sorghum grain NEm = .87 megcal/lb
NEp = .58 megcal/lb
[c]N-S = nonsheltered lots, S = sheltered lots.
[d]One crippled steer removed.
[e]Observed avg. daily gain - expected avg. daily gain.

K S U

Effect of Adding Fat to Feedlot Rations

B. E. Brent, P. A. Phar, L. J. Randle,
L. H. Harbers and D. M. Allen.

Fat is added to commercial feedlot rations as a concentrated energy source and to reduce dustiness and wear of feed processing machinery. We added fat[1] at varying levels (0 to 6% of the ration) to study effects from fat and the influence of a surface-active additive.

Two hundred 700-pound steers were allotted to 40 pens of 5 each and fed 135 days on the rations shown in Table 12, according to the schedule shown in Table 13.

Results

Cattle performance and carcass characteristics are shown in Table 14. Neither the different levels of fat nor the additive significantly affected rate of gain independently. However, their interaction was statistically significant, with highest gains from either the 2% fat diet with the surface-active additive or the 4% fat diet without the additive.

Feed efficiency was improved by both the fat and the additive. In general, efficiency improved at a lower fat level with the additive than without it.

Improved feed efficiency should result from fat added to a diet, because one pound of fat furnishes about 2.25 times as much energy as one pound of carbohydrate. Fat is not likely to increase gain, because ruminants appear to have an "appetite thermostat" that limits them to a fairly constant energy intake. Thus, animals on a high fat diet eat less feed.

Cattle receiving fat had higher quality grades, (but not significantly so), than those receiving no fat. Yield grades of cattle fed no fat were generally lower (indicating higher cutability). Differences were quite small. There were no significant differences in fat covering measured at the twelfth rib. Kidney knob percentages were similar for all treatments, except for higher percentages on cattle receiving the additive and 6% fat.

The data show that up to 6% fat can be added in practical feedlot rations (based on steam-flaked sorghum grain) without reducing gains or carcass cutability. Feed efficiency will improve with added fat.

Fat can be economically used in finishing rations when it costs less per megacalorie of NEm+p than do other ration ingredients.

[1] HEF, Proctor and Gamble Company, Cincinnatti, Ohio

Table 12 Composition of Rations Used to Test Fat and Surface-active Additives[a] in Beef Finishing Rations

	% of ration											
Ration designation	1	2A	2B	3A	3B	3C	3D	4A	4B	4C	4D	4E
Silage (2/3 corn, 1/3 sorghum)	60	51	51	36	36	36	36	18	18	18	18	18
Dehy. alfalfa pellets	16	13	13	12	12	12	12	10	10	10	10	10
Steam flaked sorghum grain	20	32	30	48	46	45	44	68	66	65	64	62
Protein supplement[b]	4	4	4	4	4	4	4	4	4	4	4	4
Fat	0	0	2	0	2	3	4	0	2	3	4	6

[a]Half the lots on each ration received the surface-active additive.

[b]72% soybean meal, 10% urea, 5.74% dicalcium phosphate, 10.4% ground limestone, 1% trace mineral mix, 30000m. I.U./lb. vitamin A, 70 mg/lb. aureomycin, 10 mg/lb. diethylstilbesterol.

Table 13. Dates and Length of Time the Respective Rations Were Fed

Lot Numbers	July 6-July 27	July 28-Augs. 17	Aug. 18-Sept. 7	Sept. 8-Nov. 17
	21 days)	(21 days)	(21 days)	(72 days)
		Ration Designations		
1, 20[a]	1	2A	3A	4A
2, 21	"	"	"	"
3, 23	"	"	"	"
4, 24	"	"	"	"
5, 25	"	"	"	4B
6, 26	"	"	3B	"
7, 27	"	"	"	"
8, 28	"	"	"	"
9, 29	"	"	"	4C
10, 30	"	"	"	"
11, 31	"	2B	3C	"
12, 32	"	"	"	"
13, 33	"	"	"	4D
14, 34	"	"	"	"
15, 35	"	"	"	"
16, 36	"	"	3D	"
17, 37	"	"	"	4E
18, 38	"	"	"	"
19, 39	"	"	"	"
20, 40	"	"	"	"

[a]Pens 1-20, no additive; Pens 21-40, additive.

Table 14. Animal Performance and Carcass Characteristics

	No additive					Additive				
Fat level	No fat	2%fat	3% fat	4% fat	6% fat	no fat	2% fat	3% fat	4% fat	6% fat
Ration last 72 days[a]	4A	4B	4C	4D	4E	4A	4B	4C	4D	4E
Daily gain, lbs.	2.60	2.47	2.73	2.80	2.67	2.58	2.89	2.58	2.58	2.72
Feed/lbs. gain	9.30	9.72	9.47	8.40	8.55	9.06	8.68	8.80	8.77	8.57
Quality grade[b]	18.0	18.4	18.7	18.3	18.6	17.8	18.7	18.5	18.1	18.3
Yield grade[c]	2.9	3.1	3.0	3.3	3.2	2.9	3.0	3.3	3.1	3.1
Fat, 13th rib, in.	.51	.51	.52	.56	.58	.49	.47	.53	.52	.51
% kidney knob	2.6	2.9	2.7	2.9	2.9	2.6	2.7	2.7	2.6	3.3

[a]Data are based on total 135 day perfromance. See tables 12 and 13 for rations fed the 1st 63 days.

[b]20 = average choice, 17 = average good.

[c]Yield or cutability is measured on a scale from 1 to 5, with 1 the most desirable.

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Feedlot Performance and Digestibility of Beef Steers Fed Steam Flaked, Popped, Reconstituted And Dry Rolled Sorghum Grain

D. O. Yauk, C. L. Drake and R. L. Schalles

Introduction

Because most finishing rations contain a high proportion of grain, better processing of sorghum grain to increase grain utilization should improve ration efficiency.

Work in Texas[1], Oklahoma[2], Arizona[3] and Fort Hays[4] has indicated that processing sorghum grain increased digestibility and utilization. This trial compared digestibility and feedlot performance of beef steers fed steam flaked, popped, reconstituted or dry-rolled sorghum grain.

Material and Methods

Sixty good to choice yearling steers averaging 717 pounds each were randomly allotted to twelve lots. Ten were group fed in two groups of five each and five were individually fed in each of the four treatments.

Steam-flaked sorghum grain was obtained by subjecting sorghum grain to steam in an over-sized steam chamber for 40 minutes at 210°F under atmospheric pressure and rolled through a heavy duty Ross roller mill with no tolerance on the rolls. The flaked sorghum grain weighed about 23.5 pounds per bushel with 18 to 20% moisture off the rolls. Flaking was done daily.

Reconstituting was by adding water to dry sorghum grain so

[1] McGinty, D. D., L. H. Breuer and J. K. Riggs. 1966. Digestibility of dry and reconstituted grain sorghum by beef cattle. Beef Cattle Res. in Texas. 2424 p. 37.

[2] Newson, J. R., R. Totusek, R. Renbarger, E. C. Nelson, L. Franks, V. Neuhaus, 1968. Methods of processing milo for fattening cattle. Oklahoma Feeder's Day Rpt. No. 80, p. 47.

[3] Hale, W. H., Luis Cuitun, W. J. Saba, B. Taylor and B. Theurer, 1966. Effect of steam processing and flaking milo and barley on performance and digestion by steers. J. Animal Sci. 25:392.

[4] Brethour, J. R. and W. W. Duitsman, 1970. Feeding high-moisture harvested milo and reconstituted ensiled milo. Round Up Rpt. Bul. 535.

the end product would contain approximately 28% moisture. Grain was in oxygen free storage three weeks before being fed. Fresh grain was rolled twice daily.

Dry heat (popped) sorghum grain was obtained by subjecting the grain to 450°F. Popped grain was then rolled. The end product weighed about 24.5 pounds per bushel and contained 8.5% moisture. Whole sorghum grain was hauled and popped at the Herington, Kansas Tri-county Feedlot. Popping was accomplished using a Cabomatic popper with 4-ton capacity and cooking chamber temperature of 450 to 500°F. Moisture was added to the popped grain before it was fed so the moisture level would be comparable to that of steam flaked grain.

Grain, supplement and roughage were fed twice daily (Table 17).

An attempt was made to evaluate chemical changes in the starch portion of the sorghum from processing, using an enzymatic technique Anstaett et al., (1969). Results are reported in Table 18.

Digestion studies were conducted using four 940 pound Hereford steers in a 4 x 4 Latin square to obtain digestion coefficients (Table 19).

Results and Discussion

Feedlot performance and carcass data are presented in Table 20. July and August temperatures reduced gains for all treatments. Average daily temperature was extremely high, including ten consecutive days of +102°F. Shades were not available and concrete surfaces of pens seemed to increase heat stress so feed consumption was reduced. An effort was made to reduce heat stress by continuously sprinkling the cattle.

There were no significant differences in rate of gain among treatments as shown in Table 20. However, steers fed the processed sorghum grain gained an average of .2 pound per day more than those fed dry rolled grain. Steam flaking produced the highest rate of gain, followed by popping.

Daily consumption on a dry basis was highest for steers receiving dry rolled ($P < .05$) and lowest for steam flaked sorghum grain. Steers consumed more popped grain than steam flaked, especially during the first 60 days of the trial.

Feed efficiencies were significantly ($P < .05$) increased by each processing method (Table 20). Steers receiving processed sorghum grain required an average of 2.15 pounds less feed per pound of gain than those receiving dry rolled grain. There were no significant differences in feed efficiency among steers receiving steam flaked, popped, or reconstituted sorghum grain. Carcass characteristics did not differ significantly among treatments.

Apparent coefficients of digestion for rations containing sorghum grain processed by four methods are presented in Table 19. Coefficients of digestion for protein, crude fiber,and ether extract were not significantly altered by processing. Total digestible nutrients and the COD of dry matter and nitrogen free extract differed significantly.

Digestion coefficients for dry matter, nitrogen-free extract compared to reconstituted sorghum grain. Total digestible nutrients, nitrogen-free extract, gross energy, and dry matter of popped grain exceeded ($P<.05$) that of rolled sorghum grain. Reconstituting increased ($P<.05$) the digestibility of nitrogen-free extract and gross energy, but total digestible nutrients and dry matter did not differ from those of dry rolled grain.

Starch alteration (gelatinization) during processing was evaluated. Starch changed most in popped grain, as indicated by mg maltose per gram of sample (Table 18). Steam-flaked grain (weighing 22 pounds per bushel) produced 110 mg maltose per gram sample: reconstituted, 25 mg; and dry rolled, 29.8 mg. Reconstituting changes starch very little. Sorghum grain steamed and not flaked yielded 20 mg of maltose, indicating that steaming at atmospheric pressure a short time does not greatly modify starch. Steam flaking altered starch indicating that both physical pressure and heat are essential for gelatinization.

CORRECTION:

Page 21, Paragraph 2, 1st sentence:

Digestion coefficients for dry matter and nitrogen-free extract were greater ($P<.05$) for steam flaked than reconstituted sorghum grain.

Page 21, Paragraph 2, 2nd sentence:

Delete - total digestible nutrients.

Table 15
Proximate Analysis of Sorghum Grain
Processed by Indicated Method

Item	Processing method			
	Recon-stituted	Popped	Steam flaked	Dry rolled
Composition, DM basis, %				
Protein (N x 6.25)	10.62	11.39	10.08	9.79
Ether extract	2.50	2.76	2.56	2.73
Ash	1.75	1.78	1.58	1.70
Crude fiber	1.89	2.40	2.08	2.07
N-free extract	83.24	81.67	83.70	83.71
Original moisture	25.80	7.11	17.92	15.09
Gross energy, kcal/gm	4.408	4.396	4.430	4.364

Table 16
Chemical Composition of Feedlot Rations Containing Sorghum Grain Processed By Indicated Method

Item	Recon-stituted	Popped	Steam flaked	Dry rolled
Composition, DM basis %				
Protein (N x 6.25)	13.09	13.66	14.89	14.08
Ether extract	2.92	2.62	2.43	2.81
Ash	2.86	2.95	2.55	2.97
Crude fiber	3.93	4.37	3.98	4.49
N-free extract	77.22	76.39	76.15	75.65
Original moisture	27.39	21.97	19.28	18.50
Gross energy, kcal/gm	4.338	4.286	4.378	4.329

Table 17

Ration Composition to Compare Four Processing Methods With Sorghum Grain

Ration Ingredient	Processing method: Reconstitution[1]	Processing method: Dry rolled steam flaked popped
	%	%
Haylage	10.000	10.000
Sorghum grain	88.235	88.055
Salt	0.5	0.5
Limestone	0.5	0.5
Urea	0.67	0.85
Vitamin A	0.015	0.015
Chlorotetracycline	0.030	0.030
Trace mineral	0.050	0.050

[1]Two rations were necessary to insure isonitrogenous rations as grain used in reconstituted ration differed from that used in other rations.

Table 18
Influence of Four Processing Methods
On Sorghum Starch Gelatinization

Item	Maltose mg/gm	Gelatinization %
Reconstituted	25.0	10
Popped	149.0	62
Steam flaked - 24#	87.1	36
Steam flaked - 22#	110.0	46
Dry rolled	29.8	12
Steamed - not flaked	20.0	8
Analytical standard (extruded)	240.0	100

TABLE 19 MEANS AND STANDARD ERRORS OF APPARENT COEFFICIENTS OF DIGESTION AND NITROGEN BALANCE OF STEERS FED SORGHUM GRAIN PROCESSED BY FOUR METHODS

Item	Reconstituted	Popped	Steam Flaked	Dry Rolled
No. steers	4	4	4	4
Dry matter intake				
kg/day	4.2	3.6	3.9	3.9
Digestibility[a]				
Protein	75.2^{b} ±1.2^{c}	73.7^{d} ±3.4	72.6^{d} ±2.2	71.3^{d} ±2.4
Crude Fiber	52.0^{d} ±5.9	47.7^{d} ±4.4	50.0^{d} ±2.6	52.1^{d} ±3.5
Ether extract	60.2^{d} ±6.3	58.4^{d} ±7.3	62.4^{d} ±5.8	62.0^{d} ±3.8
Nitrogen free extract	87.0^{d} ±2.7	91.5^{e} ±1.3	93.0^{f} ±0.5	82.7^{g} ±2.2
Dry matter	81.9^{d} ±2.4	84.3^{e} ±1.9	86.2^{e} ±0.8	77.9^{d} ±2.2
Total digestible nutrients	58.5^{d} ±1.5	61.9^{d} ±1.9	67.4^{f} ±0.6	61.7^{d} ±1.9
Gross energy	79.5^{d} ±2.6	82.1^{e} ±2.4	84.0^{e} ±0.9	74.9^{f} ±2.2
Digestibly energy Kcal/gm	2.6	2.6	2.8	2.5
Nitrogen balance				
Fecal	24.8 ±1.2	26.3 ±3.4	27.4 ±2.1	28.7 ±2.4
Urinary	52.4 ±3.8	48.0 ±3.0	60.2 ±7.0	57.4 ±3.9
Retention	22.8 ±2.7	25.7 ±4.7	12.4 ±2.6	14.0 ±10.4
Nitrogen retained gm/day	27.3 ±21.6	29.1 ±22.7	15.7 ±27.8	16.3 ±35.2

a. Percent of intake, coefficient of digestion (COD) as cited in text.

b. Percent of intake.

c. Standard error

d,e,f. Means in the same row with different superscripts differ significantly ($P < .05$)

Table 20
Performance and Carcass Data of Steers Fed Sorghum Grain
Processed By One of Four Methods (Summer 1970)

Item	Processing method: Recon-stituted	Popped	Steam flaked	Dry rolled
			Feedlot data	
No. steers	15	15	15	15
Avg. initial wt, lbs.	712.0	714.0	717.0	724.0
Avg. final wt., lbs.	1026.0	1028.0	1039.0	1021.0
Avg. daily gain, lbs.	2.65[a]±0.13[d]	2.65[a]±0.98	2.72[a]±0.11	2.46[a]±0.13
Avg. daily feed intake, lbs.	16.12[a]	15.24[a]	15.13[a]	18.69[b]
Avg. lbs. feed/lb gain	5.65[a]	5.96[a]	5.49[a]	7.85[b]
			Carcass data	
Avg. hot carcass wt, lbs.	634.0	633.0	635.0	632.0
Avg. rib-eye area, sq. in.	12.21	12.41	11.80	11.79
Avg. fat 12th rib, in.	.57[a]±0.14	.48[a]±0.60	.46[a]±0.31	.50[a]±0.57
Avg. carcass grade[c]	9.73[a]±0.22	9.86[a]±1.30	9.33[a]±0.27	9.80[a]±0.43
Avg. yield grade	2.88	2.61	2.77	2.82

[a,b]Means within rows with unlike superscripts differ significantly ($P<.05$).
[c]High good = 9; Low choice = 10.
[d]Standard error.

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Starea, Urea and Soybean Meal Compared in Wintering Rations for Cows on Bluestem Pasture

L. Tucker, L. H. Harbers, and E. F. Smith (Project 253)

More urea, a form of nonprotein nitrogen, would be fed to ruminants except for inefficient conversion of urea-nitrogen to microbial protein, toxicity, lack of palatability and urea segregating in mixed rations. As a supplement for cattle on high-roughage rations, urea should be fed with a readily available energy source for urea nitrogen to be converted to microbial protein by rumen microorganisms. Attempting to overcome some or all of those problems, Bartley and co-workers at Kansas State University (Feedstuffs, 27 Apr. 68; 40:9) developed an expansion-processed mixture of grain and urea (Starea).

We tested Starea and soybean meal as protein supplements for beef cows grazing dry bluestem pasture during the winter.

Methods

Sixty-three nonlactating, pregnant Hereford cows were alloted into four groups on the basis of the adjusted weight of each's calf (calf weight adjusted for sex and age of calf). Each group was further subdivided into 2 groups for replication. Cows were fed one of four rations (Table21) each morning six days per week receiving 7 days' feed during the 6 day feeding period. Rations, except the sorghum grain one, were isocaloric and isonitrogenous. When cows were expected to begin calving, they were given the lactation rations (Table 22). They had access to water, a salt-mineral vitamin mix (55.1% salt, 36.7% dicalcium phosphate, 8.2% vitamin A premix) fed free-choice, and pasture. Hay was fed only when snow cover prevented grazing. Cow weight data during the gestation portion of this trial were collected. Data being collected include cow weight within 24 hours following parturition, calf birth weight, birth date and weaning weight of calf.

Results

Upon initiation of this experiment, ammonia toxicity was apparent in the sorghum grain-urea ration, and one animal died. Lack of palatibility remains a problem with feed weigh-back per head per day 0.2 to 2.5 lbs. Weight change of the cows during gestation portion is given in Table 23. The most notable weight changes occurred in urea-sorghum grain (Group 3) and sorghum grain fed animals (group 4), with little or no advantage indicated for urea in a ground sorghum grain ration under our conditions. Weight changes were similar for animals fed soybean or Starea supplements.

Table 21 Gestation Rations (Average Daily Feeding)

	Nitrogen source	Sorghum grain
Group 1	1.00 lb. soybean meal	2.00 lb.
Group 2	1.00 lb. Starea	2.00 lb.
Group 3	0.13 lb. urea	2.87 lb.
Group 4	----	3.00 lb.

Table 22 Lactation Rations (Average Daily Feeding)

	Nitrogen source	Sorghum grain
Group 1	1.00 lb. soybean	5.00 lb.
Group 2	1.00 lb. Starea	5.00 lb.
Group 3	0.13 lb. urea	5.87 lb.
Group 4	----	6.00 lb.

Table 23 Weight Changes of Cows During Gestation

Ration	5 Dec. 70 - 6 Jan. 71 (32 days)	6 Jan. 71 - 13 Feb. 71 (38 days)	5 Dec. 70 - 13 Feb. 71 (70 days)
Group 1	-97#	+71#	-26#
Group 2	-96#	+48#	-48#
Group 3	-111#	+36#	-75#
Group 4	-114#	+35#	-79#

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Comparison of Biuret and Soybean Meal for Wintering Cows on Bluestem Pasture

II. Effect On Birth and Weaning Weight of Progeny (Project 253)

H. A. Thyault, L. H. Harbers, and E. F. Smith

During the winter of 1969-70, 48 five-year-old cows were divided into three groups to compare soybean meal with biuret as a winter supplement in combination with sorghum grain (Bulletin 536, 1970, p. 33). Soybean supplemented cows gained 31 lbs. each during 4 months while biuret-fed cows lost 15 lbs. each. Cows fed sorghum grain with biuret in a separate mineral mix (fed free choice) lost 62 lbs. each.

Birth weight and 205-day, adjusted, weaning weight (steer equivalent) of calves born during and after the winter-supplementation study are given in table 24. When the supplements were mixed with sorghum grain, soybean meal and biuret were equally good; but cows given biuret in a mineral mix gave birth to smaller calves ($P < .05$). Weaning weights were lower in the biuret-mineral group but not significantly different from those fed protein supplements mixed with sorghum grain.

Table 24. Birthweight And Adjusted Weaning Weight of Calves Born to Cows Receiving Soybean Meal or Biuret as Protein Supplements

Item	Sorghum grain-soybean meal	Sorghum grain-biuret	Mineral-mix biuret
Birth Wt., Lb.	67(55-60)[a]	67(50-80)	62(44-70)
Weaning Wt., Lb.	422(316-476)	423(329-481)	407(286-461)

[a] Average, with range

Biuret can be successfully added to complete wintering cow supplements but, in a separate mineral mix, biuret did not compare favorably with mixtures of either soybean meal and sorghum grain or biuret and sorghum grain.

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Winter Nutrition For Cows

R. R. Schalles, C. L. Drake and Guy Kiracofe

Cow productivity on four supplemental winter feeding levels were compared over 2 years. Cattle were grazed on native bluestem year round. Cows calved between February 15 and May 5. Only records (104) of cows that raised a calf in the year considered were used in this report. Cows averaged 3.3 years old at birth of calves. Rations fed are given in Table 25 referred to as group 1, 2, 3 and 4. Cows received the same ration each year. Cows were allotted to 4 groups and rotated among four approximately equal pastures so each group remained in each pasture an equal time. Calves were weighed at birth and cows and calves were weighed each month. During the first year, cows were rectally palpated each week after calving until the first heat to determine time of ovulation and uterine size.

Results

Performance of cows 4 years old and over differed little on the 4 rations (Table 26). Older cows on ration 3 had the highest conception rate and produced the lightest calves at weaning; whereas, cows in group 2 had the lowest conception rate and produced the heaviest calves. Weight change of cows was similar, ranging from 3 to 8% increase between the start of feeding and January and an 11 to 12% decrease between January and May.

Three-year-old cows (Table 27) on ration 2 performed best with 100% conception rate and weaned calves as heavy as any. Calves from cows in group 1 weighed as much but those cows had the lowest conception rate. Calves weaned by group 3 were the lightest. Cows on ration 2 gained 3% of their body weight between November and January and lost 8% between January and May.

The performance of 2-year-old cows on ration 1 was superior to the performance of 2-year-olds on other rations. Days from calving to rebreeding and conception rate of 2-year-olds on rations 3 and 4 would not be considered satisfactroy, while the performance of cows on ration 2 was only slightly better. Cows 2-years-old on ration 1 gained 8% between November and January and essentially maintained constant weight the remainder of the winter.

When cows of all ages were considered the first year, cows in groups 1 and 4 ovulated approximately 18 days after calving while cows in groups 2 and 3 averaged 23 and 30 days between calving and the first ovulation.

In all treatments, first heat was approximately 10 days after first ovulation. The uterus was back to approximately normal size at first heat. Conception rates in groups 1, 2 and 3 varied little during the first year; all were above 90%. Group four's conception rate was 73% and required approximately 10 days longer to conceive (Bulletin 529 gave details of the first year's work).

Data for the 2 years indicate that 3 pounds of good quality alfalfa hay per day provides enough protein for cows 3 years old and over. Energy appeared to be more critical in this study. Ration 2 was the most economical of the 4 rations when all performance factors are considered.

Table 25 Supplemental Winter Rations Provided Cows on Native Bluestem Pastures 1967-69

	Group			
Ration	1	2	3	4
Alfalfa hay, lbs.	3	3	3	3
Cracked sorghum grain, lbs.	3	3		
Soybean meal, lbs.	1½		1½	

Table 26 Performance of Cows 4 Years Old and Over

Item	Group 1	Group 2	Group 3	Group 4
Number	12	11	16	8
Conception %	83	73	94	75
Date Bred	6/5	6/15	6/9	6/22
Calving to Breeding, days	72	72	81	86
Average weaning wt, lbs	368	389	359	367
Weight change, %				
November to January	+7	+8	+5	+3
January to May	-11	-12	-12	-11

Table 27 Performance of 3 Year Old Cows

Item	Group 1	2	3	4
Number	11	11	7	8
Conception %	82	100	100	88
Date bred	6/14	6/16	6/21	6/30
Calving to Breeding, days	75	72	80	76
Average weaning wt., lbs.	411	410	376	398
Weight change, %				
November to January	+11	+3	+4	+5
January to May	-11	-8	-8	-10

Table 28 Performance of 2 Year Old Cows

Item	Group 1	Group 2	Group 3	Group 4
Number	7	3	2	8
Conception %	86	67	50	50
Date Bred	6/29	6/20	6/30	7/19
Calving to Breeding, days	71	66	93	113
Average weaning wt, lbs.	464	339	312	433
Weight change, %				
November to January	+8	+8	+9	+3
January to May	-1	-10	-12	-10

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Simmental-Hereford Cross Calves

Miles McKee, Robert R. Schalles and Keith O. Zoellner

Data on nine Simmental-Hereford cross calves (3 bulls and 6 females) from birth to 6 months of age was reported in Bulletin 536. The three bulls shared conditions with three Hereford, four Angus and one Shorthorn bull. The six cross heifers grew with three Hereford, three Angus, and two Shorthorn heifers.

All calves were weaned May 12 and their weights adjusted to a 205-day basis with corrections for age of dam and age of calf. The six Simmental-Hereford heifers adjusted to 387 pounds and their eight straight-bred contemporaries adjusted to 363 pounds. The three Simmental-Hereford bulls adjusted to 439 pounds and their eight straight-bred contemporaries to 407 pounds. Mothers of the calves were wintered on dry bluestem pasture supplemented with approximately 5 pounds of an 18% digestible protein range cube each per day. None of the calves was creep fed.

After weaning all heifers were placed on brome grass pasture. The pasture was infested with army worms in mid-June so prairie hay was supplemented then. The heifers received no other supplement until they were weighed October 1. The bulls were grazed on brome grass pasture. Starting July 15, the pasture was supplemented with approximately six to eight pounds of grain per animal per day until bulls were weighed, October 1.

The yearling weights of all cattle were adjusted to a 365-day basis using the Beef Improvement Federation's standard procedure. The six Simmental-Hereford heifers adjusted to 678 pounds; their eight straight-bred contemporaries, to 592 pounds. The three Simmental-Hereford bulls adjusted to 914 pounds; their contemporaries, to 809 pounds.

During the growing period no discernible differences other than growth rate were observed between the crosses and the straight breds. Heterosis (hybrid vigor) manifested in cross cattle normally is expressed by increased rate of gain.

Sixteen more Hereford cows in the University herd were mated to the Simmental bull, Gallant, to calve this spring. Cow ages are 3 to 13 years. As of April 1, 1971, eleven calves (3 bulls and 8 heifers) had been born, all healthy at birth. The three bulls weighed from 92 to 97 pounds at birth, and all were difficult births. One bull developed scours and died one week after birth. The eight heifers weighed from 78 to 84 pounds at birth and one was a difficult birth.

K S U

The Tenderometer as a Tool for Evaluating Beef Tenderness[1,2]

M.E. Dikeman, H.J. Tuma, and D.M. Allen

Numerous instruments have been developed to objectively measure tenderness, an important eating characteristic of beef. The Kramer shear press and Warner-Bratzler shear show the best relationships to taste panel tenderness scores. However, shear values of raw muscle are poorly correlated with shear values of cooked meat. An instrument that could be used in the beef cooler on raw carcass muscle to predict tenderness of cooked meat would be valuable.

The Tenderometer, which objectively measures the force required to push ten needle-type probes to a constant depth into the longissimus muscle, was developed for commercial use by Armour and Company. The original data indicated high correlations with Warner-Bratzler shear force and taste panel evaluations of cooked muscle.

This study provides Tenderometer data on predicting tenderness of the longissimus muscle of male cattle from different sex-treatments.

Sixty Hereford and 60 Angus male calves were randomly assigned (within each breed) to six treatment groups based on sex alteration. At approximately 200 days of age, the calves were weaned and placed in a commercial packing plant. After a 24 hr. chill, the wholesale rib was removed from the left side of each carcass and transported to Kansas State University. The longissimus muscle was probed with the Tenderometer in accordance with the manufacturer's procedure. Steaks from the eighth and seventh ribs were evaluated for tenderness by the Warner-Bratzler shear and a taste panel.

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[1]A cooperative project between the U.S. Meat Animal Research Center, Clay Center, Nebraska, and the Department of Animal Science and Industry, Kansas State University, Manhattan.

[2]The Tenderometer provided by Armour and Company, Oak Brook, Illinois.

Results and Discussion

Correlations between quality scores and tenderness data are presented in table 29. The correlation between Warner-Bratzler shear and taste panel scores (r = -.67) agrees with correlations reported by other researchers, and indicates that tenderness results in this study are both accurate and reliable. However, correlations of Tenderometer values with Warner-Bratzler shear values and taste panel scores were low (r = 0.22 and -.21, respectively).

Armour and Company has reported that as marbling increases, Tenderometer values increase. Therefore, one uses a correction factor for different carcass grades. In our study, however, marbling was not related to Tenderometer readings (r = 0.10); therefore, correction factors were not used.

The Tenderometer is simple to operate. It would be practical and useful for predicting tenderness if it could be proved accurate. However, results from this study indicate that the instrument is not accurate or reliable for tenderness predictions.

Table 29. Pooled correlations between quality scores and tenderness data

	Warner-Bratzler shear	Taste panel tenderness	Taste panel flavor	Taste panel juiciness	Taste panel overall acceptability	Tenderometer
U.S.D.A. carcass grade	0.06	-.07	0.10	-.08	-.10	0.17
Marbling score	0.01	-.01	0.11	0.02	-.01	0.10
Fat in *longissimus*, %	0.01	0.10	0.14	0.17	0.09	0.20
Tenderometer value	0.22	-.21	-.01	0.13	-.15	1.00
Taste panel tenderness	-.67					

K S U

Effect of Beet Pulp Pellets Fed Steers Wintering and Finishing Rations

Colby Branch Experiment Station

L. A. Arehart and Evans E. Banbury

Sugar beet by-products are available to cattle feeders in northwestern Kansas, but their value as livestock feed is not known. In 1967-68, steers fed liquid protein concentrate beet pulp pellets (LPC) in wintering rations gained faster (1.96 vs 1.24 lb. per day) than steers on similar amounts of alfalfa hay. Then on finishing rations, gain per day favored alfalfa-fed cattle (2.58 to 2.25 lb. per day).

In 1968-69, there was no significant difference between beet pellets and alfalfa, but 5.0 lb. LPC beet pellets reduced feed consumption and daily gains compared with results from rations involving alfalfa (wintering 1.33 to 1.19 lb. per day; finishing 2.5 to 2.14 lb. per day).

Last year, Colby Experiment Station evaluated dried molasses-beet pulp pellets in wintering and finishing rations.

Wintering Phase

Procedures: Twenty-four steer calves averaging 460 lb. were used to compare dried molasses beet pulp pellets and sorghum grain as energy sources in a wintering ration. Steers (placed on test after a two-week adjustment period) were gradually brought to full feed of sorghum silage and 4.0 lb. of alfalfa hay per day in addition to either 4 lb. of beet pulp pellets or 4 lb. of sorghum grain. Salt, dicalcium phosphate, and ground limestone were provided ad. lib. All steers were implanted with 30 mg. diethylstilbestrol.

The test ran from October 31, 1969, to February 27, 1970 (119 days). Steers were shrunk 16 hours before initial and final weighings.

Results and Discussion: Differences in gain from the two rations were not significant, however, steers consumed more silage when 25% of the sorghum grain was replaced with dried molasses beet pulp pellets (Table 30). The increased silage resulted in greater dry matter intake by steers receiving beet pulp than those receiving sorghum grain (16.4 vs 15.6 lb.). Feed efficiency was slightly better (9.15 vs 9.66 lb.) with sorghum grain rather than molasses beet pulp pellets, so feed cost was $0.51 per 100 lb. gain less with the sorghum grain.

Finishing Phase

Procedure: Dried molasses beet pulp pellets were evaluated as a concentrate in a finishing ration for steers by replacing 25% of the sorghum grain in the ration, as shown in Table 31.

The concentrate portion of the diets provided 11.5% protein. After reaching full feed, steers were hand fed daily to provide feed ad. lib., plus 2 lb. each of alfalfa hay daily. Sorghum silage was fed while the steers adjusted to the high-concentrate ration. Each steer received a 30 mg. diethylstilbestrol implant at the beginning of the finishing phase of 143 days (February 27 - July 20, 1970). Final weights and average daily gains were adjusted to a constant carcass yield of 62%, using carcass data.

Results and Discussion: Steers fed dried molasses beet-pulp pellets for 25% of the sorghum grain in the ration ate nearly 2 lb./day more ration and gained 7.8% faster than those receiving only sorghum grain, so feed efficiency was the same. Dressing percentage, marbling, and carcass grade were not affected.

Summary

This one test suggests that dried molasses beet-pulp pellets can replace 25% of the concentrate without significantly changing average daily gain, feed efficiency, feed intake, or carcass data when fed in cattle finishing rations. Future tests should evaluate using more than 25% dried molasses beet-pulp pellets.

Table 30. Performance of steer calves fed dried molasses beet pulp pellets or sorghum grain as a source of energy in a wintering ration. (October 31, 1969, to February 27, 1970 - 119 days).

Treatment	Sorghum grain	Beet pulp pellets
No. steers	12	12
Initial wt., lb.	461	460
Final wt., lb.	674	651
Av. daily gain, lb.	1.79	1.60
Av. daily ration, lb.	7.5 (23.5)[2]	6.7[1] (19.6)[2]
Forage sorghum silage	3.9	
Sorghum grain		3.9
Dried molasses beet pulp pellets		5.0
Alfalfa hay		15.6
Total (air dry)	16.4	
Feed per 100 lb. gain, lb.		
Forage sorghum silage	423[1] (1315)[2]	415[1] (1217)[2]
Sorghum grain	216	
Dried molasses beet pulp pellets		242
Alfalfa hay	276	309
Total (air dry)	915	966
Feed cost per 100 lb. gain, $[3]	13.30	13.81

[1] Converted to 12% moisture.

[2] As fed - 70% moisture.

[3] Feed costs based on these prices: Forage sorghum silage, $8/ton; sorghum grain, $1.80/cwt.; dried molasses beet pulp pellets, $1.80/cwt; alfalfa hay $30/ton.

Table 31 Effect of Replacing 25% of the Sorghum Grain In a Finishing Ration With Dried Molasses Beet Pulp Pellets (February 27, 1970 to July 20, 1970 - 143 days)

Treatment	100 % sorghum grain		25% beet pellets 75% sorghum grain	
No. steers	12		12	
Initial wt., lbs.	661		664	
Final wt., lbs.[1]	1063		1097	
Avg. daily gain, lbs.[1]	2.81		3.03	
Avg. daily ration, lbs.				
Concentrate mix	19.5		21.3	
Alfalfa hay	2.3		2.3	
Forage sorghum silage	0.6[2]	(1.8)[3]	0.6	(1.8)[3]
Total (air dry)	22.4		24.2	
Feed per 100 lbs.gain, lb.				
Concentrate mix	694		707	
Alfalfa hay	82		76	
Forage sorghum silage	21[2]	(64)[3]	19[2]	(59)[3]
Total (air dry)	797		802	
Feed cost per 100 lbs. gain, $[4]	16.09		16.20	
Carcass data				
Carcass wt., lbs.	659		680	
Dressing percent	62.2		62.8	
Marbling	4.8		4.7	
Carcass grade	18.2		18.4	

[1] Adjusted to a carcass yield of 62% based on hot carcass weight.
[2] Converted to 12% moisture.
[3] As fed - 70% moisture.
[4] Feed cost based on following prices: Ground sorghum grain, $1.85/cwt; dried molasses beet pulp pellets, $1.80/cwt; alfalfa hay, $30.00/ton; soybean oil meal, $5.00/cwt; forage sorghum silage, $8.00/ton.

Table 32. Composition of ration ingredients (%)[1]

Ingredients	Diet 1	Diet 2
Sorghum grain	82.63	61.97
Soybean meal 44%	7.10	7.10
Dried molasses beet pulp pellets	--	20.66
Alfalfa hay	10.27	10.27

[1] Contained 1200 IU Vit. A and 4 mg. aureomycin/1 lb.