1975 CATTLEMEN'S DAY

Report of Progress 230 • March 7, 1975 • Department of Animal Science & Industry • Weber Hall
Agricultural Experiment Station • Kansas State University, Manhattan
Floyd W. Smith, director

62nd Annual

CATTLEMEN'S DAY

Friday, March 7, 1975

STOCKMEN'S DINNER

THURSDAY, MARCH 6, 1975

Dr. A. D. "Dad" Weber, Appreciation Evening

6:30 p.m. Manhattan Country Club
Reservations by March 3 to:
Livestock & Meat Industry Council, Inc.
Weber Hall, Kansas State University
Manhattan, Kansas 66506

FRIDAY, MARCH 7, 1975

8:00 a.m. Weber Hall Arena
Registration—Exhibits
(Coffee and Donuts served)

9:45 a.m. Weber Hall Arena
Dr. Don L. Good, Head, Department of Animal Science and Industry, KSU, presiding

President James A. McCain—
Welcome and Introduction of
Dr. Roger L. Mitchell
Vice-president for Agriculture, KSU

Beef Cattle Research Panel
Moderator, Dr. Larry Corah, Department of Animal Science and Industrty, KSU

Taste Panel Comparisons of Grass and Grain Fed Beef, Dr. Don Kropf, Department of Animal Science and Industry

Current Status of Beef Grading Changes and Implications on Feeding Programs, Dr. Dell Allen, Department of Animal Science and Industry, KSU

Use of Harvested Crop Residues for Growing and Finishing Cattle, Dr. Keith Bolsen, Department of Animal Science and Industry, KSU

Crop Residue Utilization by Beef Cows, Dr. Miles McKee, Department of Animal Science and Industry, KSU

Producers Panel
Moderator, Dr. John McCoy, Department of Agricultural Economics, KSU

Utilizing Maximum Roughage and Grass in Growing and Finishing Cattle, Mr. Walter Porter, Miller, Kansas

The Packers Kind of Slaughter Cattle, Mr. Tom Points, Sales Manager of Dubuque Packing Company, Wichita, Kansas

Cattle Feeding Programs, The Commercial Feeder Approach, Dr. Calvin Drake, Agricultural and Industrial Development, Inc., Syracuse, Kansas

12:15 p.m. Weber Hall Arena
Lunch: Roast Beef

1:00 p.m. Weber Hall Arena
Remarks
Dr. M. P. Reeve, President Kansas Livestock Association, Garden City, Kansas

Introduction of Guest Speaker
Dr. Don L. Good, Head, Department of Animal Science and Industry, KSU

Beef Cattle Production Under Pastoral Conditions, Dr. D. C. Dalton

Dr. Clive Dalton*, Scientific Officer at the Whatawhata Country Research Station, Hamilton New Zealand. Dr. Dalton was educated in England and Wales. He served as a lecturer in Animal Production at the University of Leeds in England and guided research for honours masters and Ph.D. students. He works with commercial and purebred beef cattle producers and livestock associations in New Zealand livestock improvement programs. He has spoken to many livestock groups in England, Australia, and New Zealand on genetic improvement and management of beef cattle. He is an expert on pasture management for efficient livestock production.

2:00 p.m. Beef Cattle Research Center
(about 2 miles north, at end of College Avenue)

* Sponsored by:
Elanco Products Company
Livestock & Meat Industry Council, Inc.
Department of Animal Science and Industry

FOR THE LADIES

THURSDAY, MARCH 6, 1975

6:30 p.m. Bluemont Room, KSU Union
Kansas Cow Belles Dinner
Reservations by March 3 to:
Mrs. Don L. Good
2027 Sunnymeade Road
Manhattan, Kansas 66502

FRIDAY, MARCH 7, 1975

9:30 a.m. Weber Hall, Staff Memorial Library
Coffee

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

12:15 p.m. Weber Hall Arena
Lunch: Roast Beef

CONTENTS

Adjusting Yearling Weight Ratios for Prior Selection

J. Vanmiddlesworth, R. R. Schalles, and G. A. Milliken

Summary

We deveoped a procedure to compare yearling weight ratios of a calf crop when the calves have been on different management or feeding regimes. This procedure will also produce more meaningful sire and dam summaries.

Introduction

When a purebred breeder castrates part of his bull calves at weaning, puts some in the central bull test, and feeds some out at home, it is difficult to compare these animals. Because yearling weights are so important, he would like to compare yearling weights among all of his bull calves. That also would improve his evaluation of sires and dams. Our procedure allows comparisons.

Method and Example

When calves with the highest weaning weight are selected for one management system, and calves with lowest weaning weight are selected for another, yearling comparisons cannot be made. Calves within each management system can be compared and the average yearling weight ratio of each contemporary group will be 100. Because of the high genetic correlation between weaning weight and yearling weight (approximately 0.79), the lowest group at weaning should also have the lowest average ratio at yearling. The adjustment method presented here takes advantage of this high genetic correlation and the known amount of change in the mean due to a given amount of selection.

The adjustment (table 1) is added to the yearling weight ratios of the contemporary group with high weaning weight and is subtracted from those of calves selected for lower weaning weights. The adjustment works only if selection is based on weaning weight. The percent of animals selected for a contemporary group is given in the first column of table 1. The adjustment (last column) is added to or subtracted from the yearling weight ratios for the appropriate contemporaries.

For example, a breeder has 21 bulls in his calf crop (table 2). He castrates the 60% (13 calves) with the lowest weaning weights leaving 40% (8 calves) as bulls. At yearling, the 8 bull calves are contemporaries with an average adjusted 365 day weight of 975 lbs. The contemporary yearling weight ratios are obtained by dividing each bull's weight by 975 and multiplying by 100. Since 40% were selected, each contemporary yearling weight ratio has 7 (from table 1) added to give the adjusted yearling weight ratio in table 2. The 60% with the lowest weaning weights were castrated, giving them a ratio higher than they really should have, since the ratio is based on their contemporaries. So 60% selection adjustment of 5 (table 1) is subtracted from their contemporary yearling weight ratios. This will give an estimate of the true yearling weight ratio of all calves, both intact and castrated.

With this procedure, the entire calf crop can be compared. A breeder could castrate part of his calves, performance test some as bulls on the farm, and send some to a central bull test, and still be able to compare all calves in the bull calf crop, providing selection is based on 205-day adjusted weaning weight, making a sire summary and dam summary for yearling weight much more meaningful.

Table 1. Yearling Weight Ratio Adjustments.

% Selected	Adjustment[a]
95	1
90	1
85	2
80	2
75	3
70	4
65	4
60	5
55	5
50	6
45	6
40	7
35	8
30	8
25	9
20	10
15	11
10	13
4	15
3	16
2	17
1	19
.5	21

[a]Adjustment to be added or subtracted to yearling weight ratio after selection is practiced at weaning.

Table 2. Example of using Yearling Weight Ratio Adjustment Factor

Calf I.D.	Sire	205 day weight	365 day weight	Contemporary yearling weight ratio	Adjusted yearling weight ratio
40% selected at weaning for bulls					
14	A	468	929	95	102
31	B	445	1026	105	112
4	A	425	889	91	98
41	B	427	1019	104	111
25	B	416	1009	103	110
30	A	404	964	99	106
15	B	405	983	101	108
7	A	400	980	100	107
Averages		424	975	100	107
60% castrated at weaning					
35	A	397	692	104	99
22	A	395	716	108	103
8	A	390	734	110	105
40	B	389	677	102	97
48	B	388	643	96	91
20	B	385	708	106	101
12	A	384	750	113	108
10	A	375	699	105	100
19	B	364	682	102	97
17	B	328	577	87	82
36	B	322	605	91	86
3	A	298	603	90	85
2	B	242	570	86	81
Averages		358	666	100	95
Sire Summary					
Sire A		4 bulls	940	96	101[a]
		6 steers	699	105	
Sire B		4 bulls	1009	103	98[a]
		7 steers	637	96	

[a]Adjusted bull yearling weight ratio and adjusted steer yearling weight ratio can be averaged together bacause of the adjustment.

Effects of Creep Feeding and Post-weaning Ration on Calf Performance

J. H. Warren, E. F. Smith, R. R. Schalles,
Loren Berger, and G. Fink

Summary

We found no advantage for creep feeding calves for either all summer or 37 days prior to weaning. All calves were with their dams on native pasture. Calves not creep fed or creep fed only 37 days before weaning were sick less after weaning than those creep fed all summer.

Rate of gain for 21 days after weaning was as good on a low energy weaning ration as on a high energy ration. However, more sickness occured on the low energy ration.

Experimental Procedure

One hundred forty-two Polled Hereford calves were randomly allotted within sex, age of dam, and sire. Calves were born in March and April and were with their dams on native Bluestem pasture. Thirty-six calves were creep fed starting on June 17 and continuing through weaning on October 2. Thirty-three calves were creep fed from August 26 through weaning (37 days), while 73 calves were not creep fed. At weaning all calves were trucked approximately six miles and assigned to four lots according to their pre-weaning treatment. Three lots: creep last 37 days; no creep; and creep all summer were self-fed a higher energy ration of 60% dehydrated alfalfa-40% milo ration (70% TDN). These calves were fed approximately 4.25 lbs. of prairie hay per day for the first two days. The fourth lot was non-creep fed calves self-fed a lower energy ration (63% TDN) of 30% rolled oats, 30% cracked milo and 15% soybean meal, plus 25% prairie hay hand fed daily.

Weight and days sick were analyzed by least squares procedures. The model included type of creep feeding, type of post-weaning ration, sex of calf, age of calf at weaning, age of dam, and sire.

Results and Discussion

Table 2.1 gives performance results for the pre-weaning and post-weaning treatments. Creep feeding did not affect ($P<.05$) weaning weight or post-weaning performance. All calves lost weight the first week after weaning. Bull calves were 7% heavier ($P<.01$) at weaning and gained more weight ($P<.01$) during the post-weaning trial. Calves receiving the high energy ration tended to maintain heavier average weights during the post-weaning period.

Calves receiving no creep feed or creep feed only 37 days were sick less days post-weaning ($P<.05$) than calves receiving creep feed all summer. Calves on the high energy ration averaged less days sick ($P<.05$) than those on the low energy ration. Bull calves were sick more days ($P<.01$) than heifers (1.4 vs. 0.74 days) during the post-weaning trial.

No advantage for creep feeding either for long periods (all summer) or short periods (37 days prior to weaning) was demonstrated. Calves receiving no creep feed weaned as heavy as creep fed calves, and both gained equally during post-weaning. Calves fed no creep had less sickness post-weaning than calves creep fed all summer. The low energy post-weaning ration produced results comparable with the high energy ration.

Table 2.1. Performance of Calves Receiving Indicated Pre-weaning and Post-weaning Rations.

	Pre-weaning Treatment			Post-weaning	
Variable	Creep 37 days	No creep	Creep all summer	High energy[a]	Low energy[b]
No. calves	33	73	36	106	36
Adj.[c] 205 day wt. (lbs.)	448	452	444	-	-
Post-weaning A.D.G. (lbs.)	0.32	0.28	0.38	0.23	0.58
Average days sick/calf post-weaning	0.6	0.8	1.8	0.6	1.5

[a]60% dehydrated alfalfa, 40% milo.

[b]30% oats, 30% milo, 15% soybean meal, 25% prairie hay.

[c]Standard B.I.F. adjustment was used.

3/4 - 1/1.25
disodium Phosphate
anhydrous.

Weaning Calves Early

Miles McKee, K. K. Bolsen, J. G. Riley,
R. R. Schalles, K. L. Conway, and G. Fink

Summary

Growth rate of 38 calves after being weaned at an average of 91.6 days was compared with growth rate of 37 calves averaging 91.2 days of age and continuing to nurse their mothers the same period.

Average daily gains (lbs.) were 3.09 for the early-weaned calves and 3.23 for those nursing their mothers the same 128 days. TDN consumption (lbs.) for each early-weaned calf and its mother for the 128-days from May 22 to September 27 was 2,714.8, and 3,215.2 for nursing calves and their mothers.

Introduction

Confinement systems for managing beef cows might lead to cheaper calf production if the calves were weaned early to reduce feed required by their mothers. That idea was tested during the summer of 1973 and again during the summer of 1974.

Experimental Procedure

Seventy-five part Simmental calves, 45 bulls and 30 heifers, born to cows in confinement were used. Calves were randomly assigned by age and sex to either an early-weaning group or a continued nursing group. Five times during the test (May 22; June 5 and 6; July 10 and 25) calves approximately 90 days of age were weighed and those weaned early were separated from their mothers. All calves were weighed again September 27 when the trial ended.

All calves had access to creep feed (table 3.1) throughout the trial.

Calf performance (table 3.3) was measured from each weighing date to September 27. Creep feed and TDN intake were measured from May 22 to September 27.

May 22 all cows were divided into four groups: dry cows, lactating cows to have calves weaned early, and two groups of lactating cows that would continue to nurse calves throughout the test. When a calf was weaned, its dam was moved to the group of dry cows. Dry cows received approximately 60% of the TDN intake of the lactating cows. Feed and TDN intake during the trial (table 3.2) are for total consumption from May 22 to September 27, for both groups.

Results and Discussion

Calves weaned early had lower ADG rates (3.09) than calves that continued to nurse their mothers (3.23). However, it took fewer pounds of TDN per pound of growth for the early weaned calves (8.33) than for calves that continued to nurse their mothers (9.40), considering TDN intake by both cows and calves.

Table 3.1. Creep Ration for Nursing and Early-weaned calves.

Ingredient	Lbs.
Rolled oats	1275
Flaked milo	359
Dry molasses	150
Soybean oil meal	82
Salt	10
Aurofac-10	14
Alfalfa crumbles	90
Pre-mix[a]	20
Soy oil	30

[a]Pre-mix, lbs. per 100 lbs: soybean oil meal, 444; ground oats, 443; vitamin A, 33; Auremycin-10, 30; trace mineral, 50.

Table 3.2. Feed Consumed during 128 Days (5/22-9/27) by Indicated Beef-cow Dams.

	Dams of calves weaned early		Dams nursing calves	
Ingredient	Total intake (lbs.)	TDN intake (lbs.)	Total intake (lbs.)	TDN intake (lbs.)
Alfalfa	1534	759.2	2103	1040.8
Rolled milo	1285	925.1	1988	1431.3
SBOM	151	110.0	155	112.8
Total		1794.3		2584.9

Table 3.3. Performances of Early-weaned and Nursing Calves Compared

	Early weaned	Nursing
No. of calves	38	37
Age when first weighed (days)	91.6	91.2
Weight when first weighed (lbs.)	240.7	248.2
Weight September 27 (lbs.)	566.6	590.4
Total gain (lbs.)	325.9	342.2
A.D.G. (lbs.)	3.09	3.23
Creep feed/calf (lbs.)	1380	945
TDN in creep feed (lbs.) eaten	920.5	630.3

Effect of Culling Open Cows on Reproductive Performance

R. R. Schalles and Guy Kiracofe

Summary

The reproductive performance of a herd of Polled Hereford cows was evaluated over an eight year period. Culling cows the first time they were open would not have improved the future calving rates in this herd. The cost of replacing an open cow should be compared with the cost of maintaining an open cow. Thus, more improvement in reproduction can probably be made through good nutrition and management than by culling cows found open only once.

Introduction

Cattlemen and researchers over the years have discussed the advantages and disadvantages of culling open cows. Seldom is it possible to look back on an unculled herd to see what changes culling would have made. Our Polled Hereford cow-calf research herd was established in 1966, and all cows and heifer calves were kept through 1975 calving unless they failed to breed two continuous years. Thus, we were able to look back over the eight years to see what changes would have occured had culling been practiced.

Experimental Procedure

Polled Hereford breeders of Kansas, Oklahoma, Missouri, Illinois and Pennsylvania donated cattle from 34 herds to start our original herd. All heifer calves have been kept to build the herd to its present size of over 200 head. Records of cows found open by palpation were removed from this study (but retained in the herd), leaving a selected group represented in table 4.1. That precluded using any heifer calves from "culled" cows that later bred in the selected group. Reproductive performance of cows that were open after the first breeding season and heifers later produced by them were also evaluated.

Results and Discussion

Calf crop in the selected group ranged from 68% the first year to an expected 93% this year, with an average of 85%. The low calf crop the first year may have resulted from variation in previous management, age, and condition of the original cows. The 93% calf crop expected this year assumes no cow deaths or abortions. Of the 64 cows open just once, only 11 (17%) were open a second time during the eight years, giving a 95% calving rate after being found open once (table 4.2). Heifers produced by cows found open one or more times had an 89% calf crop (table 4.3), similar to that of the selected group. As expected, the poorest calf crop was from the younger cows (table 4.4). Few 6 to 10 year old cows were open.

Conclusions

1. More improvement in reproductive performance probably can be made through good nutrition and management than through culling cows found open only once.

2. Cows that are open once are just as likely to calve each season thereafter as young heifers.

3. Heifers produced by cows open once had as good reproductive performance as heifers from cows that did not miss calving.

4. The cost of replacing an open cow should be compared with the cost of maintaining the open cow, considering age and value of individuals.

5. Young cows are most likely to be open, emphasizing the need for special care in their nutrition and management.

Table 4.1. Reproductive Performance When Open Cows Were Always Culled.

Year	Cows with bull	Open cows culled	Death loss	Cows calving	Calf crop, %	Heifer replacements
1967-68	41	12	1	28	68	13
1968-69	41	9	0	32	78	20
1969-70	52	8	1	43	83	18
1970-71	61	5	1	55	90	21
1971-72	76	11	1	64	84	25
1972-73	89	8	4	77	87	20
1973-74	97	11	5	81	84	27
1974-75	108	8	0	100	93[a]	--
Overall	565	72	13	480	85	

[a]Based on palpation.

Table 4.2. Reproductive Performance of Cows Open Once.

Item	Number
Cows	64
Total breeding seasons	207
Calves produced	196 (95% calf crop)
Cows open a second year	11 (17% of 64 cows)

Table 4.3. Reproductive Performance of Heifers from Cows Open One or More Times.

Item	Number
Heifers	62
Total breeding seasons	192
Calves produced	171 (89%)

Table 4.4. Calving Percent by Age Groups After Previously Culling Open Cows.

Age at breeding	Calving %
1	84
2	83
3	88
4	90
5	86
6-10	95

Performance of Bulls on Kansas Bull Test

R. R. Schalles and Keith O. Zoellner

Summary

Bulls on summer test gained faster than those on winter test. Breeds from Continental Europe were taller at the shoulder and gained faster than British breeds. Older bulls that were lighter at the start of the test gained slightly faster than younger, heavier bulls, probably because of differences in condition. Adjusted 205-day weight had little relationship to performance; however, weaning weight ratio was positively related to performance on test, indicating that the heaviest bulls at weaning in a herd are most apt to perform best on test.

Introduction

The Kansas Bull Test started in June, 1971. Since then, two tests have been conducted each year at Solomon Valley Feedlot, Beloit, Kansas. Nearly 1500 bulls have completed the seven tests. Performances of the bulls are analyzed here.

Experimental Procedure

Bulls are delivered to the test station each fall and spring approximately three weeks before the test officially starts. They are weighed two consecutive days at both the start and end of the 140-day test. Intermediate weights at 56 and 112 days are obtained. The ration increases in energy at the discretion of the Kansas Bull Test committee and the feedlot manager.

Results and Discussion

The average daily gain of all bulls on test for 140 days was 2.77 lbs. Gain in the summer tests (tests 1, 3, 5, and 7) has exceeded gains in winter tests (test 2, 4, and 6) as shown in table 5.1. Gain was highest the first 56 days of most tests and lowest the last 28 days. Winter test 2 and 6 had the highest rate of gain during the last 28 days, a gain pattern in winter probably due to weather conditions.

Bulls in breeds of Continental European origin averaged 3.01 lb. per day while bulls in breeds of British origin averaged 2.79 lb. per day. Bulls of Zebu breeding in winter test only and were probably adversely affected by winter conditions, gained less than one pound a day.

Heavier bulls at the start of the test gained slightly less than lighter bulls, probably because the heavier bulls were fatter at the start of the test. Older bulls tended to gain faster than younger bulls. The average starting weight was 600 lbs. at an average age of 255 days.

Height at the shoulder was obtained when the bulls had been in test 112 days. The average height was 43.3 inches. Continental breeds were tallest; British breeds intermediate; Santa Gertrudis, shortest.

Adjusted 205-day weight had very little relation to performance on test. Varied managements of herds before delivery of bulls to be tested likely are the reason. However, weaning weight ratio was positively related to performance on test. Calves with heaviest weaning weights in a herd had higher gains on test.

Table 5.1. Average Daily Gains by Bulls in Seven Kansas Bull Tests, Beloit, Kansas, 1971-74.

Test	No. bulls tested	0-56 days A.D.G.	56-112 days A.D.G.	112-140 days A.D.G.	140-day A.D.G.
1	122	3.34	2.81	2.47	2.95
2	155	2.47	2.61	3.10	2.65
3	159	3.51	3.30	1.68	3.06
4	279	2.49	2.30	1.10	2.14
5	149	3.49	2.71	2.01	2.89
6	440	2.50	2.23	2.68	2.43
7	144	3.61	2.99	3.35	3.31
Breeds:					
Simmental	401	3.45	3.26	2.78	3.24
Angus	391	2.85	2.75	2.23	2.68
Hereford	205	2.83	2.93	2.31	2.77
Charolais	203	3.34	3.04	2.60	3.07
Polled Hereford	95	2.80	2.97	2.40	2.79
Chianina	66	3.24	3.70	2.78	3.23
Limousin	47	3.19	3.11	3.07	3.13
Santa Gertrudis	12	1.67	0.03	0.56	0.79
Maine Anjou	11	3.74	1.28	2.83	2.57

Synchronizing Estrus in Beef Heifers

G. Heersche, Jr., G. H. Kiracofe,
R. M. McKee, and D. G. Morrison

Summary

Estrous synchronization would benefit the cattle industry. Successful methods are not commercially available, so new compounds and treatment procedures are being tested. Treatment with melengestrol acetate, prostaglandin, or luteining releasing factor resulted in unsuccessful synchronization and lowered fertility. Successful synchronization and 63.2% first service conception followed syncro-mate B, $PGF_{2}\alpha$, and LRF.

Introduction

Synchronizing estrus would benefit cattlemen who use artificial insemination. In addition to the benefits of artificial insemination estrus synchronization consolidates labor and lets a cattleman control his breeding and calving seasons. Successful synchronization methods are not commercially available.

Melengestrol acetate (MGA), a progesterone like compound, will inhibit estrus when fed to heifers. Syncro-mate B is a synthetic progesterone that inhibits estrus while implanted in the ear. The $F_{2}\alpha$ series of prostaglandin ($PGF_{2}\alpha$), when injected regresses the corpus luteum if the heifer or cow is at least five days post estrus. That terminates her cycle so she returns to estrus. Luteinizing releasing factor (LRF) will result in ovulation if injected at the right stage of the estrous cycle.

MGA, $PGF_{2}\alpha$, and LRF, (trial I) and syncro-mate B, $PGF_{2}\alpha$, and LRF (trial II) were the combinations we tested.

Experimental Procedure

Trial I. Twenty-one cycling heifers were fed MGA (.7 mg/heifer/day, The Up John Co.) for 18 days. After removal of MGA, heifers were checked twice daily for signs of estrus. Eighteen days after removal of MGA all heifers were injected intramuscularly with $PGF_{2}\alpha$ (30 mgs., The Up John Co.). Heifers were observed for standing estrus every two hours from 6:00 a.m. to 9:00 p.m., and were artificially inseminated 12 to 18 hours after detected in estrus. Heifers not exhibiting standing estrus by 60 hours after $PGF_{2}\alpha$ received an intramuscular injection of LRF (325 mg./heifer, Parke, Davis and Co.) at 60.5 to 62 hours after $PGF_{2}\alpha$.

Trial II. Syncro-mate B (6 mgs., G. D. Searle Co.) was implanted in one ear of 19 cycling heifers. Seven days later the implants were removed and each heifer was injected intramuscularly with $PGF_{2}\alpha$ (30 mgs./heifer, the Up John Co.). Estrous observations and artificial insemination were conducted as in trial I. Those not exhibiting standing estrus by 60 hours after $PGF_{2\alpha}$ received an intramuscular injection of LRF (250 mg./heifer, Parke, Davis and Co.) at 60.5 hours after $PGF_{2\alpha}$. The treated heifers plus 13 non-synchronized heifers were confined to drylot. First service conception was determined by rectal pregnancy diagnosis 55 and 95 days later.

Results and Discussion

Trial I. Fifteen of the 21 heifers were in estrus between day 5 and day 10 after MGA removal. Mucus discharge or roughing of the hair on tail head and rump was observed in the other six heifers.

Eight heifers (38.1%) exhibited estrus between $PGF_{2\alpha}$ and 60 hours later. Two of these heifers had follicular cysts. Four of the eight heifers (50.0%) conceived. The cystic heifers did not conceive. Thirteen heifers did not exhibit estrus by 60 hours after $PGF_{2\alpha}$ and received LRF. Five of the 13 (38.5%) conceived when inseminated 13 to 14.5 hours after LRF. First service conception in all heifers was 42.8% (9 of 21).

Trial II. Results of this trial are in table 6.1. The first estrous was observed 31 hours after $PGF_{2\alpha}$, and by 60 hours 17 of the 19 (89.5%) had exhibited estrus. Two heifers received LRF. First service conception was 63.2% (12 of 19). First service conception in the non-synchronized heifers was 53.8% (7 of 13).

Conclusions

Successful synchronization followed by 63.2% first service conception resulted from syncro-mate B, $PGF_{2\alpha}$ and LRF in combination (trial II). Treatment with MGA, $PGF_{2\alpha}$ and LRF resulted in unsuccessful synchronization and lowered fertility.

Table 6.1. Estrus and Conception Rates of Heifers Treated With Syncro-mate B and Prostaglandin $F_{2\alpha}$.

	Day post prostaglandin			
	pm 1	am 2	pm 2	Total
Estrus	9	5	3	17[a]
Conceived	6	2	3	11[b,c]

[a]Two that did not show heat by 60 hours post $PFG_{2\alpha}$ were injected with LRF at 60 hours, bred at 72 hours post $PGF_{2\alpha}$; one conceived, one did not.

[b]64.7%.

[c]Conception of all 19 heifers (12/19)--63.2%.

Insemination at an Appointed Time After Estrous Synchronization in Beef Cattle

D. G. Morrison, G. H. Kiracofe, G. Heersche, Jr., R. R. Schalles, and Miles McKee

Summary

Eighty-three cows were each treated with a nine-day Syncro-mate B ear implant and one estrogen and progesterone injection. After implant removal, cows were artifically inseminated either 48, 54 or 60 hours later or 12 hours after estrus. An additional 16 cows received no treatment and were pasture mated. First service conception rates were 26.3, 23.8, 38.1, 33.3, and 68.8% for the 48-, 54-, and 60-post implant group, 12-hour post-estrus, and naturally bred cows, respectively.

Introduction

The widespread artificial insemination of cattle has increased labor and management by requiring estrus detection daily. Synchronization can decrease the time required to check for estrus by shortening the breeding season. However, estrus detection still is difficult. If acceptable fertility could be obtained by breeding at a predetermined time after synchronization, no estrus detection would be necessary.

We compared first service conception rates of synchronized cows bred artificially at predetermined times after treatment with cows synchronized and bred at estrus and with nonsynchronized cows bred naturally.

Experimental Procedure

Syncro-mate B (6 mgs, G. D. Searle Co.) was implanted in one ear of 83 Polled Hereford cows and removed nine days later. An estrogen-progestogen injection (3.0 and 1.5 mgs., respectively, G. D. Searle Co.) also was administered with the implant. After being treated, the cows were equally divided into four groups. Cows in groups A, B, and C were bred artificially 48, 54, and 60 hours later, respectively. Cows in group D were bred artificially approximately 12 hours after estrus onset. Sixteen additional cows received no synchronization treatment and were pasture bred naturally.

Results and Discussion

First service and total conception rates for groups A through E are shown in table 7.1. The treatment effectively synchronized estrus, but, first service conception by all synchronized cows (groups A to D) was lower than the conception rates of naturally bred, nonsynchronized cows the first 21 days of the breeding season (group E). The number of cows in estrus at each of the three appointed inseminations decreased (11, 8, and 5 for groups A, B, and C, respectively), indicating that breeding may have been too early. However, conception rates of cows bred at estrus were no higher than rates of cows bred 60 hours post-treatement. Conception at the estrus after synchronized estrus was not affected by the treatment, as 53.4% of the synchronized cows conceived to the second service.

One of the 83 cows who lost her implant during the nine-day period was removed from the experiment. Three cows in group D failed to show estrus within five days after the implant was removed; then were classified as not synchronized.

Conception rates were lowered in synchronized, artificially bred cows compared with nonsynchronized, naturally mated cows. We do not know whether conception rates were low because of artifical insemination or synchronization of estrus.

Table 7.1. Conception Rates by Cows After Synchronization of Estrus with Syncro-mate Band Estradiol Valerate.

Time of artificial insemination	No. of cows	First service conception (%)	Total conception (%)[a]
48 hours after implant removal	19	26.3	78.9
54 hours after implant removal	21	23.8	95.2
60 hours after implant removal	21	38.1	85.7
12 hours after observed in estrus	21	33.3[b]	95.2
Nonsynchronized pasture bred naturally	16	68.8	93.7

[a]Percent of cows conceiving during a 63-day breeding season.

[b]Three cows did exhibit estrus within five days after implant removal and were not included.

Induced Calving in Beef Cattle

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Summary

Calving was induced in 44 Polled Hereford cows at 275 days' gestation. Twenty mgs. of dexamethasone (Azium) given intramuscularly caused parturition an average of 43.1 hours after injection (range 21 to 57). An injection of 30 mgs. of prostaglandin $F_{2\alpha}$ 40 hours after dexamethasone effectively increased predictability of calving. Seven of nine cows calved 2.5 to five hours post prostaglandin (average time of calving 44.9 hours after dexamethasone). Prostaglandin given 30 hours after dexamethasone or dexamethasone 40 hours after prostaglandin was less effective (average 46.6, range 34.5 to 57.5; average 75.3, range 63 to 100, respectively).

Calving ease did not differ between induced and noninduced cows, but viability of induced calves was lower; 88% of the induced cows retained placenta. Placentae were expelled an average of six days after calving regardless of treatment. Rectal palpations at three and five weeks postpartum showed cows treated with intramuscular injections of combiotic and intrauterine infusions of nitrofurazone plus proteolytic enzymes plus lactinex granules had faster uterine involution and more ovarian activity than cows treated with intrauterine infusions of nitrofurazone alone. However, more intrauterine-nitrofurazone treated cows conceived on first service and conceived sooner than cows receiving either of the other two treatments.

Introduction

The increasing intensity of cattle production and constantly rising costs force today's cattleman to strive to control each phase of the management program. Controlling the estrous cycle also controls time of parturition, however, currently available estrus synchronization methods have not been widely accepted. Therefore, researchers are inducing calving to study its effect on the cattle industry. Although certain compounds can be used to predict parturition with reasonable accuracy, the range is still rather wide. Retained placenta, by a high percentage of induced cows, also must be managed properly to maintain reproductive efficiency.

We sought to increase the predictability of induced calving by combining prostaglandin with dexamethasone. We also compared a systemic antibiotic treatment for retained placenta with two intrauterine treatments.

Experimental Procedure

Forty-four Polled Hereford cows, three-nine years old, were given one of four treatments to induce calving: (1) dexamethasone (Azium);

(2) dexamethasone plus prostaglandin $F_{2\alpha}$ (The UpJohn Co.) 30 hours later; (3) dexamethasone plus prostaglandin 40 hours later; or (4) prostaglandin plus dexamethasone 40 hours later. The dosages (20 mgs. dexamethasone and 30 mgs. prostaglandin) were given intramuscularly at 275 days' gestation. Observations were made for calving ease and calf viability. Assistance was given when necessary. Birth weights were recorded for all calves within 12 hours after birth.

Cows that had not expelled placenta by the day after calving were assigned to one of these treatments: (1) 20 cc combiotic intramuscularly for 3 days; (2) intrauterine infusions of nitrofurazone in sterile saline for 3 days; or (3) intrauterine infusions of nitrofurazone+ 100 mgs. α-chymotrypsin and 100 mgs. collagenase in sterile saline for 3 days followed on day 4 with an infusion of 6 g of lactinex granules in sterile saline. Days to placental expulsion were noted for each treatment. Rectal palpations were made at three and five weeks postpartum to estimate uterine regression and ovarian function.

Subsequent fertility of induced cows was recorded, and two-month weights of the calves were recorded.

Control data were collected for all observations from 12 cows that calved during the same time period as the treated cows.

Results and Discussion

Times of calving in response to the various treatment groups are shown in table 8.1. Gestation by nontreated cows averaged 283.4 days compared with 277 for induced cows, six days earlier. Cows given dexamethasone alone (group 1) calved an average of 43.1 ± 13.77 hours later. In groups where dexamethasone and prostaglandin were combined (2, 3, and 4), range of calving tended to be shorter than in group 1. Eight of nine cows in group 3 calved an average of 44.9 ± 5.37 hours after treatment; seven of nine calved 2.5 to 5 hours after the prostaglandin injection. One cow in group 3 did not calve in response to treatment. Calving time was less predictable in groups 2 and 4 than group 3.

Eight cows originally assigned to group 3 and four cows originally assigned to group 4 calved before receiving a second injection of either dexamethasone or prostaglandin, respectively.

Calves from induced parturition weighed less at birth than calves from control cows (seven of 44 died shortly after birth). Twenty percent of the induced cows required assistance and one caesarean section was performed. Calf viability of induced calves was lower than that of noninduced calves. However, average daily gains of the two groups did not differ.

Eighty-eight percent of the induced cows retained placentae compared with only 8.7% by noninduced cows (table 8.2). There was no difference in time when placenta were expelled among groups. Palpations at 3 and 5 weeks postpartum showed overall uterine and ovarian conditions most desirable in the combiotic treated group. Uterine regression in that group was rapid; few cows retained fluid or pus in the uterus. In addition, the ovarian score was better (more large follicles and ovulations) for the combiotic group than for the nonretained animals. Uterine infusions of nitrofurazone alone yielded slower uterine regression with fluid and pus in the uteri of more cows.

Subsequent fertility of all cows is shown in table 8.3. Fertility did not correlate closely with rate of uterine regression or ovarian activity at three and five weeks postpartum. Cows treated with nitrofurazone alone required less time from calving to conception and the highest percentage of them conceived with the first service. Inducing parturition did not affect subsequent fertility. Six cows that were induced but did not retain placenta had higher conception rates (both first service and total) than induced cows that retained placenta. First service conception rate for cows that retained placenta was lower, but days from calving to conception did not differ.

Table 8.1. Indicated Data from Using Dexamethasone and/or Prostaglandin, $F_{2\alpha}$, to Induce Calving in Beef Cows.

Group	No. of cows	Hours from treatment to fetal expulsion mean ± S.D.[a]
Dexamethasone (1)	5	43.1 ± 13.77
Dexamethasone plus prostaglandin 30 hours later (2)	7	46.6 ± 10.85
Dexamethasone plus prostaglandin 40 hours later (3)	9	44.9 ± 5.37
Prostaglandin plus dexamethasone 40 hours later (4)	11	75.3 ± 9.87
Non-induced controls	12	----
Dexamethasone calved before 40 hours	8	35.2 ± 3.34
Prostaglandin calved before 40 hours	4	38.7 ± 2.36

[a]Standard deviation means that 68% of the cows in each groups calved within the range indicate + and - days indicated for each group.

Table 8.2. Treatment of Retained Placenta, Effect on Uterine, and Ovarian Functions.

Treatments	No. of cows	Days to placental expulsion	3 weeks: % with expected uterine size[a]	3 weeks: % with fluid or pus	3 weeks: Ovarian function score[b]	5 weeks: % with expected uterine size[a]	5 weeks: % with fluid or pus	5 weeks: Ovarian function score[b]
Combiotic (IM)	13	6.44	60	30	2.70	20	10	2.40
Intrauterine infusion of nitrofurazone	13	6.08	23	54	3.07	31	38	2.61
Nitrofurazone plus enzyme plus lactinex intrauterine	10	6.37	70	30	3.44	70	20	2.66
Non-retained	9	--	33	33	2.50	22	11	2.77

[a]Based on an external diameter of the uterine horns of 60 mm at 3 weeks and 40 mm at 5 weeks.

[b]Scored as CL = 1, follicles > 12 mm = 2, follicles < 12 mm = 3, and no significant structures = 4.

Table B.3. Postpartum Fertilities of Cows After Indicated Treatments for Retained Placenta.

Treatment	No. of cows	Days from calving to conception	First service conception (%)	Total conception (%)[a]
Combiotic (IM)	13	95.8	15.1	84.6
Intrauterine infusion of nitrofurazone	13	80.5	54	84.6
Nitrofurazone plus enzyme plus lactinex intrauterine	10	105.3	20	90
AVERAGE		92.9	31	86
Induced Non-retained	6	91.6	83.3	100
Non-induced Non-retained	12	97.2	66.7	100
AVERAGE		95.3	72	100

[a]Percentage of cows conceiving during a 63-day breeding period.

Cow and Calf Performance as Affected by Nitrogen Fertilization and Burning of Bluestem Pastures

Loren L. Berger, R. R. Schalles, C. E. Owensby, L. H. Harbers, and E. F. Smith

Summary

Burning and fertilizing treatments on six Bluestem pastures were evaluated by comparing performance of spring-calving cows and calves that grazed them. Two control pastures were not burned or fertilized, two pastures were burned, and two were burned and fertilized with 40 pounds of nitrogen an acre, applied aerially. Neither average daily gains of the calves nor reproductive performance of the cows differed significantly among treatments.

Introduction

Economic conditions in the beef industry are forcing producers to find ways to improve the productivity of native range to reduce production costs. Fertilization has long been used to increase crop production, but the results have not been so favorable on native range. Fertilizing pasture has been limited because it tends to increase weeds and cool-season grasses, is difficult to apply, and has not proved economically feasible. Late-spring burning has been shown to reduce weeds and cool-season grasses on Flint Hills range. Therefore, fertilization and burning currently are being studied separately and in combination to see if they complement each other and result in increased productivity of Bluestem grass and, subsequently, of performance of animals grazing on them.

Experimental Procedure

In the fall of 1971, 72 Polled Hereford cows were assigned to three pasture treatments with culling and replacement of cows that died, were unsound, or failed to calve for two years. In the winter of 1973-74, the cows received in addition to the pasture, a cubed ration consisting of ½ dehydrated alfalfa and ½ milo. From November 1 to February 15, cows on pastures 1, 3, and 5 received 10.5 lb. twice a week, and those on pastures 2, 4, and 6 received 3 lbs. daily. Cows on pastures 1, 3, and 5 received 21 lbs. twice a week from February 15 to February 22; 14 lbs. three times weekly from February 22 to April 20. From February 15 to April 20 cows on pastures 2, 4, and 6 received 6 lbs. daily. Calving was from March 1 to April 30. One Polled Hereford bull was placed in each pasture from May 27 to July 26.

All pastures were treated the same as they had been the previous two years. April 24, four of the six pastures were burned. May 2, ammonium nitrate (34% nitrogen) was applied aerially at 40 lbs. of nitrogen per acre. The year-around stocking rates were 5.6 acres per cow-calf on fertilized pastures, and 8 acres per cow-calf on burned and control pastures. Stocking rates, the same as the previous two years, were calculated from previous plot studies on herbage production under similar treatments. The first week of every month, the cows and calves were gathered and weighed, after being penned without feed and water overnight. The calves from one pasture for each treatment had access to creep feed 37 days prior to weaning. Calves were weighed and weaned October 2.

Results and Discussion

Burning or burning plus fertilizing combined did not significantly affect weaning weight or cow performance (table 9.1). Pounds weaned per acre were significantly increased by burning and fertilizing through heavier stocking rates, not increased daily gains. When cows in pastures 1, 3, and 5 were switched abruptly from 10.5 to 21 lbs. of supplemental feed twice a week on February 15, four of the 35 cows died and several others became sick. Changing treatment to 14 lbs. three times weekly proved satisfactory.

Table 9.1. Effects on Cow and Calf Performance by Burning and Fertilizing Native Bluestem Pastures, 1973-74.

	Control		Burned		Burned and fertilized	
Pasture number	1[a]	2	3[a]	4	5[a]	6
Acres in pasture	64	104	104	84	84	84
Cow per pasture	8	12	12	10	15	15
Acres per cow	8	8.5	8.5	8.4	5.6	5.6
Winter feeding, 1973-74						
Nov. 1-Feb. 15, lb/hd/wk[b]	21	21	21	21	21	21
Feb. 15-April 20, lb/hd/wk[c]	42	42	42	42	42	42
Avg. calving date	4-12	3-30	4-2	3-19	3-23	3-15
No. of calves born alive	8	12	11	10	15	15
Avg. wt. of calves born	74	76	74	83	69	72
No. of cows open	0	1	0	1	2	0
Avg. weaning wt.	409	430	410	436	399	431
Adjusted weaning wt.	445	466	462	451	443	444
Pounds weaned per acre	51	55	45	54	71	77

[a]Calves in pastures 1, 3, and 5 were creep fed a mixture of 60% dehydrated alfalfa and 40% milo 37 days prior to weaning.

[b]Cows on pastures 1, 3, and 5 were fed 10.5 lbs. twice a week; those on pastures 2, 4, and 6 were fed 3 lbs. daily.

[c]Cows on pastures 1, 3, and 5 were fed 14 lbs. three times a week; those on pastures 2, 4, and 6 were fed 6 lbs. daily.

Response of Yearling Steers to Pasture Burning, Fertilization, and Intensive Early Season Stocking (Bluestem Pastures)

Loren L. Berger, L. H. Harbers, R. R. Schalles, C. E. Owensby, and E. F. Smith

Summary

Nine pastures totaling 492 acres were summer grazed by yearling Hereford steers. Five pastures were burned April 24, 1974; four were not burned. Burned and nonburned pastures had 0, 40, or 80 lbs. of nitrogen per acre applied aerially May 2, 1974. Stocking rates were determined with herbage production data from experimental plots under similar treatments. Under equal fertilization and stocking rates, burned pastures produced more average daily gain and gain per acre than nonburned pastures. Fertilizing and heavier stocking tended to reduce average daily gains, but increase gain per acre. Steers on the early-season, intensively grazed pasture, gained the most per day (2.09 lbs.) and produced a high gain per acre (96 lbs.). Range condition was higher on burned pastures. On unburned pastures, range condition decreased as fertilizer rate increased.

High feed grain prices have forced beef producers to use forages to lower beef production costs. The native bluestem grasses have long provided a major portion of the forage for the Flint Hills beef producer and methods of increasing native grass production are being studied. Late spring burning (late April) has increased steer gains and improved range condition. Nitrogen fertilization has improved both the quantity and protein content of the forage produced, but also increased cool-season grasses and weedy species in the pastures. We are studying treatments explained above separately and in combination to evaluate effects they have on beef production and range condition. The effects of early-season, intensive stocking on a burned pasture also are being studied.

Experimental Procedure

Nine native bluestem pastures, totaling 492 acres, four miles northwest of Manhattan were used in the study. All treatments were the same as the previous two years. One burned, nonfertilized pasture, and one nonburned, nonfertilized pasture have had the same treatment the last 24 years, to study long term effects. Burned pastures were burned April 24, and ammonium nitrate (34% nitrogen) was applied aerially May 2. The pastures grazed the entire summer season were stocked from May 1 to October 4. The intensively grazed pasture was stocked from May 1 to July 16. All were stocked with Hereford steers averaging 408 lb. One half of the steers were implanted with Ralgro, the other half with Synovex-S before being placed on pasture. All were sprayed for flies as needed, and salt was free choice. They were gathered the first of each month, penned overnight without feed or water, and weighed the next morning.

Results and Discussion

Late spring burning increased daily gain and gain per acre (table 10.1). Nitrogen fertilization at 40 or 80 lbs. per acre tended to reduce daily gain, but increased gain per acre. The burned pasture receiving 80 lb. of nitrogen probably was stocked too heavily for maximum long range productivity. The burned, nonfertilized pastures produced highest average daily gain for the full-season stocked pastures. The intensively-stocked pasture produced the highest average daily gain over all. Differences in average daily gain between the steers implanted with Ralgro and those implanted with Synovex-S were not significant.

All burned pastures had better range condition than unburned pastures did. Pastures not burned had high amounts of Kentucky Bluegrass and western ragweed. Carbohydrate reserves were much higher on burned than on nonburned pastures. The highest range condition was in the intensive, early-stocked pasture. Major plant species in the pastures are shown in table 10.2.

Table 10.1. Effects on Steer Gains From Burning and Fertilizing Native Bluestem Pasture, May 1 to October 4 (156 days), 1974.

	Daily gain per steer, lbs.	Gain per acre, lbs.	Acres per steer
Not burned			
No nitrogen, same treatment 24 years	1.30	61	3.3
No nitrogen	1.30	61	3.3
40 lb. nitrogen per acre	.99	70	2.2
80 lb. nitrogen per acre	.99	74	2.1
Burned April 27			
No nitrogen, same treatment 24 years	1.85	92	3.1
No nitrogen	1.69	79	3.3
40 lb. nitrogen per acre	1.48	93	2.2
80 lb. nitrogen per acre	1.19	101	1.8
Intensively stocked			
May 1 to July 16 (76 days)	2.09	96	1.7

Table 10.2. Composition (Percentages) of Major Species on Burned and Fertilized Pastures in Loamy Upland Bluestem Range.

	Nitrogen (lb/A)		
	0	40	80
	Kentucky Bluegrass		
Burned			
1972	8.6	0.2	1.2
1973	8.3	1.0	2.2
1974	11.9	2.0	5.7
Nonburned			
1972	9.1	15.3	21.2
1973	15.1	21.6	32.5
1974	23.2	31.9	41.8
	Big Bluestem		
Burned			
1972	25.6	34.4	34.2
1973	27.7	32.6	33.2
1974	26.2	30.1	23.1
Nonburned			
1972	14.9	19.1	18.3
1973	17.1	19.5	12.3
1974	13.4	14.1	12.4

Milo Stover and Sources of Supplemental Nitrogen for Growing Heifers

K. K. Bolsen, J. G. Riley, and Gary Boyett

Summary

Seventy-two heifer calves were used in a 98-day trial to evaluate four rations: (1) forage sorghum silage plus soybean meal, (2) milo stover pellets plus soybean meal, (3) milo stover silage plus soybean meal and (4) milo stover silage plus soybean meal-corn gluten meal-urea. Daily gain was highest (P<.05) and feed required per lb. of gain lowest (P<.05) for heifers fed the forage sorghum silage ration. Heifers fed milo stover pellets consumed more feed (P<.05) than those fed any of the other three rations and, they were less efficient than those fed rations 1 or 4. The mixture of supplemental nitrogen sources fed with milo stover silage (ration 4) gave animal performance similar to that from soybean meal with milo stover silage (ration 3).

The results indicate that milo stover's value is 53 to 57% that of forage sorghum in growing rations. On the average, heifers fed milo stover gained 57% as rapidly and 53% as efficiently as heifers fed forage sorghum.

Introduction

Milo stover is a by-product of grain production. As humans continue to compete with livestock for the world's feed grain supply, it becomes increasingly important that crop aftermaths, like milo stover, be used as energy sources for beef production.

Machine harvested or grazed milo stover can meet the energy requirement of beef cows during gestation. In a previous trial at this station (Progress Rpt. 210, Kansas Agr. Expt. Sta., 1974) growing heifers made substantial gains when fed milo stover pellet or milo stover silage rations.

Experimental Procedure

Seventy-two heifer calves of Angus, Hereford and AxH breeding averaging 460 lbs. were allotted by breed and weight to 12 pens of six heifers each. Three pens were assigned to each of these rations: (1) forage sorghum silage plus soybean meal, (2) milo stover pellets plus soybean meal, (3) milo stover silage plus soybean meal and (4) milo stover silage plus soybean meal-corn gluten meal-urea.

The trial was 98 days (December 7, 1973 to March 15, 1974). All rations contained 72.4% of the appropriate forage, 13.8% dehy. alfalfa pellets (¼ inch) and 13.8% supplement on a dry matter basis. All were formulated to be equal in crude protein (12.5%), minerals, vitamins and additives.

Compositions of the supplements are shown in table 11.1; supplement A was fed in rations 1, 2 and 3; supplement B in ration 4. Corn gluten meal and urea each provided one-third of the crude protein equivalent in supplement B. All rations were mixed twice daily and fed free-choice. Initial and final weights of the heifers were taken after heifers went 15 hours without access to feed or water.

Forage sorghum and milo stover each was obtained from a single source in October, 1973. Milo stover was harvested after a killing frost from milo that yielded 95 bushels of grain per acre. The forage harvester[1] used was equipped with a three-inch recutter screen. Approximately 50 tons of forage sorghum and 100 tons of milo stover were ensiled in upright, concrete stave silos (10 ft. x 50 ft.). Milo stover pellets (¼ inch diameter) were processed by a commercial dehydrator.[2]

Results and Discussion

Chemical analyses of the forages are shown in table 11.2.

Heifer performance is shown in table 11.3. Heifers fed forage sorghum silage gained fastest ($P<.05$) and most efficiently ($P<.05$). Differences in daily gain among the three milo stover rations were not statisitically significant. Calves fed the milo stover pellet ration tended to gain faster than calves fed either of the two milo stover silage rations. Heifers fed milo stover pellets consumed the most feed and required the most feed per lb. of gain. Supplementing milo stover silage with soybean meal or with soybean meal-corn gluten meal-urea made no difference in animal performance.

Performances by heifer calves fed forage sorghum silage, milo stover pellet or milo stover silage rations supplemented with soybean meal during the past two winters (1973 and 1974) are summarized in figure 11.1. Responses of heifers fed forage sorghum were similar from the two trials; however, heifers fed milo stover in trial 1 gained faster and more efficiently than heifers fed milo stover in trial 2. Differences in performance between the two years could be attributed to several factors: stover quality (crude protein, digestibility, etc.), weather condition, length of the wintering period.

In trial 1, calves fed stover pellets gained 80% as rapidly and 67% as efficiently, and those fed stover silage gained 70% as rapidly and 82% as efficiently as calves fed forage sorghum silage. In trial 2, those relative percentages were 68 and 50 for stover pellets .and 50 and 55 for stover silage compared with forage sorghum silage.

Averages of the two trials and two milo stovers (pellets and silage) show that milo stover has a value of 63 to 67% that of forage sorghum. These results indicate that milo stover should not be used as the major energy source in growing rations if performance similar to that from grain silages is desired. Calves fed pelleted milo stover gain too inefficiently and calves fed ensiled milo stover gain too slowly for either to be acceptable to most cattlemen. However, a feeder willing to accept gains of about one pound a day could use milo stover.

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[1]Provided by Field Queen Corporation (a division of Hesston Corporation), Maize, Kansas.

[2]C. K. Processing Co., Manhattan, Kansas.

Table 11.1. Compositions of Supplements[1]

Ingredient	Supplement A	Supplement B
	%, dry matter basis	
Soybean meal (48% CP)	74.27	14.70
Milo, rolled	10.45	42.25
Corn gluten meal (60% CP)	--	--
Urea (45% nitrogen)	--	41.55
Dehy. alfalfa	10.00	10.00
Limestone	3.00	4.50
Salt	2.00	2.00
Trace mineral premix	0.50	0.50
Vitamin A premix[2]	0.33	0.33
Aureomycin[2]	0.35	0.35

[1]Fed as a 3/16-inch pellet.

[2]Formulated to supply 30,000 IU of vitamin A and 70 mg of aureomycin per heifer per day.

Table 11.2. Dry Matter, pH, and Proximate Analyses of the Three Milo Forages.

Item	Forage sorghum silage	Milo stover Silage	Milo stover Pellet
Dry matter, %	26.1	29.9	93.3
pH	4.3	4.9	--
	%, dry matter basis		
Ash	8.6	15.5	13.3
Crude protein	7.6	6.0	5.0
Crude fiber	26.2	28.7	28.7
Ether extract	2.6	2.2	1.5
Nitrogen-free extract	55.0	47.6	51.5

Table 11.3. Performances of Heifers.

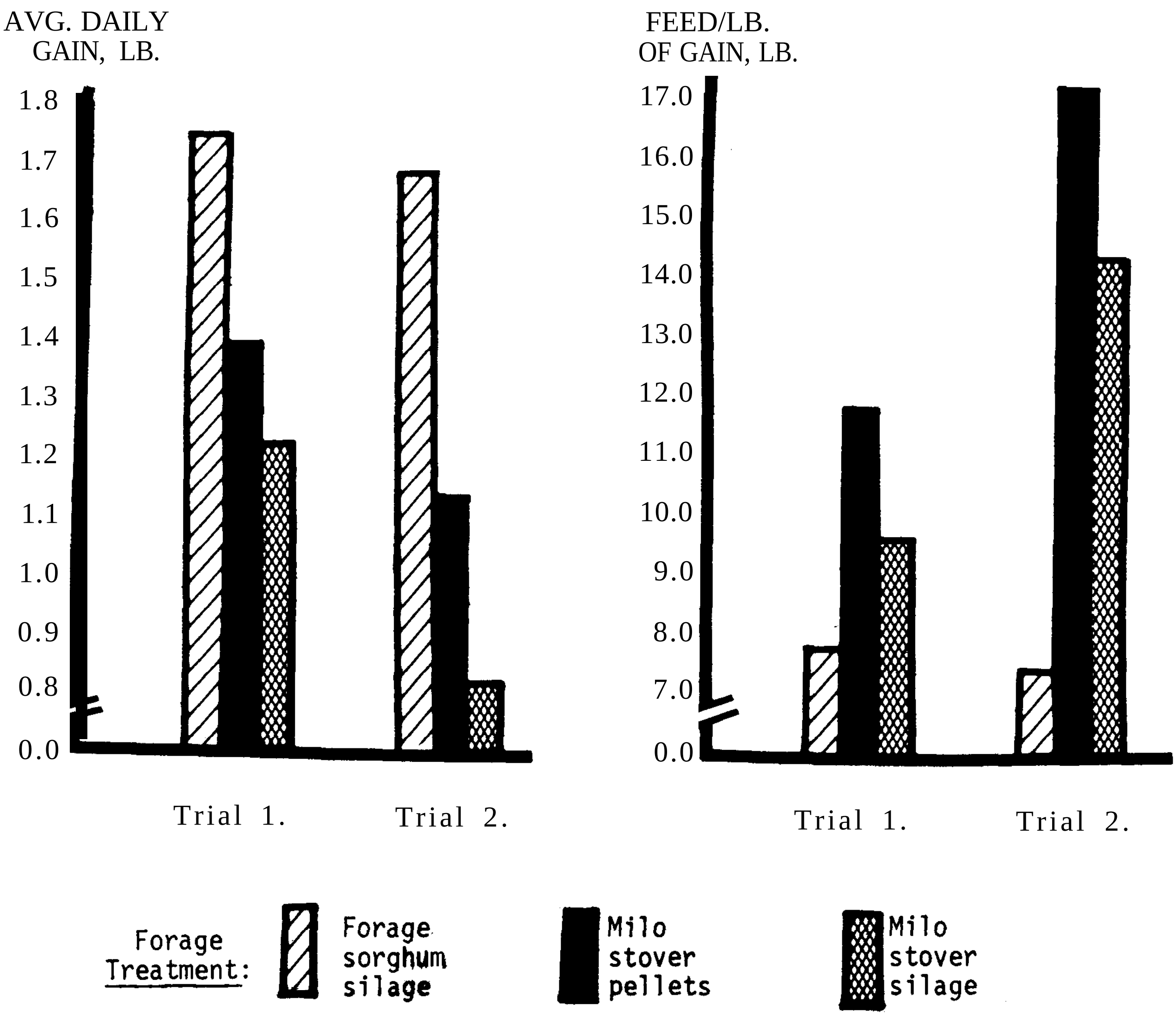
Item	Forage sorghum silage	Milo stover pellet	Milo stover silage + Soybean meal	Milo stover silage + SBM-CGM-urea
No. of heifers	18	18	18	18
Initial wt., lbs.	454	466	463	460
Final wt., lbs.	614	575	542	552
Avg. daily gain, lbs.	1.63[a]	1.11[b]	0.81[b]	0.94[b]
Avg. daily feed, lbs.[1]				
silage &/or pellets	9.17	13.31	8.02	8.40
dehy. alfalfa	1.74	2.53	1.52	1.59
supplement	1.74	2.53	1.52	1.59
Total[2]	12.65[b] (2.37)	18.37[a] (3.53)	11.06[c] (2.20)	11.58[c] (2.29)
Feed/lb. gain, lbs.[1]	7.75[c]	16.82[a]	14.01[a,b]	12.34[b]

[a,b,c] Means in the same row with different superscripts differ significantly (P<.05).

[1] 100% dry matter basis.

[2] Values in parenthesis are dry matter intake as percentage of body weight.

Figure 11.1. Average Daily Gains and Feed Efficiencies of Heifers in Trial 1 (1973)[1] and Trial 2 (1974).[2]



[1]Progress Rpt. 210, Kansas Agr. Expt. Sta., 1974.

[2]Table .3.

Wheat, Barley and Corn Silage Rations for Growing Yearling Steers

K. K. Bolsen, Larry L. Berger, and J. G. Riley

Summary

Seven silage and ration treatments compared were: (1) Paoli barley, (2) Arthur wheat, (3) Parker wheat, (4) Parker-head wheat, (5) Parker-head wheat and corn silage (equal parts), (6) corn silage plus a soybean meal supplement, (7) corn silage plus a urea supplement. Treatments 1 through 5 included a soybean meal supplement.

Each ration was fed to eighteen steers (3 pens of 6 steers each) for 100 days. All steers were full-fed a 12.5% crude protein ration containing 86% silage and 14% supplement. Steers fed Paoli barley, Parker head wheat-corn silage, corn silage plus soybean meal or corn silage plus urea rations performed similiarly. Daily gain and dry matter intake were lowest for steers fed Parker wheat and Parker head wheat rations. Steers fed the Parker silage ration were less efficient than those fed Paoli barley, Arthur wheat, Parker head-wheat-corn silage or corn silage plus soybean meal rations.

Introduction

In 1973 there were 10.6 million acres of hard, red winter wheat grown in Kansas. This is six times the corn acreage and two and one half times the grain sorghum acreage in the state. Fluctuations in price often have made wheat competitive with other feed grains.

In 1972, studies were initiated at this station to evaluate the potential of wheat as a silage crop. In a steer growth trial, type of wheat ensiled (awnless, soft red winter vs. awned, hard red winter) influenced performance of steers receiving high-silage rations (Progress Rpt. 210, Kan. Agr. Expt. Sta., 1974). Steers fed the awnless, soft red winter wheat silage gained faster and consumed more feed than steers fed the awned, hard red winter wheat silage. Gain and efficiency of steers fed corn silage were superior to that of steers fed wheat silage.

This second year's trial (1) repeated the comparison of hard red winter wheat and soft red winter wheat silages; (2) compared relative feeding values of wheat, barley and corn silages; (3) compared whole-plant wheat silage and head-wheat silage and (4) evaluated a mixture of equal parts of head-wheat and corn silages.

Experimental Procedure

Cereal grain forages were harvested in dough stage between June 1 and June 12, 1973, in this order: Paoli (awned, winter) barley, Arthur (awnless, soft red winter) wheat, Parker (awned, hard red winter) wheat and Parker head-wheat. All forages were direct-cut with a self-propelled forage harvester equipped with a 15-foot cutter bar and a two-inch recutter screen. Whole-plant forages were cut as near the soil as possible leaving 2 to 3 inches of stubble. Water was added to the forages at the silo blower to raise their moisture contents from 56 to 60% when harvested to 64 to 68% when ensiled. The upper half of the wheat plant was harvested for head-wheat silage. Approximately 45 tons of each of the cereal grain forages were ensiled in concrete stave silos (10 x 50 ft.). Corn with an estimated grain yield of 125 bu. per acre was ensiled in a 12 x 60 ft. concrete stave silo.

One hundred twenty-six Hereford, Angus and mixed breed steers averaging 586 lbs. were used in the 100-day growing trial (October 10, 1973 to January 18, 1974). Three pens of six steers were randomly assigned to each of the seven rations. Ration composition (dry matter basis) was 86% silage and 14% supplement (table 12.1). Supplement A was fed with Paoli barley and Parker head-wheat; supplement B with Arthur and Parker wheats and corn silage; supplement C with corn silage and supplement D with corn silage and Parker head-silage-corn silage. All rations were formulated to contain 12.5% crude protein and each was mixed twice daily and fed free-choice. Steers were fed in 15 x 30 ft. sheltered, concrete pens. Weights were taken at the beginning and end of the trial after steers were without feed or water 15 hours; 42-day and 84-day intermediate weights were taken before the a.m. feeding.

Results and Discussion

Results of chemical analyses of the five silages are shown in table 12.2. Crude protein was lowest and crude fiber highest in the whole-plant Arthur and Parker wheat silages. No nitrogen fertilizer was applied to the growing cereal grains, which probably explains those relatively low crude protein values.

Performance of the steers is shown in table 12.3. Steers fed the Paoli barley, Parker head-wheat-corn silage, corn silage plus soybean meal or corn silage plus urea rations performed similarly. Average daily gain and feed intake were lower ($P<.05$) for steers receiving Parker wheat and Parker head-wheat silage rations than for those receiving any of the other five rations. Steers fed the Parker silage ration were less efficient ($P<.05$) than those fed Paoli barley, Arthur wheat, Parker head-wheat-corn silage or corn silage plus soybean meal rations.

Table 12.1. Compositions of Supplements.

Ingredient	A	B	C	D
	%, dry matter basis			
Soybean meal	38.21	82.83	0.00	62.74
Urea	0.00	0.00	12.12	0.00
Milo	53.37	11.24	76.24	30.17
Fat	1.00	1.00	1.00	1.00
Dicalcium phosphate	1.19	1.92	8.09	1.72
Limestone	3.68	0.46	0.00	1.85
Salt[1]	2.14	2.14	2.14	2.14
Trace mineral premix	0.05	0.05	0.05	0.05
Vitamin A[2]	0.09	0.09	0.09	0.09
Aureomycin[3]	0.27	0.27	0.27	0.27

Supplement columns: A, B, C, D.

[1]Formulated to be 0.3% of the total ration.

[2]Formulated to provide 30,000 IU per steer per day.

[3]Formulated to provide 70 mg per steer per day.

Table 12.2. Compositions of the Five Silages.

Item	Paoli barley	Arthur wheat	Parker wheat	Parker head-wheat	Corn silage
Dry matter, %	32.9	36.9	34.6	41.2	40.9
			%, dry matter basis		
Crude protein	9.5	7.5	7.4	9.9	8.3
Crude fiber	23.1	26.5	30.8	21.3	19.4
Ether extract	2.5	2.4	2.1	2.6	2.7
NFE	55.7	54.7	51.7	59.1	63.0
NDF	47.03	48.84	57.35	50.15	45.53
ADF	50.66	52.95	62.34	44.58	42.91
Acetate, molar %	2.11	1.36	1.04	0.90	1.12
Propionate molar %	0.17	0.17	0.19	0.18	0.15
Butyrate molar %	0.36	0.21	0.13	0.20	0.27
Lactate, % of the dry matter	6.10	3.86	4.61	4.79	2.14

Table 12.3. Steer Performances.

Item	Paoli barley	Arthur wheat	Parker wheat	Parker head-wheat	Parker head-wheat + corn silage	Corn silage + soybean meal	Corn silage + urea
	Silage and ration treatment						
No. of steers	18	18	18	18	18	18	18
Initial wt., lb.	580.1	585.2	579.7	593.6	583.7	595.1	584.5
Final wt., lb.	807.8	794.2	734.1	768.2	805.9	842.4	812.9
Avg. daily gain, lb.	2.28[a,b]	2.09[b]	1.54[c]	1.75[c]	2.22[a,b]	2.48[a]	2.29[a,b]
Avg. daily feed, lb.[1]	17.4[a]	17.4[a]	14.7[b]	14.8[b]	18.0[a]	18.6[a]	19.1[a]
Feed/lb. gain, lb.[1]	7.7[a]	8.4[a]	9.6[b]	8.5[a,b]	8.1[a]	7.5[a]	8.4[a,b]

[1]100% dry matter basis.

[a,b,c]Means on the same line with different superscripts differ significantly ($P<.05$).

KSU

Milo Head Silage (Milage) Rations for Finishing Yearling Steers[1,2,3]

K. K. Bolsen, J. G. Riley, and G. Fink

Summary

Four finishing rations evaluated in the 102-day trial were: (1) unprocessed (whole) milage, (2) processed (rolled) silage, (3) processed milage plus high-moisture milo and (4) high-moisture milo plus chopped hay. Approximate roughage levels were 24% in rations 1 and 2 and 15% in rations 3 and 4. Yearling steers fed processed milage plus high-moisture milo gained faster ($P<.05$) and more efficiently ($P<.05$) than steers fed any of the other three rations. Steers receiving whole milage (ration 1) consumed 9.4% more feed ($P<.05$) and required 14.0% more feed per lb. of gain than steers receiving rolled milage (ration 2). Steers fed rolled milage (rations 2 and 3) required an average of 15.8 and 8.5%, respectively, less grain per lb. of gain than steers fed rations 1 and 4.

Introduction

Harvesting and storing milo as milage have increased rapidly the past three years. Previous research at this station demonstrated that feedlot cattle could be finished on properly supplemented milage rations. Also processing milage to crack all of the grain improved its efficiency 11.4%.

In this trial, unprocessed (whole) milage, processed (rolled) milage and processed milage plus added grain rations were compared with a conventional, high-moisture milo plus chopped hay ration for finishing yearling steers.

Experimental Procedures

Forty-eight mixed breed yearling steers averaging 732 lbs. were allotted by breed and weight to 12 pens of four steers each. Three pens were assigned to each of these rations: (1) whole milage, (2) rolled milage, (3) rolled milage plus high-moisture milo and (4) high-moisture milo plus chopped hay. The 102-day trial began March 11 and ended June 20, 1974.

Milage and high-moisture milo were harvested from the same source the fall of 1973. Milage grain moisture was 30 to 32%; high-moisture

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[1] In this report, the term "milage" refers to milo head silage.

[2] Harvesting equipment provided by Field Queen Corporation (a division of Hesston Corporation), Maize, Kansas.

[3] Roller mill for processing milage provided by Davis Manufacturing Co., Bonner Springs, Kansas.

milo was 25% moisture. The milage forage harvester was equipped with a two-inch recutter screen, but only 20 to 30% of the grain was cracked. Approximately six percentage units of water was added to the milage as it was ensiled in 10 ft. x 50 ft. concrete stave silos.

Compositions of the four rations and milage are shown in table 13.1. All rations were mixed twice daily and fed free-choice. Rations 1 and 2 were 24% roughage. Milage for ration 2 was put through a roller mill set to crack all grain in the silage before it was fed. The ratio of milage to high-moisture milo in ration 3 resulted in 15% roughage. Ration 4 contained 15% roughage from chopped prairie hay. Initially, rations 1, 2, and 3 contained 25% forage sorghum silage, and ration 4 contained 40% chopped hay. Silage and hay were gradually decreased until all steers were receiving their final ration after 10 days.

Initial and final weights of the steers were taken after steers went 15 hours without access to feed or water. Final live weights were adjusted to a 60.3% dress for feedlot performance calculations.

Results and Discussion

Feedlot performances of the steers are presented in table 13.2. Steers fed rolled milage plus milo (ration 3) gained faster ($P<.05$) and more efficiently ($P<.05$) than steers fed any of the other three rations. Steers fed rations 1, 2, and 4 gained at similar rates; however, those fed whole milage were less efficient ($P<.05$) than those fed rolled milage or those fed milo plus chopped hay. Steers receiving whole milage (ration 1) consumed more ration dry matter ($P<.05$) than steers receiving any of the other three rations. The two rations containing rolled milage (rations 2 and 3) produced more gain per lb. of milo grain fed ($P<.05$) than either the whole milage or milo plus chopped hay rations (rations 1 and 4).

Performances of yearling steers fed whole and rolled milage rations the past two years (1973 and 1974) are summarized in figure 1. Feedlot responses of the steers receiving the two milages were similar both years. Processing the milage to crack all the grain did not influence rate of gain. However, in trial 1, steers fed whole milage consumed 14.6% more dry matter than steers fed rolled milage; in trial 2, that difference was 9.4%. As a result, steers fed whole milage in trial 1 were 11.5% less efficient than steers fed rolled milage; in trial 2, the difference was 14.0%.

An average of the two trials shows that one ton of rolled milage produced 16.5 pounds more gain than one ton of whole milage. In both trials, steers fed rations containing rolled milage required sigificantly less grain dry matter to produce a pound of gain than steers fed whole milage rations or typical feedlot rations containing 10 and 20% corn or wheat silage or 15% chopped hay.

Table 13.1. Ration Compositions and Milage Analyses (%,Dry Matter Basis).

Item	Milage			
	Whole	Rolled	Rolled + milo	Chopped hay + milo
Ration ingredients				
Milage	92.5	92.5	58.3	--
Rolled milo, 25% moisture	--	--	42.6	80.0
Chopped hay	--	--	--	15.0
Soybean meal	2.5	2.5	--	--
Supplement I[a]	5.0	5.0	--	--
Supplement II[a]	--	--	5.0	5.0
Milage analyses				
Dry matter		56.5		
Crude protein		9.5		
Grain		73.6		
Roughage		26.4		

[a]Formulated to provide 14.0% of the total ration crude protein equivalent from urea, 30,00 IU of vitamin A and 70 mg of aureomycin per steer per day.

Table 13.2. Feedlot Performance of the Steers.

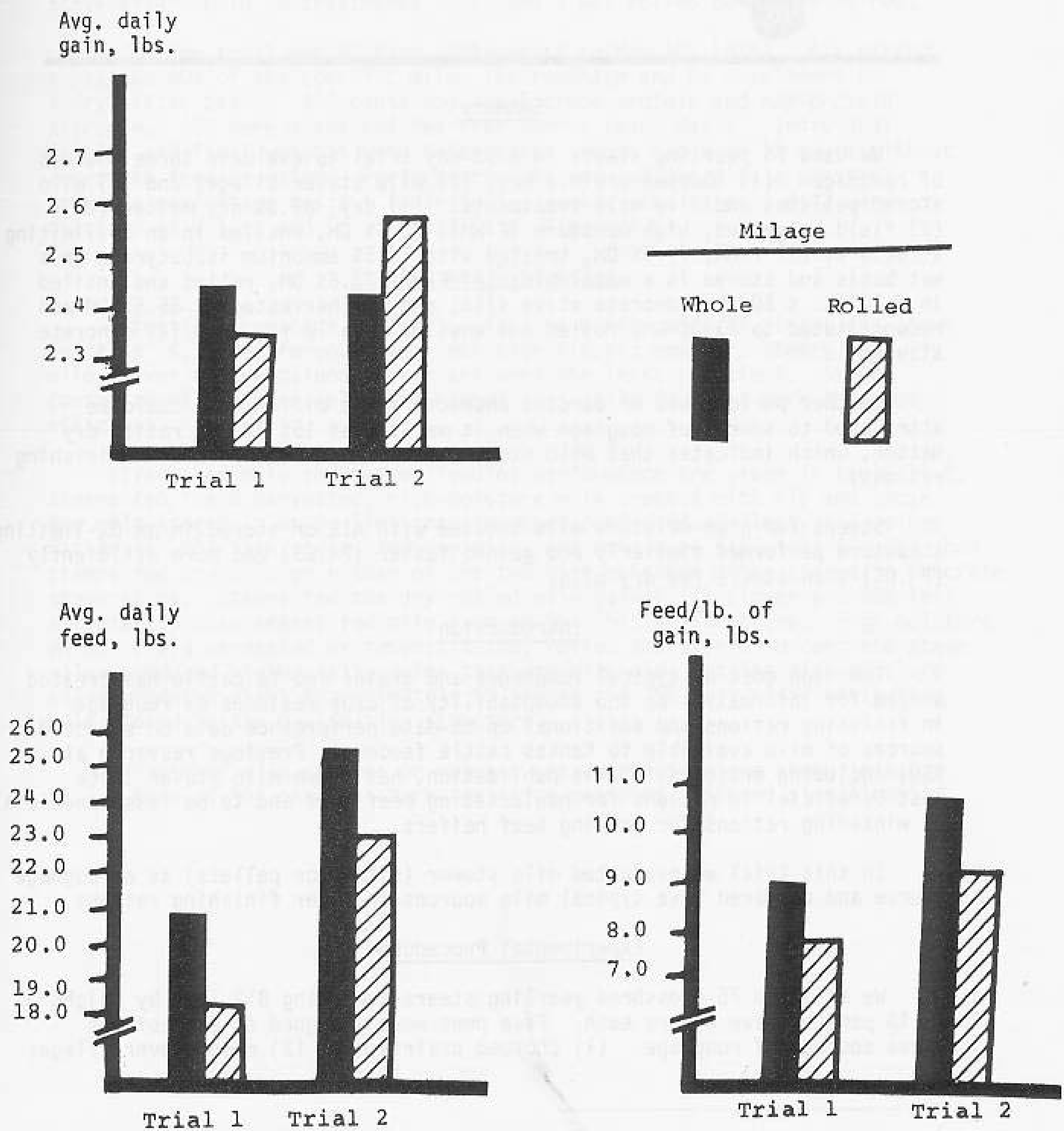
Item	Milage: Whole	Milage: Rolled	Milage: Rolled + milo	Chopped hay + milo
No. of steers	13	13	12	12
Initial wt., lbs.	730	730	735	733
Final wt., lbs.	974	989	1028	987
Avg. daily gain, lbs.	2.40[b]	2.53[b]	2.87[a]	2.49[b]
Avg. daily feed, lbs.[1]				
milage	23.33	21.13	12.14	--
milo, 25% moisture	--	--	8.41	16.40
chopped hay	--	--	--	3.90
soybean meal	0.66	0.60	0.07	0.05
supplement	1.30	1.18	1.10	1.04
sorghum silage	0.27	0.25	0.27	--
Total	25.56[a]	23.16[b]	21.99[b,c]	21.39[c]
Feed/lb. gain, lbs.[1]	10.66[c]	9.17[b]	7.67[a]	8.62[b]
Milo grain/lb. gain, lbs.[1]	7.15[c]	5.99[a]	6.05[a]	6.59[b]
Dressing %	60.5	59.7	60.9	60.0
Quality grade	10.4	10.7	11.0	10.6

[1] 100% dry matter basis.

[2] 10 = avg. good; 11 = high good; 12 = low choice.

[a,b,c] Means in the same row with different superscripts differ significantly ($P<.05$).

Figure 13.1. Summary of Feedlot Performance of Steers Fed Whole or Rolled Milage in Two Trials (trial 1, Progress Report 210, Kansas Agricultural Experiment Station, 1974; trial 2, table 13.2).



Sources of Roughage and Milo for Finishing Steers

J. G. Riley, K. K. Bolsen, and G. Fink

Summary

We used 75 yearling steers in a 92-day trial to evaluate three sources of roughage: (1) chopped prairie hay; (2) milo stover silage; and (3) milo stover pellets; and five milo treatments: (1) dry, 85.5% dry matter (DM); (2) field harvested, high moisture (F-HM), 72.6% DM, ensiled in an O_2-limiting structure; (3) F-HM, 79.5% DM, treated with 1.75% ammonium isobutyrate[1] on a wet basis and stored in a metal bin; (4) F-HM, 73.6% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo; and (5) harvested at 85.5% DM and reconstituted to 73.3% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo

Neither performance or carcass characteristic differences could be attributed to source of roughage when it was fed at 15% of the ration dry matter, which indicates that milo stover can be effectively used in finishing rations.

Steers fed high-moisture milo treated with AIB or stored in an O_2-limiting structure performed similarly and gained faster ($P<.05$) and more efficiently ($P<.05$) than steers fed dry milo.

Introduction

The high cost of typical roughages and grains fed to cattle has created a need for information on the acceptability of crop residues as roughage in finishing rations and additional up-to-date performance data on selected sources of milo available to Kansas cattle feeders. Previous research at KSU, including articles in this publication, has shown milo stover to be most beneficial in rations for nonlactating beef cows and to be less beneficial in wintering rations for growing beef heifers.

In this trial we evaluated milo stover (silage or pellets) as a roughage source and compared five typical milo sources in steer finishing rations.

Experimental Procedure

We allotted 75 crossbred yearling steers averaging 812 lbs. by weight to 15 pens of five steers each. Five pens were assigned to each of the three sources of roughage: (1) chopped prairie hay; (2) milo stover silage;

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[1] Ammonium isobutyrate and partial financial assistance provided by W. R. Grace and Company, Clarksville, Maryland.

and (3) milo stover pellets. One pen from each roughage source was assigned to each of the five sources of milo: (1) dry, 85.5% dry matter (DM); (2) field harvested, high moisture (F-HM), 72.6% DM, ensiled in an O_2-limiting structure; (3) F-HM, 79.5% DM, treated with 1.75% ammonium-isobutyrate on a wet basis and stored in a metal bin; (4) F-HM, 73.6% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo; and (5) harvested at 85.5% DM and reconstituted to 73.3% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo. Milo in treatments 1, 2, and 3 was rolled before being fed.

The trial was 92 days (February 7 to May 10, 1974). All rations contained 80% of the specific milo, 15% roughage and 5% supplement on a dry matter basis. All contained equal crude protein and non-protein nitrogen. All were mixed and fed free choice twice daily. Individual initial and final weights were taken after steers had been 15 hours without access to feed or water. Performance data were adjusted to a constant dressing percentage basis. Individual slaughter and carcass data were obtained at Wilson and Co., Kansas City, Missouri,

Results and Discussion

Effects of roughage sources on feedlot performance of steers are shown in table 14.1. Differences were not significant; however, steers fed milo stover silage gained slower and were the least efficient. Steers consuming milo stover pellets consumed less daily feed and were the most efficient.

Effects of milo sources on feedlot performance are given in table 14.2. Steers fed field harvested, high-moisture milo treated with AIB and those fed milo stored in an O_2-limiting structure performed similarly and gained faster ($P<.05$) than steers fed dry milo, and were more efficient ($P<.05$) than steers fed dry milo or either of the two high moisture milos stored in concrete stave silos. Steers fed the dry-rolled milo gained 17% slower and 22% less efficiently than steers fed milo from an O_2-limiting structure. High-moisture

silos produced higher daily gains than dry milo did, but the high-moisture milos produced gains approximately 6% slower and 18% less efficiently than milo stored in the O_2-limiting structure.

Effects of milo sources on carcass characteristics are shown in table 14.3. None of the carcass characteristics measured differed significantly.

Table 14.1. Effects of Roughage Sources on Performance of Finishing Steers.

	Roughage		
	Chopped hay	Milo stubble pellets	Milo stubble silage
No. steers	25	25	25
Initial wt., lb.	812	814	817
Final wt., lb.	1056	1056	1052
Gain, lb.	243	241	235
A.D.G., lb.	2.65	2.62	2.56
Daily D.M., lb.	22.93	21.48	22.36
D.M./gain, lb.	8.65	8.20	8.73

Table 14.2. Effects of Milo Sources on Performance of Finishing Steers, 92 Days.

	Milo				
Item	Dry[1]	AIB[3]	O_2 L[2]	H-M-S[4]	Recon-S[5]
No. steers	15	15	15	15	15
Initial wt., lb.	813	815	814	812	819
Final wt., lb.	1027	1073	1070	1052	1060
Gain, lb.	214	258	256	240	242
A.D.G., lb.	2.32[a]	2.80[b]	2.78[b]	2.60[a,b]	2.62[a,b]
Daily D.M., lb.	22.42[a,b]	22.14[a,b]	20.77[a]	22.05[a,b]	23.90[b]
D.M./gain, lb.	9.66[a]	7.91[b]	7.47[b]	9.08[a]	9.12[a]

[a,b] Different superscripts indicate significant (P<.05) differences.

[1] 85.5% dry matter (DM), rolled prior to feeding.

[3] Field harvested, high moisture (F-HM), 79.5% DM, treated with 1.75% AIB and stored in metal bin, rolled prior to feeding.

[2] F-HM, 72.6% DM, ensiled in an O_2-limiting structure, rolled prior to feeding.

[4] F-HM, 73.6% DM, rolled and ensiled in a 10 ft. x 50 ft concrete stave silo.

[5] Harvested at 85.5% DM and reconstituted to 73.3% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo.

Table 14.3. Effects of Milo Sources on Carcass Characteristics of Steers.

Item	Milo				
	Dry[1]	AIB[3]	O_2L[2]	H-M-S[4]	Recon-S[5]
No. steers	15	15	15	15	15
Dressing %	59.8	59.5	58.5	59.1	59.0
Fat, in.	0.49	0.45	0.53	0.58	0.46
LEA, $in.^2$	11.00	11.60	11.20	10.90	11.40
USDA grade[6]	11.5	11.6	11.7	11.6	11.5

[1]85.5% dry matter (DM), rolled prior to feeding.

[3]Field harvested, high moisture (F-HM), 70.5% DM, treated with 1.75% AIB and stored in metal bin, rolled prior to feeding.

[2]F-HM, 72.6% DM, ensiled in an O_2-limiting structure, rolled prior to feeding.

[4]F-HM, 73.6% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo.

[5]Harvested at 85.5% DM and reconstituted to 73.3% DM, rolled and ensiled in a 10 ft. x 50 ft. concrete stave silo.

[6]11 = high good; 12 = low choice; etc.

Effects of Growth Stimulating Implants and Implanting Sequence on Steer Performance

J. G. Riley and G. Fink

Summary

Three trials used 264 steers to evaluate the effects of 36 mg zeranol (Ralgro)[1] and 20 mg estradiol benzoate plus 200 mg progesterone (Synovex-S)[2] implants on performance of steers during one growing and two finishing studies. Daily gain during the 105-day growth trial by steers implanted with Synovex-S (S) exceeded that of steers implanted with Ralgro (R). Before a 151-day finishing trial, equal numbers from each implant group in the growth trial were re-implanted with either R or S so we had four implanting sequences each of two implants: SS; SR; RS; and RR. Implant sequences SR, RS, and RR all gave similar performances and produced faster ($P<.05$) gains than implant sequence SS. Combining the growing and finishing phases into a 256-day implanting program resulted in no significant differences in daily gain by implant sequence. In a second finishing trial, we compared a single implant of S or R in a 108-day trial. Rate of gain did not differ significantly. Also, carcass measurements did not differ significantly by implant.

Introduction

Even though diethylstilbestrol (DES) has been re-instated at least temporarily, cattle feeders want more research data on Ralgro and Synovex-S as implants for growing and finishing steers. Additional information is also needed to determine whether implanting sequence is important. For example, do steers need to be re-implanted after a certain period on feed with the same type implant or a different implant?

Experimental Procedure

We randomly divided 168 steers averaging 501 lbs. into two groups of 84 and implanted with 36 mg zeranol (R) or 200 mg estradiol benzoate plus 200 mg progesterone (S) before a 105-day growing trial. Forty-two from each implant group were re-implanted with either R or S before a finishing trial 1 (151 days). A second finishing trial used 96 Angus and Angus cross yearling steers averaging 758 lbs. in a 108-day trial with equal numbers receiving R or S. A 40% concentrate ration was fed during the growing trial and an 80% concentrate ration during the two finishing trials. All rations were mixed twice daily and fed free choice. Initial and final weights were obtained after 15 hours without access to feed or water. Performance data

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[1]Ralgro provided by Commercial Solvents Corp., Terre Haute, Indiana.

[2]Synovex-S provided by Myzon Laboratories, Inc., Des Moines, Iowa.

were adjusted to a constant dressing percentage basis. Individual slaughter and carcass data were obtained at Wilson and Company, Kansas City, MO.

Results

Effects of implants on steer performance during the 105-day growing trial are shown in table 15.1. Daily gain was 9% greater (P<.05) by the Synovex-S treated steers. The effect of implanting sequence on steer performance during finishing trial 1 is shown in table 15.2. Implant sequences SR, RS, and RR produced similar and greater (P<.05) gains than sequence SS. The combined results for the 256 days are shown in table 15.3. Sequence SS produced slowest gains; however, not significantly slower. Results of finishing trial 2 (table 15.4) indicated no significant differences in daily gain. Effect of implants and implanting sequence on carcass characteristics are shown in tables 15.4 and 15.5. Again no significant differences were observed.

Table 15.1. Effects of Indicated Implants on Steer Performance, Growing Phase, 105 Days.

	Implant	
Item	Ralgro	Synovex-S
No. steers	84	84
Avg. initial wt., lb.	498.6	504.3
Avg. final wt., lb.	720.2	745.7
Avg. gain, lb.	221.6	241.4
Avg. daily gain, lb.	2.12[a]	2.29[b]

[a,b]Significantly different (P<.05).

Table 15.2. Effects of Implanting Sequence on Steer Performance, Finishing Phase, 151 Days, Trial 1.

	Period	Implant			
	Growing	Synovex		Ralgro	
Item	Finishing	Synovex	Ralgro	Synovex	Ralgro
No. steers		42	42	42	42
Avg. initial wt., lb.		738.2	753.2	717.3	723.0
Avg. final wt., lb.		1030.0	1077.4	1054.6	1062.6
Avg. gain, lb.		291.7	324.1	337.4	339.6
Avg. daily gain, lb.		1.94[a]	2.14[b]	2.23[b]	2.25[b]

[a,b]Significantly different ($P<.05$).

Table 15.3. Effects of Implanting Sequence on Overall Performance, 256 Days, Growing Phase & Finishing Trial 1.

	Period	Implant			
	Growing	Synovex		Ralgro	
Item	Finishing	Synovex	Ralgro	Synovex	Ralgro
No. steers		42	42	42	42
Avg. initial wt., lb.		499.4	507.2	495.9	498.1
Avg. final wt., lb.		1030.0	1077.4	1054.6	1062.6
Avg. gain, lb.		530.5	570.2	558.7	564.5
Avg. daily gain, lb.		2.07	2.23	2.18	2.20

No significant differences.

Table 15.4. Results from Synovex-S and Ralgro Implants During Finishing Trial 2, 108 Days.

Item	Synovex-S	Ralgro
No. of steers	48	48
Avg. initial wt., lb.	757.5	758.5
Avg. final wt., lb.	1098.8	1095.5
Avg. gain, lb.	341.3	338.0
Avg. daily gain, lb.	3.16	3.13
Carcass characteristics:		
Fat thickness, in.	0.77	0.74
Loin eye area, sq. in.	11.31	11.25
U.S.D.A. grade[a]	12.40	12.10
Yield grade	3.95	3.88

[a]Low choice = 12, high good = 11.

Table 15.5. Effects of Implanting Sequence on Carcass Characteristics of Finishing Steers, Trial 1.

	Period	Implant			
	Growing	Synovex		Ralgro	
Item	Finishing	Synovex	Ralgro	Synovex	Ralgro
No. steers		42	42	42	42
Dressing %		61.52	61.82	61.60	61.81
Fat thickness, in.		0.52	0.63	0.56	0.62
Loin eye area, sq. in.		11.12	12.10	11.70	11.66
Yield grade		3.28	3.35	3.34	3.49
U.S.D.A. grade[a]		11.67	12.15	11.97	12.25

[a]11 = high good; 12 = low choice; etc.

Effects of Protein Levels and Withdrawing Supplemental Protein on Performance of Growing and Finishing Steers

J. G. Riley, K. F. Harrison, and G. Fink

Summary

In one growing trial and two finishing trials we used 264 steers. Rations containing 13.2% crude protein during the 105-day growing trial significantly ($P<.05$) improved rate of gain compared with 11.3% crude protein rations. Withdrawing supplemental protein at approximately 750, 850, or 950 pounds live weight did not significantly affect rate of gain; however, gain was slowest by steers without supplemental protein.

Introduction

Previous research here (1973, 1974) indicated that steers on growing rations gained faster and more efficiently when fed more crude protein than is now recommended by the National Research Council. The earlier research also demonstrated that supplemental protein could be removed from the ration when animals reached approximately 950 pounds without significantly depressing performance. Ohio State and Texas Tech researchers found that supplemental protein could be withdrawn when animals reached 750 or 850 pounds. Trials reported here were to get more information relating to protein withdrawal and carcass characteristics of growing and finishing steers.

Experimental Procedure

We randomly allotted 168 mixed-breed steers averaging 501 lb. to four pens of 42 steers each. Two pens were fed a 13.2% crude protein ration and two, an 11.3% crude protein ration for a 105-day growing trial. Then we reallotted the steers according to previous growing ration into 4 trial groups: supplemental protein withdrawn at: (1) approximately 750 lbs; (2) at 850 lbs; (3) at 950 lbs; (4) protein fed continuously until slaughter. The same four treatments were used in finishing trial 2 on 96 Angus and Angus X yearling steers. Compositions of rations fed are shown in table 16.1, and of the withdrawal supplement in table 16.2. Periodic samples of each ingredient used in the rations were taken and proximate analyses obtained. Average crude protein was calculated as shown at the bottom of table 16.1. All rations were mixed twice daily and fed free-choice. Initial and final weights were taken after 15 hours without access to feed or water. Individual slaughter and carcass data were collected at Wilson and Company, Kansas City, MO. Performance data are adjusted to an equal dressing percentage basis.

Results and Discussion

Steers fed rations containing 13.2% crude protein gained significantly faster ($P<.05$) than those on 11.3% crude protein rations (table 16.3). Daily dry matter consumption and efficiency also were better for steers getting 13.2% crude protein.

Withdrawing supplemental protein for the duration or the last two-thirds of the trial slightly depressed gains and lowered daily dry matter intake (table 16.4). However, during trial 2 (table 16.5) withdrawing supplemental protein the final two-thirds or the final third of the finishing period resulted in similar gains and efficiency to those by steers that were fed supplemental protein to slaughter weights. Withdrawals were at approximately 750, 850, or 950 pounds of live weight for the two trials. The results suggest that British breeds of cattle do not need supplemental protein in high concentrate rations when they reach 950 pounds, and that supplemental protein may be withdrawn with minimal effects when British breeds on high concentrate rations reach 750 or 850 pounds.

Table 16.1. Composition of Final Rations Fed Steers During Indicated Feeding Phases. (%, dry matter basis)

	Growing		Finishing Trial 1		Finishing Trial 2	
Ingredient	11% C.P.	13% C.P.	Basal	11% C.P.	Basal	11% C.P.
Sorghum silage	55.0	55.0	20.0	20.0	15.0	15.0
Grain sorghum	20.0	18.0	40.0	37.0	60.0	56.0
Corn	15.0	12.0	37.5	34.5	23.0	22.0
Cottonseed meal	7.5	12.5	--	--	--	--
Soybean meal	--	--	--	6.0	--	5.0
Supplement	2.5	2.5	2.5	2.5	2.0	2.0
Crude protein content[a]	11.3	13.2	8.7	11.2	9.3	11.2

[a]Calculations based on periodic sampling of each ingredient during the trials.

Table 16.2. Composition of Supplement Withdrawn from Basal Rations During Finishing Trials 1 and 2.

Ingredient	%
Rolled milo	69.0
Dical	4.8
Dyna-K	2.5
Limestone	12.3
Salt	7.2
Aureomycin (10 gms/lb.)	1.4
Trace minerals (Z-5)[a]	1.5
Soy oil	1.0
Vitamin A (30,000 I.U./gm)	.3

[a]Calcium Carbonate Company.

Table 16.3. Effects of Protein Levels on Performance of Growing Steers, 105 Days, Aug. 23-Dec. 6, 1973.

	% crude protein			
Item	11	11	13	13
No. of steers	42	42	42	42
Initial wt., lb.	495.5	500.6	507.4	498.0
Final wt., lb.	725.5	723.2	752.1	738.5
Avg. gain, lb.	230.0	222.6	244.7	240.5
Avg. daily gain, lb.	2.19[a]	2.12[a]	2.33[b]	2.29[b]
Daily dry matter, lb.	18.66	18.63	18.96	19.08
Dry matter/lb. gain, lb.	8.52	8.79	8.14	8.33

[a,b]Means in same row with different superscripts differ significantly ($P<.01$).

Table 16.4. Effects of Withdrawing Supplemental Protein from Finishing-Steer Rations, 151 Days, Trial 1. Dec. 6, 1973-May 7, 1974.

Item	Days	% crude protein			
	0-49 50-91 92-151	Basal[a] Basal Basal	11 Basal Basal	11 11 Basal	11 11 11
No. of steers		42	42	42	42
Initial wt., lb.		725.4	728.1	736.3	736.5
Final wt., lb.		1033.3	1036.3	1059.8	1066.8
Avg. gain, lb.		307.9	308.2	323.5	330.3
Avg. daily gain, lb.		2.04	2.04	2.14	2.19
Daily dry matter, lb.		19.31	19.46	20.84	20.56
Dry matter/lb. gain, lb.		9.47	9.54	9.74	9.39

[a]Basal ration ranged from 8.7-9.1% crude protein, based on periodic sampling during trial 1.

Table 16.5. Effects of Withdrawing Supplemental Protein from Finishing Steer Rations, 108 Days, Trial 2. June 11-Sept. 27, 1974.

Item	Days	% crude protein			
	0-38 39-73 74-108	Basal[a] Basal Basal	11 Basal Basal	11 11 Basal	11 11 11
No. of steers		24	24	24	24
Initial wt., lb.		749.7	754.6	749.9	774.9
Final wt., lb.		1082.0	1100.0	1088.3	1118.4
Avg. gain, lb.		332.3	345.4	338.4	343.5
Avg. daily gain, lb.		3.08	3.20	3.13	3.18
Daily dry matter, lb.		24.73	25.01	24.09	25.05
Dry matter/lb. gain, lb.		8.03	7.82	7.70	7.88

[a]Basal ration ranged from 8.9-9.3% crude protein during trial 2.

Table 16.6. Effects on Carcass Characteristics of Withdrawing Supplemental Protein from Finishing Steers, Trials 1 & 2.

	Days Trial 1	Days Trial 2	% crude protein			
	0-49	0-38	Basal	11	11	11
	50-91	39-73	Basal	Basal	11	11
Item	92-151	74-108	Basal	Basal	Basal	11
Fat thickness, in.						
Trial 1			.53	.66	.58	.57
Trial 2			.75	.73	.76	.78
Loin eye area, sq. in.						
Trial 1			12.1	11.7	11.3	11.5
Trial 2			10.8[a]	11.3[a,b]	11.1[a,b]	11.9[b]
U.S.D.A. grade[c]						
Trial 1			12.0	12.3	12.4	12.1
Trial 2			12.3	12.3	12.1	12.3
U.S.D.A. yield grade						
Trial 1			3.0	3.6	3.5	3.4
Trial 2			4.0	3.8	4.0	3.8

[a,b] Means on same row with different superscripts differ significantly ($P<.05$).

[c] Choice = 13, low choice = 12, high good = 11.

Performance and Carcass Characteristics of Chianina-X Steers

Jack Riley and Galen Fink

Summary

Chianina-X steers gained consistently during a 151-day finishing test and produced high yielding carcasses with 0.06 in. fat and 1.71 square in. of loin per hundred pounds of carcass. Average USDA quality grade was between high good and low choice.

Introduction

Glenkirk Farms, Maysville, Mo., and the Kansas State University Animal Science and Industry Department cooperated in a project to evaluate performance and carcass characteristics of 40 Chianina-X steers. The predominant dam breed represented was Angus. Because Chianina is one of the newest exotic breeds introduced to the United States, data on their rate and efficiency of gain and their relative carcass merits were desired.

Experimental Procedure

The 40 steers were started on trial April 16, 1974, averaging 779 pounds after a 15-hour shrink and fed an average of 151 days. Final slaughter weight averaged 1177 lbs. when adjusted to an equal dressing percentage. The finishing rations (70-85% concentrate) were similar to those used in trials at the Beef Research Unit. Weights were taken at 28-day intervals and carcass data obtained for each steer at slaughter.

Results and Discussion

Performance and carcass characteristics are presented in table 17.1. The rate of growth was extremely consistent for each 28-day weight interval, including just before slaughter, which indicates that the steers could have been fed to heavier slaughter weights if rate of gain were the only criterion for length of feeding period. However, the efficiency of gain and, consequently, cost of gain became prohibitive the final month.

The carcasses were highly desirable in color and trimness. U.S.D.A. grade was between high good and low choice, indicating several carcasses borderline in marbling. The average rib eye area was smaller than normal for carcasses of their weight.

Only a small portion of the Chianina crossbred steers produced in the United States were represented in trial 1. Our data indicate that they will gain consistently, produce attractive, high yielding carcasses and gain efficiently during early stages of growth.

Table 17.1. Performance and Carcass Characteristics of Chianina-X Steers Fed 151-days, 1974.

Item		Item	
No. of steers	40	Daily D.M. intake, lb.	24.3
Initial wt., lb.	779.1	D.M./gain, lb. (151 days)	9.24
Final wt., lb.	1176.5	D.M./gain, lb. (1st 56 days)	7.24
Total gain, lb.	397.4	D.M./gain, lb. (Final 33 days)	12.91
A.D.G., lb.	2.63		
Carcass wt., lb.	736.9		
Fat thickness, in.	0.44		
Rib eye area, sq. in.	12.60		
Kidney fat, %	2.76		
U.S.D.A. grade[a]	10.40		
Yield grade	2.92		

[a]High Good = 10, low Choice = 11.

Calcium Sources Compared in Liquid Feed Supplements For Finishing Steers

L. H. Harbers, R. D. Teague, and J. G. Riley

Summary

When calcium chloride was added to a mixture of minerals and urea in molasses, the minerals had not settled after the mixture was shipped 350 miles and stored 4 weeks. Calcium carbonate added to a similar supplement caused all minerals tested except sodium, potassium, and copper to precipitate.

Using a 112-day, steer-feeding trial, we found that animals performed similarly when their liquid feed supplement contained either calcium chloride or resuspended calcium carbonate.

Introduction

Limited information is available on calcium chloride as a potential calcium source for practical ruminant rations. The true digestibility of the chloride form does not differ from those of other inorganic calcium sources. When calcium chloride was added to beef finishing rations as a urolithiasis preventative, growth rate and feed efficiency were not impaired.

Because it is soluble, calcium chloride should have an advantage over other inorganic sources (i.e., carbonate) in liquid supplements. Reported here are results from a beef finishing trial that compared chloride and carbonate calcium sources in a liquid feed supplement.

Experimental Procedure

Forty-two steers (797 lb.) were divided by weight into six lots of seven animals. Three randomly selected lots received a liquid feed supplement containing calcium carbonate; the other three lots, a supplement containing calcium chloride* (table 18.1). Each animal was allowed 2 lb. of the specific liquid feed supplement daily plus a starter ration of 60% roughage. The liquid feed supplements were stored in 5 gal. buckets to facilitate complete mixing. The animals were changed gradually to a high concentrate ration during 28 days and maintained on that ration 84 days (table 18.2). Animals were slaughtered at a commercial plant that allowed appropriate data to be collected and kidneys to be sampled.

*Dowflake®, The Dow Chemical Company, Midland, Mich.

Barrels containing 55 gal. of either calcium carbonate or calcium chloride were sampled at the top and bottom of liquid layers without disturbing precipitated residues when the barrels arrived, then 2 and 4 weeks later. Samples were analyzed for N, P, Ca, Na, K, Mg, Fe, Mn, Zn, and Cu. Residues in the 5 gal. buckets were determined at various times during the experimental period.

Results and Discussion

A summary of animal performance and carcass information is given in table 18.3. During the 112-day period, animals receiving $CaCO_3$ gained 2.39 lb. daily and those fed $CaCl_2$ supplement, 2.37 lb. daily. Calcium source did not influence gain. Steers fed $CaCO_3$ ate slightly more dry matter (19.3 lb. vs. 18.3) but those fed $CaCl_2$ were slightly more efficient (7.71 vs. 8.08). No disease or gastric-disturbance differences were apparent.

Carcass data (table 18.3) favor the $CaCO_3$ fed groups, but not significantly. Slight differences in carcass data probably reflect the heavier weight of the carbonate cattle. More livers were condemned from animals fed $CaCO_3$ (15.8%) than those fed $CaCl_2$ (5.0%). All observed kidneys were normal.

Changes in the protein supplements with time are summarized in tables .4-.5. Neither supplement fermented during the feeding period, but residue (table 18.4) in $CaCO_3$-containing buckets (3-4%) was difficult to resuspend. One bucket was used in each of three feedings, so residual losses would not bias growth data. Residue in the calcium chloride supplemented liquid varied from ½ to 1%. It was easily mixed before adding the supplement to the other feed ingredients. The pH of the chloride supplement was at least one unit below that of the carbonate supplement.

The mineral analyses of the 55-gal. barrels taken at 0, 2, and 4 weeks did not include residue but only minerals remaining in the liquid--the minerals most likely used under practical conditions using bulk tanks. Analyses are summarized in table 18.5. In the $CaCO_3$ supplement calcium, phosphorous, and magnesium in the top layer upon arrival were lost by week 2. Concomitant increases were noted in the bottom portion (not in the solid residue, but in that portion capable of being siphoned via a glass tube). Sodium and potassium were not affected. In the supplement containing calcium chloride as the calcium source, no differences between top and bottom were found after 4 weeks. Zinc, iron, and manganese were drastically reduced in the top portion of the calcium carbonate liquid supplement. No changes were evident in the calcium chloride liquid supplement. Copper remained suspended in both supplements.

Table 18.1. Compositions of Liquid Feed Supplements Used To Compare Sources of Calcium.

Ingredients	Control ($CaCO_3$)	Treatment ($CaCl_2$)
	%	%
Water	5.00	5.00
Minugel clay	1.50	--
Urea, 50% solution	18.50	18.50
Powdered limestone	6.10	--
Calcium chloride[a]	--	8.34
$(NH_4)_2SO_4$	1.80	1.80
NaCl	2.00	2.00
Trace minerals	0.40	0.40
Vitamins A-D-E[b]	0.02	0.02
Ammonium polyphosphate (10-34-0)	3.40	3.40
Cane molasses	61.25	61.00

[a]Dowflake®, Dow Chemical Co., Midland, Mich.

[b]Pound of supplement: 30,000 I.U. vitamin A; 3.000 U.S.P. units vitamin D; 4 U.S.P. units vitamin E.

Table 18.2. Average Composition of Feed Fed to Steers the Last 84 Days.

Ingredient	Daily amount, lb.	Moisture, %
Cracked sorghum grain	22.0	13
Corn silage	7.1	67
Liquid feed supplement	2.0	21

Table 18.3. Feedlot Performance and Carcass Data from Animals Used to Test Indicated Sources of Calcium.

Item	$CaCO_3$	$CaCl_2$
No. of animals fed	21	21
Initial weight, lb.	820	774
Final weight, lb.	1285	1048
Daily gain, lb.	2.39	2.37
Dry matter intake, lb.	19.3	18.3
Feed efficiency, feed/gain	8.08	7.71
No. of animals slaughtered	19	20
Hot carcass weight, lb.	642	622
Condemned livers, %	15.8	5.0
Grade[a]	3.4	3.7
Yield grade[b]	2.91	2.75
Loin-eye area, $in.^2$	11.64	11.62
Backfat, in.	.45	.42
Kidney knob, %	2.76	2.78

[a] 1= High choice; 6 = low good.

[b] 1 = Most desirable; 5 = least desirable.

Table 18.4. Residue and pH of Liquid Feed Supplements Maintained in 5 gal. Containers.

	$CaCO_3$		$CaCl_2$	
Time, weeks	% residue	pH	% residue	pH
0	3.65	5.22	0.48	4.15
2	3.56	5.20	0.51	4.15
4	3.08	5.30	0.50	4.30
8	4.07	5.30	1.02	4.55

Table 18.5. Mineral Concentrations in Undisturbed Liquid Feed Supplements Containing Either $CaCO_3$ or $CaCl_2$ (55 gal. containers).

Supplement	Time, wks.	Ca, %		P, %		Na, %		K, %		Mg, %	
		top	bottom	top	bottom	top	bottom	top	bottom	top	bottom
$CaCO_3$	0	1.37	1.67	.54	.57	2.02	2.04	.10	.09	.15	.14
	2	0.17	2.29	.21	.58	1.97	1.99	.09	.10	.06	.16
	4	0.18	2.63	.23	.64	2.03	2.05	.10	.12	.07	.19
$CaCl_2$	0	2.40	2.26	.45	.56	1.60	1.59	.12	.12	.09	.10
	2	2.56	2.53	.49	.50	1.59	1.52	.12	.12	.08	.09
	4	2.46	2.32	.49	.48	1.54	1.55	.12	.12	.10	.09

Supplement	Time, wks.	Mn, ppm		Fe, ppm		Zn, ppm		Cu, ppm	
		top	bottom	top	bottom	top	bottom	top	bottom
$CaCO_3$	0	123	138	705	714	285	314	53	68
	2	6	145	58	830	45	320	48	56
	4	7	164	67	900	50	348	44	57
$CaCl_2$	0	133	141	495	470	320	314	53	58
	2	124	133	445	439	271	292	46	51
	4	127	126	444	411	309	297	52	55

Polioencephalomalacia (PEM)--Current Research Status

D. A. Sapienza and B. E. Brent

Summary

In ruminants fed high grain rations, a condition called polioencephalomalacia (PEM), characterized by central nervous system derangement, can develop. It usually is noninfectious, responds to thiamin injections, and is characterized by sudden onset. Using artificial rumen techniques, we established that PEM results from a bacteria-produced enzyme in the rumen that converts the vitamin thiamin to a nonusable alternate form, pyrithiamin, which in turn causes severe metabolic disturbances in the central nervous system.

Introduction

Polioencephalomalacia (PEM) is a central nervous system disorder that occurs most often in feedlot cattle on high grain diets. It responds to intravenous injections of large doses of thiamin. Signs include muscular incoordination, "circling" and pushing on feed bunks and fences with the head. Animals are sometimes (but not always) blind. If not treated, they die in a short time. If treated too late, they may die or suffer permanant derangements because of irreversable central nervous-system damage.

In 1972, we developed an experimental system that produced PEM in sheep (Kan. Ag. Exp. Sta. Bul. 557), which permitted research on other than spontaneously occurring cases.

Because cells in the central nervous system had to be thiamin deficient to produce the observable signs, thiamin had to be either destroyed or made unavailable. Normally, rumen bacteria produce all the B-complex vitamins needed by the host animal. The diet of a grain-fed ruminant should provide excess thiamin, even if none were produced in the rumen, because thiamin is plentiful in grain. How then, can a ruminant become thiamin deficient?

Experimental Procedure

We created polioencephalomalacia in three lambs, using the experimental model mentioned. We used rumen fluid removed from the lambs in "artificial rumen" studies, added thiamin (1 mg) to 200 ml of rumen fluid, and removed samples every five minutes to see how much thiamin remained. Half of the thiamin had disappeared in 14 minutes. In rumen fluid taken from a steer with spontaneous PEM, thiamin half-life was nine minutes.

To find out if the thiamin disappeared because it was being bound inside rumen bacteria, we harvested the bacteria from the artifical rumen and broke them up with ultrasonic sound waves. No thiamin was released, so we proposed that the thiamin was destroyed by a bacterial enzyme, thiaminase.

Earlier studies had indicated that PEM occurred (on the experimental model) after animals were switched rapidly to a high level of readily fermentable energy. To examine adaptation to concentrates more closely, we started lambs on all alfalfa hay diets (1200 g per day) and then switched them to 1200 g per day of whole oats or ground milo by replacing 100, 200, or 600 g per day of the alfalfa with an equal amount of grain. Thus, some animals made the transition from all hay to all grain in 12 days, and others had only two days to adapt. We used ground milo because of its high amount of readily fermentable energy, and whole oats because it contributes less readily fermentable energy. We then measured rumen pH, thiamin, and thiaminase activity (the ability of rumen fluid to destroy thiamin).

Results and Discussion

The more rapidly the change was made from hay to grain, the more acid the rumen microbes produced. When the lambs were changed to oats or milo at 600 g per day, lactic acid acidosis occurred, and on the milo diet, thiaminase, was produced. Thus thiaminase occurred only when animals were changed to grain rapidly, and then in conjunction with lactic acid acidosis.

As grain in the diets increased, the amount of thiamin in the rumen fluid decreased; there was no thiaminase activity (added thiamin was not destroyed), so less thiamin was being produced by the rumen microbes. Grains are higher in thiamin than alfalfa is, so we expected thiamin in the rumen fluid to increase with increasing grain.

Chemically, the vitamin, thiamin, is composed of two rings. One type of thiaminase destroys thiamin by simply spliting it into its two chemical rings. The other, more dangerous thiaminase, can substitute several nitrogen-containing rings for one of thiamin's rings, creating a new compound called pyrithiamin. Pyrithiamin is particularly dangerous to the animal. For thiamin to be used in the cells, it must be phosphorylated (by an enzyme) to thiamin pyrophosphate (TPP). Pyrithiamin blocks the phosphorylating enzyme. Thus, when the "substituting" type of thiaminase is present, less thiamin is available, and what is available cannot be phosphorylated, so it is not useful to the central nervous system cells. Pyrithiamin has special affinity for brain, heart, and kidney tissues where it exhibits its blocking phenomenon.

Our artificial rumen studies on rumen fluids known to contain thiaminase have shown that as thiamin disappears, pyrithiamin accumulates. So, the thiaminase in the rumen during PEM is the more dangerous variety.

Lactic acid acidosis and PEM both occur most often on high grain diets. Our early studies indicated that both occurred simultaneously.

Our early work showed that PEM often occurred about two weeks after an increase in ration concentrate--the type of change that leads to acidosis. Other workers have shown that when the rumen becomes acidotic, histamine is often produced. We believe that histamine may be the key to the PEM-acidosis relationship. Because histamine is a nitrogen-containing chemical ring, it might lead to pyrithiamin production.

Cattle with PEM will respond to large doses of thiamin, if they are treated early enough. A 600-lb. feeder calf with PEM needs about 600 mg thiamin hydrochloride intravenously (for immediate effect) and another 600 mg intramuscularly (for longer lasting effect). Give another 600 mg of thiamin intramuscularly daily for about three days to guard against a relapse when the first thiamin is used. Change the animals back to a higher roughage ration to relieve any lactic acid acidosis that might be present. Animals should start to recover from the PEM within one or two hours. However, the damage may be permanent so the animal dies or is permanently impaired, if found too late.

If, as we suspect, PEM is related to lactic acid acidosis, gradual ration changes should help in preventing it because lactic acid acidosis then would not develop.

Feeding thiamin, at the levels required to prevent PEM, probably is not feasible. Our work with sheep indicates that cattle would require as much as one gm per day. Injecting the high levels of thiamin probably "floods the system" and allows thiamin phosphorylation even when pyrithiamine is present.

Cattle feeders should keep injectable thiamin solution on hand, because PEM must be treated immediately to prevent death or permanent damage.

Performance and Carcass Characteristics of Three Groups of Crossbred Steers Fed to the Same Energy Efficiency Endpoint

R. J. Lipsey, M. E. Dikeman, and J. G. Riley

Summary

Sixteen Maine Anjou and 16 Gelbvieh steer calves from Angus or Hereford crossbred dams, and 16 Hereford X Angus crossbred steers were fed the same ration in individual pens until they reached a weekly energy efficiency endpoint of 10.3 lb. of feed per pound of gain above their maintenance requirements.

Both the Gelbvieh and the Maine Anjou crosses were fed an average of 70 days longer, weighed 200 lb. more at slaughter, and gained 0.3 lb. per day more than Hereford X Angus crossbred steers. The Hereford X Angus carcasses averaged 0.1 inch more fat at the 12th rib and 0.5 poorer U.S.D.A. yield grade. The average U.S.D.A. Quality Grade was highest for the Maine Anjou crosses, lowest for Gelbvieh crosses and intermediate for Hereford X Angus crosses.

Introduction

More energy is required to produce tissue weight gain if the gain includes a large proportion of fat rather than a large proportion of muscle. As an animal grows, the percentage of gain taken up by fat increases, so more energy is required per pound of gain.

This report is only preliminary. Few conclusions can be drawn until more statistics are available.

We measured the feed intake of 3 groups of cattle individually and each week calculated the average energy each steer had used to gain one pound of body weight. When the steers reached a predetermined energy efficiency endpoint, they were slaughtered at the KSU Meat Laboratory and the carcasses were analyzed for percentages of muscle, fat and bone, and quality grades and yield grades were determined.

Experimental Procedure

December 1, 1973, we obtained 16 Maine Anjou and 16 Gelbvieh steer calves from Angus or Hereford crossbred dams, and 16 Hereford X Angus steers of common environmental background. They were born in March and April, 1973, and purchased from the U. S. Meat Animal Research Center, Clay Center, Nebraska. They were group fed by breed until March 21, 1974, when they were randomly assigned to individual feeding pens. Daily feed records were kept so that by ration analyses and weekly weighing, we could calculate the available energy to each steer above his energy required for maintenance. The finishing ration was 30% corn silage, 41% milo, 25% corn and 4% protein-mineral supplement on an as-fed basis. When a steer's weekly feed efficiency exceeded 10.3 lb. of feed per pound of gain above his maintenance requirements, he was slaughtered. After the carcass was chilled two days, carcass data were collected, and the right side round was separated into lean, fat and bone.

Results and Discussion

Because the data are only preliminary, we caution against steadfast conclusions; however, the Maine Anjou and Gelbvieh sired steers apparently used energy above maintenance more efficiently when nearly 200 pounds heavier than the Hereford X Angus crosses. The Maine Anjou and Gelbvieh steers also had more than 0.3 lb. advantage in A.D.G. even though they were on feed more than 70 days longer.

The Hereford X Angus steers showed no advantage in quality grade over the average of the Maine Anjou and Gelbvieh sired steers, although they averaged 0.1 inch more external fat at the 12th rib. Yield grade of Hereford X Angus steers was 0.5 poorer than Maine Anjou and Gelbvieh crosses when slaughtered at the same energy efficiency endpoint above maintenance.

Other information we hope to obtain from this project is testing whether or not cattle at the same point of efficiency in energy used above maintenance are at the same physiological maturity. At the same physiological maturity, they should have the same carcass percentages of bone, fat and muscle. We also plan to analyze the economics of feeding the three breed types to the same efficiency endpoint. That will include the growing period after weaning as well as the finishing phase.

Table 20.1. Breed Averages for Performance of Steers Fed Individually March 21 to Slaughter.

Breed	Initial wt., lb.	Final wt., lb.	Days on feed	A.D.G., lb.
Hereford X Angus	827	1113	122	2.33
Maine Anjou crosses	803	1319	196	2.64
Gelbvieh crosses	772	1306	199	2.69

Table 20.2. Breed Averages for Carcass Fat, Yield Grade, and Quality Grade.

Breed	Adjusted fat thickness, in.	U.S.D.A. yield grade	U.S.D.A. quality grade[a]
Hereford X Angus	0.64	4.0	11.6
Maine Anjou crosses	0.53	3.4	12.1
Gelbvieh crosses	0.53	3.4	11.3

[a] 11 = high good, 12 = low choice, 13 = average choice, etc.

Performance and Carcass Characteristics of Different Cattle Types

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Summary

Different cattle types were evaluated for growth, feed efficiency, and carcass and meat traits. Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais sires were bred artificially to Angus and Hereford dams to obtain different cattle types. Three calf crops were born in March, April, and May of 1970, 1971, and 1972 and were weaned when 200 days old. All male calves (1,123) were castrated, fed out and slaughtered in a commercial slaughter plant. Carcass cooler data were obtained and the right side transported to Kansas State University for detailed cut-out and meat quality evaluations.

Jersey crosses, a small early-maturing type, had the poorest feedlot performance of all breed types. They were similar to the Angus x Hereford and Hereford x Angus controls in U.S.D.A. quality and yield grades, in retail percentages and meat palatability traits. Simmental and Charolais crosses, a large type, were superior to controls in feedlot performance, yield grade, and retail percentages. They were lower in quality grade and had steaks slightly less desirable in palatability than controls.

Limousin crosses surpassed controls in feed efficiency, final weight, yield grade and retail percentages. They were equal in A.D.G. and had a definitely lower quality grade and meat palatability than controls. South Devon crosses surpassed controls in A.D.G. and final weight, were slightly higher in cutability and retail product percentages but were equal in feed efficiency, quality grade and palatability.

Introduction

Three years results from the U.S. Meat Animal Research Center's "cattle germ plasm evaluation program" are reported here. Dr. Keith Gregory, director of the U.S. Meat Animal Research Center at Clay Center, Nebraska, initiated the project. Kansas State University and the Standardization Branch, A.M.S., U.S.D.A. are cooperating on the carcass and meat aspects of the study.

The project was designed to characterize breeds from different cattle types regarding economic traits that relate to reproduction, maternal ability, growth, feed efficiency, and carcass and meat characteristics.

Calving ease and preweaning growth data on all three calf crops were presented in the 1973 Cattlemen's Day report. Preliminary data on post weaning growth, feed efficiency, and carcass and meat traits from two calf crops were presented in the 1972 and 1973 Cattlemen's Day reports. Performance and carcass characteristics from the three year study are reported here.

Data on reproduction and maternal traits of the female progeny in this study were also obtained. In addition, calving difficulty results of artificially mating Hereford, Angus, Red Poll, Maine Anjou, Brown Swiss, Gelbvieh and Chianina sires to Hereford and Angus cows were obtained. This information can be obtained by writing for:

Report 1, March 1974
Germ Plasm Evaluation Program
U.S. Meat Animal Research Center
Clay Center, Nebraska 68933

Experimental Procedure

Hereford and Angus females were artificially bred to Hereford, Angus, Jersey, South Devon, Limousin, Simmental and Charolais bulls. The three calf crops were born in March, April and May of 1970, 1971 and 1972 and were weaned when approximately 200 days old. All male calves (1,123) were castrated, fed in a feedlot by breed of sire groups to obtain growth and feed efficiency data. The steers were fed a corn silage-and-concentrate ration that approximated 70-72% TDN most of the feeding period. Final slaughter weights were adjusted for 200-day adjusted weaning weights. Feed efficiency for each breed group was obtained by dividing the cumulative average daily TDN consumed per steer by average daily gain.

Approximately one-third of the steers in each sire breed-by-dam breed group were slaughtered at each of three slaughter times that averaged 212, 247 and 279 days on feed after weaning. Steers slaughtered at each of the three times had approximately the same average birth date but varied in age about 80 days within slaughter groups.

Steers were transported to a commercial slaughter plant approximately 12 hours before slaughter. Carcass data were obtained after a 24-hour chill. Carcasses were evaluated for conformation, maturity, marbling, color, texture, firmness and USDA quality grade by representatives of the U.S. Meat Animal Research Center; Standardization Branch, A.M.S., U.S.D.A.; and Kansas State University. Longissimus muscle area, external fat thickness and U.S.D.A. yield grade were determined.

The right side of each carcass was transported to Kansas State University for detailed cutout and meat quality evaluations. Each side was separated into essentially boneless, closely trimmed retail cuts. Steaks were cooked at 350°F to an internal temperature of 150°F and evaluated for tenderness, flavor, juiciness and overall acceptability by an experienced taste panel of six members and for tenderness by the Warner-Bratzler shear.

Results and Discussion

Postweaning A.D.G., final weight and feed efficiency data are in table 21.1. Simmental and Charolais crossbred steers gained 0.23 lb. per day (average) more than Angus x Hereford or Hereford x Angus crossbred steers (controls); South Devon crosses 0.12 lb. per day more than controls;

Limousin crosses equalled the controls. As expected, Jersey crosses gained the least (0.16 lb. less than controls). Steers from Hereford dams gained 0.10 lb. per day more than steers from Angus dams.

Superior feedlot gains and weaning weights gave Simmental and Charolais crosses considerably higher final weight ratios than controls. South Devon crosses had a 2.5% higher ratio than controls; Limousin crosses, because of their heavier weaning weights, had a 1.5% higher ratio than controls. Again Jerseys were lowest in final weight ratio, and straightbred Angus and Hereford steers were 2.6% lower in ratio than controls.

Charolais, Simmental, and Limousin crosses and even straightbred Angus steers used feed more efficiently than the controls. Limousin crosses had a slight advantage over all types, apparently because they were depositing less fat. However, it is difficult to explain why straightbred Angus and Hereford steers were identical in efficiency to Simmental and Charolais crosses. Jersey crosses used feed least efficiently.

Dressing percentages and U.S.D.A. quality grades are in table 21.2. Differences in dressing percentages were small although Simmental and Jersey crosses tended to be lowest. Straightbred steers, controls, Jersey crosses and South Devon crosses were essentially equal in quality grades; 68% graded low Choice or higher. Limousin crosses had the lowest quality grades; only 32% graded low Choice or higher; 58% of the Charolais crosses and 51% of the Simmental crosses graded low Choice or higher; 67% of steers from Angus dams graded at least low Choice, while 48% of steers from Hereford dams graded at least low Choice.

Limousin, Simmental and Charolais crosses were similar in yield grades, rib eye areas, and fat thicknesses and were superior in those traits to the other breeds (table 21.3).

Cutability and retail product percentages in table 21.4 were higher for Charolais and Limousin crosses, followed closely by Simmental crosses. The Jersey crosses were equal to the controls in product percentages, while South Devon crosses and straightbred Angus and Herefords had slightly higher product percentages.

Bone percentage differences were small among breeds. Fat trim percentages were inversely related to both cutability and retail product percentages. Charolais, Simmental and Limousin crosses had lower percentages of fat trim than all other breeds.

Warner-Bratzler shear values in table 21.5 suggest that all breeds had steaks with desirable tenderness despite some differences among breeds. Jersey and South Devon crosses had steaks somewhat more tender than the other breeds, while Limousin and Simmental crosses had steaks less tender than other breeds. However, the taste panel only detected minor differences in palatability. Steaks from all breeds were evaluated as "moderately" desirable in palatability.

Table 21.1. Postweaning Average Daily Gains, Adjusted Final Weights and Feed Efficiencies, 1970-71-72 Calf Crops.

		No. steers[a]				Postweaning average daily gain[b]				Adjusted final weight[c]					Feed efficiency[d]			
Breed of sire	Breed of dam	212	247	279	Total	212	247	279	Avg.	212	247	279	Avg.	Ratio[e]	212	247	279	Avg.
Hereford	Hereford	23	24	22	69	2.42	2.30	2.28	2.33	955	1005	1090	1017	97.6				
Angus	Angus	28	28	29	85	2.35	2.26	2.15	2.25	952	1030	1057	1013	97.2				
	Average	51	52	51	154	2.38	2.28	2.21	2.29	954	1018	1074	1015	97.4	6.17	6.74	6.97	6.63
Angus	Hereford	31	34	32	97	2.42	2.42	2.35	2.39	961	1060	1125	1049	100.7				
Hereford	Angus	39	37	38	114	2.35	2.30	2.24	2.29	960	1048	1096	1035	99.3				
	Average	70	71	70	211	2.38	2.36	2.29	2.34	961	1054	1110	1042	100.0	6.34	6.81	7.09	6.75
Jersey	Hereford	17	18	18	53	2.41	2.14	2.17	2.24	938	975	1068	994	95.4				
	Angus	27	27	27	81	2.21	2.13	2.05	2.13	929	979	1030	979	93.9				
	Average	44	45	45	134	2.31	2.13	2.11	2.18	934	977	1049	986	94.6	6.64	7.21	7.37	7.07
South Devon	Hereford	14	16	14	44	2.51	2.49	2.40	2.47	977	1068	1128	1057	101.4				
	Angus	16	17	17	50	2.55	2.50	2.29	2.45	1013	1091	1129	1078	103.5				
	Average	30	33	31	94	2.53	2.49	2.34	2.46	995	1080	1128	1068	102.5	6.30	6.83	7.06	6.73
Limousin	Hereford	28	28	29	86	2.36	2.41	2.28	2.35	992	1070	1093	1052	101.0				
	Angus	30	30	29	89	2.29	2.35	2.25	2.30	987	1082	1121	1063	102.0				
	Average	59	58	58	175	2.32	2.38	2.27	2.32	990	1076	1107	1058	101.5	6.19	6.56	6.93	6.56
Simmental	Hereford	27	29	26	82	2.70	2.63	2.62	2.65	1047	1135	1213	1132	108.6				
	Angus	30	32	33	95	2.43	2.45	2.48	2.46	1023	1111	1201	1112	106.7				
	Average	57	61	59	177	2.57	2.54	2.55	2.55	1035	1123	1207	1122	107.7	6.23	6.69	6.91	6.61
Charolais	Hereford	25	27	26	78	2.81	2.61	2.60	2.67	1074	1128	1189	1131	108.5				
	Angus	32	34	34	100	2.57	2.47	2.47	2.50	1066	1113	1206	1128	108.2				
	Average	57	61	60	178	2.69	2.54	2.53	2.59	1070	1121	1197	1129	108.3	6.31	6.74	6.80	6.62
Average all sire breeds	Hereford	166	176	167	509	2.52	2.43	2.38	2.44	992	1063	1129	1061	101.8				
	Angus	202	205	207	614	2.39	2.35	2.28	2.34	990	1065	1120	1058	101.5				
	Average	368	381	374	1123	2.46	2.39	2.33	2.39	991	1064	1125	1060	101.7	6.31	6.80	7.02	6.71

[a]Number of steers slaughtered for the 3 years after an average of 212, 247, and 279 days on feed.
[b]ADG = (actual final wt. - actual weaning wt.) ÷ days on feed, adjusted for year and to a mature age of dam bases.
[c]Adj. final wt. = 200-day wt. + (postwn. A.D.G. x days on feed postwn.), adj. for year and to a mature age of dam bases.
[d]TDN efficiency = lb. TDN consumed per lb. gain.
[e]Ratio computed relative to the average 1042 lb. Angus x Hereford and Herford x Angus controls.

Table 21.2. Hot Carcass Weights, Dressing Percentages, U.S.D.A. Quality Grades, and Marbling Scores[a], 1970-71-72 Calf Crops.

Breed of sire	Breed of Dam	Hot carcass wt., lb.				Dressing percent				U.S.D.A. quality grade[b]				Marbling score[c]			
		212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.
Hereford	Hereford	593	630	676	633	60.1	60.8	60.7	60.5	11.0	11.0	11.6	11.2	9.5	9.6	11.0	10.0
Angus	Angus	603	661	673	646	60.8	61.8	61.9	61.5	12.2	12.5	12.7	12.5	12.5	12.7	14.5	13.2
	Average	598	646	675	639	60.4	61.3	61.3	61.0	11.6	11.7	12.2	11.8	11.0	11.1	12.7	11.6
Angus	Hereford	598	664	711	657	60.1	61.3	61.9	61.1	11.7	12.0	12.3	12.0	11.0	12.0	13.4	12.1
Hereford	Angus	607	668	706	661	60.6	61.5	62.0	61.4	11.6	11.8	11.8	11.7	11.2	11.2	11.8	11.4
	Average	602	666	709	659	60.4	61.4	61.9	61.2	11.6	11.9	12.0	11.9	11.1	11.6	12.6	11.8
Jersey	Hereford	576	601	662	613	59.0	59.6	60.4	59.7	10.9	11.2	11.8	11.3	11.3	12.4	14.5	12.7
	Angus	585	617	647	617	60.4	60.1	60.3	60.3	11.8	12.3	12.2	12.1	14.2	14.2	15.6	14.7
	Average	580	609	654	6 5	59.7	59.9	60.3	60.0	11.3	11.7	12.0	11.7	12.7	13.3	15.0	13.7
South Devon	Hereford	603	669	715	663	60.5	61.4	61.9	61.3	11.2	11.4	11.9	11.5	10.3	10.4	12.4	11.0
	Angus	642	701	714	686	61.4	62.5	61.9	61.9	11.9	12.3	12.1	12.1	11.8	12.3	13.2	12.4
	Average	623	685	714	674	61.0	61.9	61.9	61.6	11.6	11.8	12.0	11.8	11.0	11.4	12.8	11.7
Limousin	Hereford	611	669	674	652	61.0	61.7	61.3	61.3	10.2	10.4	11.0	10.5	8.1	8.4	9.7	8.7
	Angus	620	685	707	670	61.6	62.3	62.2	62.0	10.8	10.8	11.1	10.9	9.4	9.4	10.3	9.7
	Average	615	677	690	661	61.3	62.0	61.7	61.7	10.5	10.6	11.0	10.7	8.7	8.9	10.0	9.2
Simmental	Hereford	638	696	740	691	59.5	60.3	60.2	60.0	10.8	11.0	10.8	10.9	9.8	9.4	9.6	9.6
	Angus	643	695	746	695	60.7	60.8	61.1	60.9	11.3	11.3	11.6	11.4	10.8	10.3	11.8	11.0
	Average	640	696	743	693	60.1	60.6	60.7	60.4	11.1	11.1	11.2	11.1	10.3	9.8	10.7	10.3
Charolais	Hereford	668	700	753	707	60.9	60.5	61.1	60.8	10.5	10.9	11.8	11.0	8.8	9.3	12.2	10.1
	Angus	672	710	768	717	60.9	61.9	62.1	61.7	11.4	11.9	12.1	11.8	10.7	11.5	12.7	11.6
	Average	670	705	760	712	60.9	61.2	61.6	61.2	10.9	11.4	11.9	11.4	9.7	10.4	12.4	10.9
Average all sire breeds	Hereford	613	661	704	659	60.1	60.8	61.1	60.7	10.9	11.1	11.6	11.2	9.8	10.2	11.8	10.6
	Angus	625	677	709	670	60.9	61.6	61.6	61.4	11.6	11.8	12.0	11.8	11.5	11.7	12.8	12.0
	Average	619	669	707	665	60.5	61.2	61.4	61.0	11.2	11.5	11.8	11.5	10.7	10.9	12.3	11.3

[a]Data for all traits are adjusted for year and to a mature age of dam bases.

[b]U.S.D.A. quality grade: 10 = average good, 11 = high good, 12 = low choice, 13 = average choice, etc.

[c]Marbling score: 9 = slight$^+$, 10 = small$^-$, ... 21 = slightly abundant$^+$.

Table 21.3. U.S.D.A. Yield Grades, Ribeye Areas, Fat Thicknesses, and Percentages of Kidney, Pelvic and Heart Fat, 1970-71-72 Calf Crops.

Breed of sire	Breed of dam	U.S.D.A. yield grade 212	247	279	Avg.	Ribeye area, sq. in. 212	247	279	Avg.	Fat thickness, in. 212	247	279	Avg.	Estimated percent kidney, pelvic and heart fat 212	247	279	Avg.
Hereford	Hereford	3.0	3.1	3.5	3.2	10.7	11.5	11.4	11.2	.44	.58	.60	.53	2.4	2.5	2.6	2.5
Angus	Angus	3.4	3.6	3.7	3.6	10.9	11.6	11.6	11.4	.60	.69	.77	.68	3.3	3.4	3.0	3.2
	Average	3.2	3.4	3.6	3.4	10.8	11.5	11.5	11.3	.52	.63	.68	.61	2.8	2.9	2.8	2.9
Angus	Hereford	3.1	3.5	3.7	3.5	11.2	11.6	12.0	11.6	.53	.67	.74	.65	3.0	3.1	2.8	2.9
Hereford	Angus	3.2	3.7	3.9	3.6	11.2	11.3	11.9	11.5	.57	.70	.80	.69	2.8	2.9	3.0	2.9
	Average	3.2	3.6	3.8	3.5	11.2	11.4	12.0	11.5	.56	.68	.77	.67	2.9	3.0	2.9	2.9
Jersey	Hereford	3.1	3.3	3.7	3.4	10.9	10.9	11.4	11.0	.30	.40	.54	.41	4.7	4.7	4.9	4.8
	Angus	3.4	3.5	3.8	3.5	11.0	11.1	11.3	11.1	.51	.50	.59	.53	4.6	4.8	5.0	4.8
	Average	3.2	3.4	3.7	3.5	10.9	11.0	11.3	11.1	.41	.45	.56	.47	4.6	4.8	4.9	4.8
South Devon	Hereford	2.9	3.2	3.7	3.3	11.7	11.8	11.7	11.7	.41	.50	.55	.48	3.6	3.4	3.5	3.5
	Angus	2.9	3.3	3.5	3.2	12.1	12.4	12.4	12.3	.45	.54	.64	.54	3.3	3.7	3.8	3.6
	Average	2.9	3.3	3.6	3.3	11.9	12.1	12.0	12.0	.43	.51	.59	.51	3.5	3.5	3.6	3.5
Limousin	Hereford	2.2	2.4	2.8	2.4	12.5	13.3	12.7	12.8	.34	.41	.48	.41	2.5	3.0	2.9	2.8
	Angus	2.2	2.8	2.8	2.6	12.8	12.9	13.4	13.0	.37	.45	.51	.44	2.9	3.3	3.2	3.1
	Average	2.2	2.6	2.8	2.5	12.6	13.1	13.0	12.9	.35	.43	.50	.42	2.7	3.1	3.1	3.0
Simmental	Hereford	2.3	2.6	2.8	2.6	12.3	12.5	12.8	12.5	.32	.38	.44	.38	2.8	2.8	2.8	2.8
	Angus	2.6	2.9	3.2	2.9	12.3	12.6	12.7	12.5	.40	.44	.53	.46	3.2	3.4	3.4	3.3
	Average	2.5	2.7	3.0	2.7	12.3	12.6	12.7	12.5	.36	.41	.48	.42	3.0	3.1	3.1	3.1
Charolais	Hereford	2.4	2.4	2.7	2.5	12.5	13.0	13.1	12.9	.33	.35	.42	.36	2.8	2.7	2.8	2.8
	Angus	2.4	2.8	2.9	2.7	12.8	13.0	13.9	13.2	.36	.45	.52	.44	2.8	3.3	3.4	3.2
	Average	2.4	2.6	2.8	2.6	12.7	13.0	13.5	13.1	.34	.40	.47	.40	2.8	3.0	3.1	3.0
Average all sire breeds	Hereford	2.7	3.0	3.3	3.0	11.7	12.1	12.2	12.0	.38	.47	.54	.46	3.1	3.2	3.2	3.2
	Angus	2.9	3.2	3.4	3.2	11.9	12.1	12.4	12.1	.47	.54	.62	.54	3.3	3.5	3.6	3.5
	Average	2.8	3.1	3.3	3.1	11.8	12.1	12.3	12.1	.42	.50	.58	.50	3.2	3.3	3.4	3.3

[a]Data for all traits are adjusted for year and to a mature age of dam bases.

Table 21.4. Percentages of Cutability, Retail Product, Fat Trim, and Bone[a], 1970-71-72 Calf Crops.

Breed of sire	Breed of dam	Actual cutability, %[b]				Retail product, %[c]				Fat trim, %				Bone, %			
		212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.
Hereford Angus	Hereford	54.9	54.0	52.6	58.8	68.3	66.8	64.9	66.7	18.4	20.7	23.1	20.8	13.3	12.5	11.9	12.6
	Angus	53.6	51.4	51.4	52.1	67.5	64.9	64.0	65.5	20.3	23.8	24.9	23.0	12.2	11.3	11.1	11.6
	Average	54.2	52.7	52.0	53.0	67.9	65.8	64.5	66.1	19.4	22.2	24.0	21.9	12.8	11.9	11.5	12.1
Angus Hereford	Hereford	53.2	52.4	51.8	52.4	66.9	65.4	64.2	65.5	20.5	22.7	24.2	22.5	12.6	11.9	11.6	12.1
	Angus	53.2	51.4	51.1	51.9	66.7	64.2	63.4	64.8	20.9	24.1	25.6	23.5	12.4	11.6	11.0	11.7
	Average	53.2	51.9	51.4	52.2	66.8	64.8	63.8	65.1	20.7	23.4	24.9	23.0	12.5	11.8	11.3	11.9
Jersey	Hereford	53.6	52.2	51.7	52.5	67.1	65.1	64.0	65.4	19.6	22.2	23.8	21.9	13.2	12.7	12.2	12.7
	Angus	52.1	51.4	51.0	51.5	65.9	64.6	63.6	64.7	22.0	23.5	24.7	23.4	12.1	11.9	11.7	11.9
	Average	52.8	51.8	51.4	52.0	66.5	64.8	63.8	65.1	20.8	22.9	24.2	22.6	12.7	12.3	12.0	12.3
South Devon	Hereford	53.9	53.2	52.1	53.1	67.3	66.6	64.3	66.0	19.6	20.9	23.8	21.5	13.1	12.5	11.9	12.5
	Angus	54.2	52.8	52.1	53.1	68.0	66.3	64.9	66.4	19.5	21.9	23.5	21.6	12.5	11.9	11.6	12.0
	Average	54.0	53.0	52.1	53.1	67.6	66.4	64.6	66.2	19.6	21.4	23.6	21.5	12.8	12.2	11.8	12.3
Limousin	Hereford	58.6	56.3	55.7	56.9	71.8	69.7	68.3	70.0	14.6	17.7	19.3	17.2	13.6	12.6	12.4	12.9
	Angus	57.9	56.0	55.5	56.5	71.5	69.4	68.2	69.7	15.3	18.5	19.8	17.9	13.1	12.1	11.9	12.4
	Average	58.2	56.2	55.6	56.7	71.6	69.6	68.3	69.8	15.0	18.1	19.5	17.5	13.4	12.3	12.2	12.6
Simmental	Hereford	56.7	55.5	55.2	55.8	70.2	68.6	67.9	68.9	15.4	17.8	18.8	17.4	14.3	13.6	13.3	13.7
	Angus	55.4	54.8	54.1	54.8	68.9	68.0	66.9	67.9	17.6	19.1	20.5	19.1	13.4	12.8	12.6	12.9
	Average	56.1	55.2	54.7	55.3	69.6	68.3	67.4	68.4	16.5	18.5	19.7	18.2	13.9	13.2	12.9	13.3
Charolais	Hereford	57.1	56.7	56.3	56.7	70.8	69.9	68.9	69.9	15.7	16.9	18.1	16.9	13.5	13.2	13.0	13.2
	Angus	56.4	55.3	54.7	55.5	70.0	68.7	67.5	68.7	16.6	18.9	20.5	18.7	13.3	12.4	12.1	12.6
	Average	56.8	56.0	55.5	56.1	70.4	69.3	68.2	69.3	16.2	17.9	19.3	17.8	13.4	12.8	12.5	12.9
Average all sire breeds	Hereford	55.4	54.3	53.6	54.5	68.9	67.4	66.1	67.5	17.7	19.9	21.6	19.7	13.4	12.7	12.3	12.8
	Angus	54.7	53.3	52.8	53.6	68.4	66.6	65.5	66.8	18.9	21.4	22.8	21.0	12.7	12.0	11.7	12.2
	Average	55.1	53.8	53.2	54.0	68.6	67.0	65.8	67.1	18.3	20.6	22.2	20.4	13.1	12.4	12.0	12.5

[a]Data for all traits are adjusted for year and mature age of dam.

[b]Actual cutability, % = Acutal yield of boneless, closely trimmed beef from the round, loin, rib, and chuck.

[c]Retail product, % = Actual yield of boneless, closely trimmed beef from the carcass.

Table 21.5. Warner-Bratzler Shear and Taste Panel Evalautions of Cooked Steaks, 1970-71-72 Calf Crops.

Breed of sire	Breed of dam	Warner-Bratzler shear, lb.[a]				Taste panel tenderness[b]				Taste panel flavor[b]				Taste panel juiciness[b]				Taste panel acceptability[b]			
		212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.	212	247	279	Avg.
Hereford Angus	Hereford	7.0	6.6	7.2	6.9	7.6	7.3	7.4	7.4	7.5	7.4	7.4	7.4	7.1	6.8	7.0	7.0	7.3	7.2	7.3	7.3
	Angus	7.1	7.0	7.0	7.0	7.5	7.2	7.4	7.4	7.7	7.4	7.5	7.5	7.1	7.1	7.1	7.1	7.4	7.2	7.3	7.3
	Average	7.0	6.8	7.1	7.0	7.5	7.3	7.4	7.4	7.6	7.4	7.4	7.5	7.1	7.0	7.0	7.0	7.4	7.2	7.3	7.3
Angus Hereford	Hereford	6.8	7.1	6.7	6.8	7.6	7.8	7.4	7.6	7.5	7.5	7.4	7.5	7.2	7.2	6.9	7.1	7.4	7.5	7.2	7.4
	Angus	7.9	7.1	7.3	7.4	7.3	7.3	7.6	7.4	7.3	7.3	7.7	7.4	7.1	6.8	7.3	7.1	7.2	7.2	7.5	7.3
	Average	7.3	7.1	7.0	7.1	7.5	7.5	7.5	7.5	7.4	7.4	7.5	7.5	7.2	7.0	7.1	7.1	7.3	7.3	7.3	7.3
Jersey	Hereford	7.0	6.7	6.7	6.8	7.4	7.7	7.8	7.6	7.7	7.6	7.6	7.6	7.3	7.0	7.5	7.3	7.5	7.5	7.5	7.5
	Angus	6.6	6.1	6.6	6.5	7.6	7.8	7.4	7.6	7.6	7.5	7.6	7.6	7.4	7.3	7.4	7.4	7.4	7.5	7.4	7.4
	Average	6.8	6.4	6.6	6.6	7.5	7.8	7.6	7.6	7.6	7.5	7.6	7.6	7.4	7.2	7.5	7.3	7.4	7.5	7.5	7.5
South Devon	Hereford	6.8	6.8	6.8	6.8	7.6	7.4	7.4	7.5	7.5	7.6	7.2	7.4	7.0	7.1	7.2	7.1	7.4	7.4	7.2	7.3
	Angus	6.5	6.5	6.2	6.4	7.8	7.7	7.7	7.7	7.5	7.4	7.6	7.5	7.5	7.2	7.2	7.3	7.4	7.4	7.5	7.4
	Average	6.7	6.6	6.5	6.6	7.7	7.5	7.5	7.6	7.5	7.5	7.4	7.5	7.2	7.1	7.2	7.2	7.4	7.4	7.4	7.4
Limousin	Hereford	7.4	7.5	7.6	7.5	7.2	6.7	7.2	7.0	7.5	7.4	7.6	7.5	7.3	6.8	7.2	7.1	7.3	6.8	7.2	7.1
	Angus	7.4	7.5	7.7	7.5	7.7	7.1	7.1	7.3	7.5	7.4	7.5	7.5	7.1	6.9	6.9	7.0	7.4	7.1	7.2	7.2
	Average	7.4	7.5	7.6	7.5	7.4	6.9	7.1	7.2	7.5	7.4	7.5	7.5	7.2	6.9	7.0	7.0	7.3	6.9	7.2	7.2
Simmental	Hereford	7.9	7.7	7.5	7.7	6.6	7.0	6.7	6.7	7.2	7.5	7.4	7.4	7.1	6.7	6.9	6.9	6.8	7.0	6.9	6.9
	Angus	7.8	7.3	7.4	7.5	7.5	7.3	7.0	7.3	7.6	7.6	7.4	7.6	7.2	7.4	7.1	7.2	7.4	7.4	7.0	7.3
	Average	7.8	7.5	7.5	7.6	7.0	7.1	6.8	7.0	7.4	7.6	7.4	7.5	7.1	7.1	7.0	7.1	7.1	7.2	7.0	7.1
Charolais	Hereford	7.0	7.4	7.2	7.2	7.4	7.2	7.3	7.3	7.4	7.4	7.6	7.5	7.1	6.9	7.3	7.1	7.2	7.3	7.4	7.3
	Angus	6.9	6.6	7.0	6.8	7.7	7.4	7.6	7.6	7.5	7.5	7.7	7.6	7.2	6.9	7.1	7.1	7.4	7.3	7.5	7.4
	Average	6.9	7.0	7.1	7.0	7.5	7.3	7.5	7.4	7.5	7.5	7.7	7.5	7.1	6.9	7.2	7.1	7.3	7.3	7.4	7.3
Average all sire breeds	Hereford	7.1	7.1	7.1	7.1	7.3	7.3	7.3	7.3	7.5	7.5	7.5	7.5	7.2	6.9	7.1	7.1	7.3	7.2	7.2	7.2
	Angus	7.2	6.9	7.0	7.0	7.6	7.4	7.4	7.5	7.5	7.4	7.6	7.5	7.2	7.1	7.1	7.1	7.4	7.3	7.4	7.3
	Average	7.2	7.0	7.1	7.1	7.5	7.3	7.3	7.4	7.5	7.5	7.5	7.5	7.2	7.0	7.1	7.1	7.3	7.3	7.3	7.3

[a]Pounds of force required to shear one-half inch cores of steaks cooked at 350°F to 150°F internal temperature (obtained on steaks from all 1123 steers).

[b]Taste panel scores are based on a 9-point scale, with higher scores indicating greater acceptability. Taste panel steaks from 4 steers per sirexdam breed group, per slaughter date, per year (496 steers).

Short-fed, Grass-fed, and Long-fed Beef Compared

D. H. Kropf, D. M. Allen, and G. J. Thouvenelle

Summary

Thirty carcasses, ten each from three groups - short-fed concentrate rations for about 70 days, grass-fed on Flint Hill pasture without supplemental feeding until slaughter in mid-to-late October, and long-fed concentrate rations at least 150 days - were used for taste-panel and display-color comparisons.

Carcasses from long-fed cattle were heavier, fatter, had more marbling, graded higher on quality, and had a higher yield grade (fatter). Carcasses from grass-fed beef graded lowest (five Standards and five Goods). Carcasses from short-fed beef were intermediate between long-fed and grass-fed in all measurements recorded. Carcasses of grass-fed beef had less finish than other carcasses but did not differ in yield grade from short-fed cattle carcasses.

Steaks from long-fed beef had the most desirable color after cutting and also after three days of retail display. Those from short-fed cattle were intermediate, and those from grass-fed beef were darkest, unacceptably so after three days of display. Fat on T-bone steaks from grass-fed beef was yellowest.

Cooking losses were highest from steaks from grass-fed beef. Taste panelists scored flavor, tenderness, and over-all acceptablity highest for long-fed, intermediate for short-fed, and lowest for grass-fed beef steaks. Shear force supported taste panel evaluations for tenderness. Tenderness was unacceptably low for steaks from one long-fed, four short-fed, and seven grass-fed carcasses. Long-fed beef steaks were juicier but taste-panel juiciness score did not differ between short-fed and grass-fed beef steaks.

Introduction

Current high prices of feed grains suggest production of beef with less concentrate feed and more roughage, including grass pasture. However, in addition to economical beef production, we must be concerned with such product display characteristics as shelf life and color and also with consumer acceptance. Those three factors greatly influence both initial and repeat sales. This study compared short-fed, grass-fed and long-fed beef by carcass quality and yield grade, fresh display-case appearance, cooking losses, cooked product flavor, juiciness, tenderness, and acceptance.

Experimental Procedure

Short-fed cattle of known background that had been fed largely concentrate rations for about 70 days were obtained from a commercial beef slaughter plant. Grass-fed cattle that had been kept on Flint Hill pasture without supplemental concentrate feeding were obtained near the end of the 1974 grass season (mid-to-late October). Long-fed cattle were obtained from a feeding trial at the KSU Beef Research Center. They had been on feed at least 150 days. Ten cattle were used from each group.

Cattle were slaughtered after fasting overnight (16 to 18 hours). After a 24- to 48-hour chill, carcasses were ribbed and grade information was obtained (table 22.1).

A wholesale loin was cut from each carcass and shipped to the KSU Meat Laboratory. Loins were cut with a power meat saw into one-inch thick steaks at about four days post slaughter.

Steaks that were tested in display cases were removed from each loin over the fourth lumbar vertebra; bone dust was removed, the steaks were placed in styrofoam meat trays and overwrapped with polyvinyl chloride film. It is the film used by most fresh meat, self-service retailers.

One steak (boneless loin strip) was displayed three days; another five days before they were cooked and evaluated by a taste panel.

Two similar freshly cut muscles from the third lumbar vertebra from each loin were cooked without being displayed (Day 0). One was used for taste-panel evaluation and another for shear-force evaluation.

All steaks were modified broiled in a 350°F rotary oven to an internal temperature of 151°F. Weights to the nearest 0.01 gram were taken before and after cooking, to calculate cooking losses.

For taste panel evaluation, 0.5 inch cores of cooked longissimus muscle were obtained after cooling at least ten minutes. Samples contained no subcutaneous fat, heavy seams of marbling, or connective tissue. Panelists received samples from 6 different loins in random order and scored each for desirability of flavor, juiciness, tenderness and over-all acceptability. Each sample was scored by six experienced panelists.

Six ½-inch cores were removed from one steak from each carcass that was cooked the same day the loins were cut. After cooking and cooling they were subjected to Warner-Bratzler shear-force tests. Shear-force was determined to the nearest 0.1 pound.

Visual color was evaluated on three muscles as steaks went on display test and after three days of display at about 32°F under 100-foot candles of Delux Warm White lighting. Display was continuous, i.e., 24 hours a day. Color was evaluated on longissimus (loin or rib eye) muscle and psoas major (tenderloin) muscle of the T-bone from which the longissimus would be removed for taste panel evaluation after 5 days of display. In addition, color was evaluated on gluteus medius, a muscle from the top sirloin steak.

Visual color was scored independently by four persons using the KSU Beef Color Standards to the nearest 0.5 point.

Anaylsis of variance was used with least significant difference to determine significance of differences between means.

Results and Discussion

Carcass Weights and Grades

Carcasses averaged 501, 532, and 615 pounds, respectively, for grass-fed, short-fed, and long-fed cattle (table 22.1).

Distribution of carcass quality grades for carcasses is given in table 22.1. Only one of ten short-fed beef carcasses graded Choice, but three more graded Good+ and all were Good or better. Carcasses from grass-fed cattle were equally divided between the Standard and Good grades and carcasses from long-fed beef were equally divided between Choice and Good, a lower than expected proportion of Choice.

Conformation score was highest for carcasses from the long-fed group (Choice+), lowest for those from grass-fed cattle (Good-) and intermediate for short-fed (Good+). This is partly due to influence of finish on conformation score.

Carcass maturity score for long-fed cattle suggested that they were younger than the other animals, possibly because their muscle color was brighter.

Marbling scores were highest for carcasses from long-fed cattle with an average of typical Small; scores from grass-fed beef averaged Traces-, which is customary for the top end of the Standard grade; marbling from the short-fed group averaged Slight+, typical of Average Good.

Fat averaged thickest for carcasses from long-fed cattle and thinnest from the grass-fed group, as expected. Rib-eye area was least for grass-fed cattle, a reflection of their lighter carcasses.

Kidney, pelvic, and heart fat percentages averaged 2.6 for short-fed, 2.3 for grass-fed, and 3.4 for long-fed groups.

Yield grades did not differ between short-fed and grass-fed groups, but for the fatter long-fed group yield grade was higher.

Fat Color

Fat on T-bone steaks from the grass-fat group was yellowest as expected (table 22.2). That degree of yellow color is not a marketing problem in all areas of the U.S., except where consumers are sensitive to differences in fat color.

Muscle Color

Freshly packaged (Day 0) beef steak muscles from long-fed beef have the most desirable color; those from grass-fed beef, least desirable (table 22.2). The longissimus (loin eye or rib eye) from grass-fed beef was especially darker than those from the other groups. Some steaks from grass-fed beef tended toward "dark cutters."

As all animals were fasted 18 to 24 hours before being slaughtered, it appears that grass-fed beef cattle are more sensitive to pre-slaughter feed withdrawal so shorter fasting periods may be appropriate for them.

A color score of 3.5 is considered marginally unacceptable. Higher scores indicate likely rejection by meat purchasers. All muscles were "saleable" after cutting and packaging, but those from long-fed beef were most attractive.

After three days of display, muscles from long-fed beef were still most desirable in color. Color score differed little between short-fed and grass-fed beef, psoas major (tenderloins), and gluteus medius (sirloin muscles), although longissimus (loin or rib eye) from grass-fed beef was noticably darker than from short-fed beef. After three days' display, all three muscles from grass-fed beef approached undesirable color, while those from long-fed beef were still acceptable.

Therefore, cuts from grass-fed beef would present marketing problems if merchandized in unfrozen state.

Cooking Loss, Shear Force and Taste Panel Results

Cooking-loss percentages from boneless top loin steaks (loin strip steaks) prepared by modified broiling to an internal temperature of 151°F did not differ between short-fed and long-fed cattle, but about 1% more was lost by steaks from grass-fed cattle (table 22.3).

Feeding treatment affected taste panel evaluations of steaks taken shortly after cutting (Day 0) and after three or five days of refrigerated display that simulated retail display for cuts packaged in polyvinyl chloride film.

Steaks from long-fed cattle displayed 0, three, or five days were most desirable; those from short-fed cattle, intermediate; and those from grass-fed cattle, least desirable in flavor score. Panelists noted sweet, metallic, or grassy flavor in some steaks from grass-fed cattle.

Table 22.4 shows mean flavor scores for steaks from each carcass in each group ranked from least to most desirable. When flavor scores are arbitrarily divided into acceptable and unacceptable halfway between six (slightly desirable) and seven (moderately desirable), four short-fed carcasses and five grass-fed carcasses average unacceptable, while steaks from all long-fed carcasses were acceptable.

Juiciness scores did not differ between short-fed and long-fed groups but were lower for steaks from grass-fed cattle. All groups had acceptable mean juiciness scores.

Tenderness scores were lowest for steaks from grass-fed beef and highest for those from long-fed beef after 0, three, and five days' display. Although tenderness scores of steaks from long-fed beef carcasses exceeded those from short-fed carcasses, both averaged near seven (moderately tender), but steaks from grass-fed cattle lacked tenderness.

Mean tenderness scores of each carcass (table 22.5), showed seven of ten from the grass-fed group, four of ten from the short-fed group, and one of ten from the long-fed group to be unacceptable.

Shear-force values (table 22.4) also show low tenderness for steaks from grass-fed cattle.

All of the taste-panel, shear-force, and cooking data were from steaks cooked by modified broiling, a dry heat procedure, so the results would not apply to other cuts or other methods of cookery. Perhaps other cooking methods should be recommended for steaks from grass-fed cattle. Further comparisons of short-fed, grass-fed, and long-fed beef should include roast cuts and cuts cooked by moist heat.

Table 22.1. Comparative Data From Carcasses of Short-fed, Grass-fed, and Long-fed Beef.

	Short fed	Grass fed	Long fed	Variance ratio	Least sig. diff.
Carcass wt., lbs.					
average	532.5	501.0	614.9		
range	437-664	396-554	551-844		
Conformation score[d]	9.3[b]	7.3[c]	11.8[a]	22.95**	0.96
Maturity[e]	1.9	2.1	1.5		
Marbling[f]	11.8[b]	7.3[c]	13.6[a]	12.14**	1.91
Carcass quality grade					
Av. Choice	1		2		
Choice-			3		
Good+	3		4		
Av. Good	4	1	1		
Good-	2	4			
Standard+		2			
Av. Standard		3			
Fat thickness, in.	0.36[b]	0.19[a]	0.53[c]	20.39**	0.08
Rib eye area	10.9[a]	9.5[b]	11.6[a]	5.60**	0.89
Rib eye/cwt.	2.05	1.90	1.89		
Yield grade	2.4[a]	2.2[a]	3.1[b]	9.75**	0.31

**P<1%.

[a,b,c]Means in same row with same superscript letters do not differ (P<5%).

[d]Conformation score: Avg. Standard = 5, Avg. Good = 8, Avg. Choice = 11, Avg. Prime = 14.

[e]Maturity: A- = 1, A = 2, A+ = 3.

[f]Marbling: Prac. devoid = 5, traces = 8, slight = 11, small = 14.

Table 22.2. Fat and Muscle Colors From Short-fed, Grass-fed, and Long-fed

	Fat and muscle color				
	Short fed	Grass fed	Long fed	Variance ratio	Least sig. diff.
Fat color[d]	1.35[a]	2.20[b]	1.20[a]	18.58**	0.256
Muscle color[e]					
Longissimus					
Day 0	2.19[b]	3.00[c]	1.94[a]	88.61**	0.117
Day 3	2.96[b]	3.81[c]	2.46[a]	171.74**	0.104
Psoas major					
Day 0	2.44[b]	2.74[c]	2.26[a]	19.48**	0.108
Day 3	3.55[b]	3.58[b]	3.29[a]	6.12**	0.128
Gluteus medius					
Day 0	2.34[b]	2.72[c]	1.99[a]	84.01**	0.080
Day 3	3.45[b]	3.49[b]	2.91[a]	26.86**	0.123

**P<.01.

a,b,c Means in same row with same superscript letter do not differ (P<.05).

d Fat color: 1 = white, 2 = slightly yellow, 3 = moderately yellow.

e Muscle color: 1 = very bright red, 2 = bright red, 3 = slightly dark red or brown, 4 = dark red or brown, 5 = extremely dark red or brown.

Table 22.3. Indicated Characteristics of *Longissimus* Steaks from Short-fed, Grass-fed, and Long-fed Beef Carcasses Compared.

	Short fed	Grass fed	Long fed	Variance ratio	Least sig. diff.
Day 0					
Flavor[d]	6.82^{b}	6.45^{c}	7.28^{a}	7.62**	0.295
Juiciness[d]	7.18^{a}	6.68^{b}	7.44^{a}	5.35**	0.329
Tenderness[d]	6.88^{b}	5.22^{c}	7.41^{a}	90.44**	0.238
Acceptability[d]	6.80^{b}	5.88^{c}	7.36^{a}	46.20**	0.217
Shear force, lbs.	7.54^{b}	10.70^{c}	7.01^{a}	1194.52**	0.114
Day 3					
Flavor	7.00^{b}	5.94^{c}	7.26^{a}	28.51**	0.273
Juiciness	7.06^{a}	6.32^{b}	7.12^{a}	12.46**	0.249
Tenderness	6.92^{b}	5.40^{c}	7.66^{a}	81.89**	0.252
Acceptability	6.85^{b}	5.65^{c}	7.33^{a}	52.80**	0.237
Day 5					
Flavor	6.88^{b}	5.94^{c}	7.53^{a}	29.92**	0.290
Juiciness	7.22^{a}	6.57^{b}	7.46^{a}	7.97**	0.325
Tenderness	6.96^{b}	5.49^{c}	7.78^{a}	233.12**	0.151
Acceptability	6.98^{b}	5.71^{c}	7.59^{a}	88.41**	0.202
Cooking loss[e]	12.61^{a}	13.74^{b}	12.75^{a}	2.72*	0.748

**P<.01, *P<.05.

[a,b,c] Means within row with same letter superscript not different (P<.05).

[d] Flavor, juiciness, tenderness and over-all acceptability evaluated using 9 point scale (9 = most desirable, 6 = slightly desirable, juicy or tender). Modified broiling at 350°F to 151°F for one-inch steaks.

[e] Cooking losses percentage (by weight) of steaks.

Table 22.4. Flavor of Steaks From Carcasses of Short-fed, Grass-fed, and Long-fed Beef[a].

Ranked individual carcass flavor scores[b]		
Short-fed	Grass-fed	Long-fed
5.7[c]	5.2	6.8
6.2	5.3	6.9
6.3	5.8	7.0
6.5	6.3	7.1
6.7	6.5	7.1
6.9	6.7	7.4
7.2	6.7	7.6
7.4	7.2	7.6
7.7	7.3	7.6
7.9	7.7	7.7

[a]*Longissimus* (loin eye) steaks, 1 inch thick, modified broiled at 350°F to 151°F. No display.

[b]Flavor scores: 8 = Desirable, 7 = Moderately desirable, 6 = Slightly desirable, 5 = acceptable.

[c]Mean for 6 taste panelists. Line in column represents an arbitrary distinction between less desirable and desirable steaks.

Table 22.5. Tenderness of steaks From Carcasses of Short-fed, Grass-fed, and Long-fed Beef[a].

Ranked indivdual carcass tenderness scores[b]		
Short-fed	Grass-fed	Long-fed
4.9[c]	3.7	5.8
5.9	3.8	6.9
6.0	3.8	7.0
6.3	4.3	7.2
6.8	4.5	7.2
7.0	4.9	7.7
7.3	5.7	7.9
8.2	6.8	8.0
8.2	7.7	8.0
8.3	7.7	8.5

[a] Longissimus (loin eye) steaks, 1 inch thick, modified broiled at 350°F to 151°F. No display.

[b] Tenderness score: 9 = Extremely tender, 7 = Moderately tender, 6 = Slightly tender, 5 = Acceptable, 4 = Slightly tough, 3 = Moderately tough.

[c] Mean for 6 taste panelists. Line in column represents an arbitrary distinction between less desirable and desirable steaks.

Energy Levels and Roughage Sources for Bulls on 140-Day Test

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Summary

Thirty-nine Angus, Hereford, and part Simmental bulls were tested 140 days (December 18, 1973 to May 6, 1974) for weight gained. Bulls were divided into four groups and fed four different rations that had been formulated for two energy levels (high and medium) and two sources of roughage (corn silage or oats and prairie hay).

Average daily gains (lbs.) on the four rations were: high energy silage, 3.48; high energy oats and prairie hay, 3.27; low energy silage, 2.58; and low energy oats and prairie hay, 3.41.

Introduction

Each year many bulls are performance tested in Kansas to identify prospective herd sires with superior genetic material for beef production. Difference of opinion exists regarding management during the tests. Such things as feeds used in ration formulation and energy levels for gain are controversial.

This test compared two levels of energy and two sources of roughage in formulated rations for a 140-day test.

Experimental Procedure

Forty bulls (11 Angus, 6 Hereford, and 23 part Simmental) produced in the Kansas State University teaching herd and the cow confinement herd were randomly allotted by breed to four different rations (table 23.1). One bull was removed from the test during a brief pre-test period.

Prairie hay was chopped to two inch lengths so that all rations were completely mixed. Bulls were fed twice daily to consumption.

Results

Bull performances are reported in table 23.3. Bulls on ration C gained at a lower rate than expected probably due to random error caused by poor gaining bulls. The test is being repeated.

Table 23.1. Compositions[a] of rations for 140-day Weight-gaining Test by Beef Bulls.

Ingredient	Ration A	Ration B	Ration C	Ration D
Rolled milo	68.3	68.3	6.7	16.7
Supplement[b]	16.7	16.7	16.7	16.7
Corn silage	15.0	--	76.6	--
Chopped prairie hay	--	7.5	--	33.3
Rolled oats	--	7.5	--	33.3
NE_m[c]	90.6	89.9	75.8	74.9
NE_p[c]	58.4	58.0	45.5	45.3

[a]Percentage of feedstuffs on dry matter basis.

[b]Formulation given in table 23.2.

[c]Calculated.

Table 23.2. Composition of Supplement Used with all Rations in Weight-gaining Test.

Ingredient (lbs./ton)	Rations A&B	Rations C	Rations D
Soybean oil meal	1330.0	1686.0	1176.0
Milo	511.3	189.3	694.3
Dicalcium phosphate	16.0	54.0	10.0
Calcium carbonate	80.0	8.0	57.0
Salt	30.0	30.0	30.0
Fat	20.0	20.0	20.0
Trace minerals	5.0	5.0	5.0
Vitamin A	3.0	3.0	3.0
Aurofac-10	4.7	4.7	4.7

Table 23.3. Performances of Bulls on Indicated Rations During 140-day Test.

	Ration[a]			
	A	B	C	D
No. of bulls	10	9	10	10
Avg. wt. 12/18, lb.	711.5	691.7	689.5	645.5
Avg. age 12/18, days	280.2	286.4	279.6	280.1
Avg. wt. 5/7, lb.	1198	1150	1050	1123
A.D.G., lbs.	3.48	3.27	2.58	3.41

[a]Rations listed in table 23.1.

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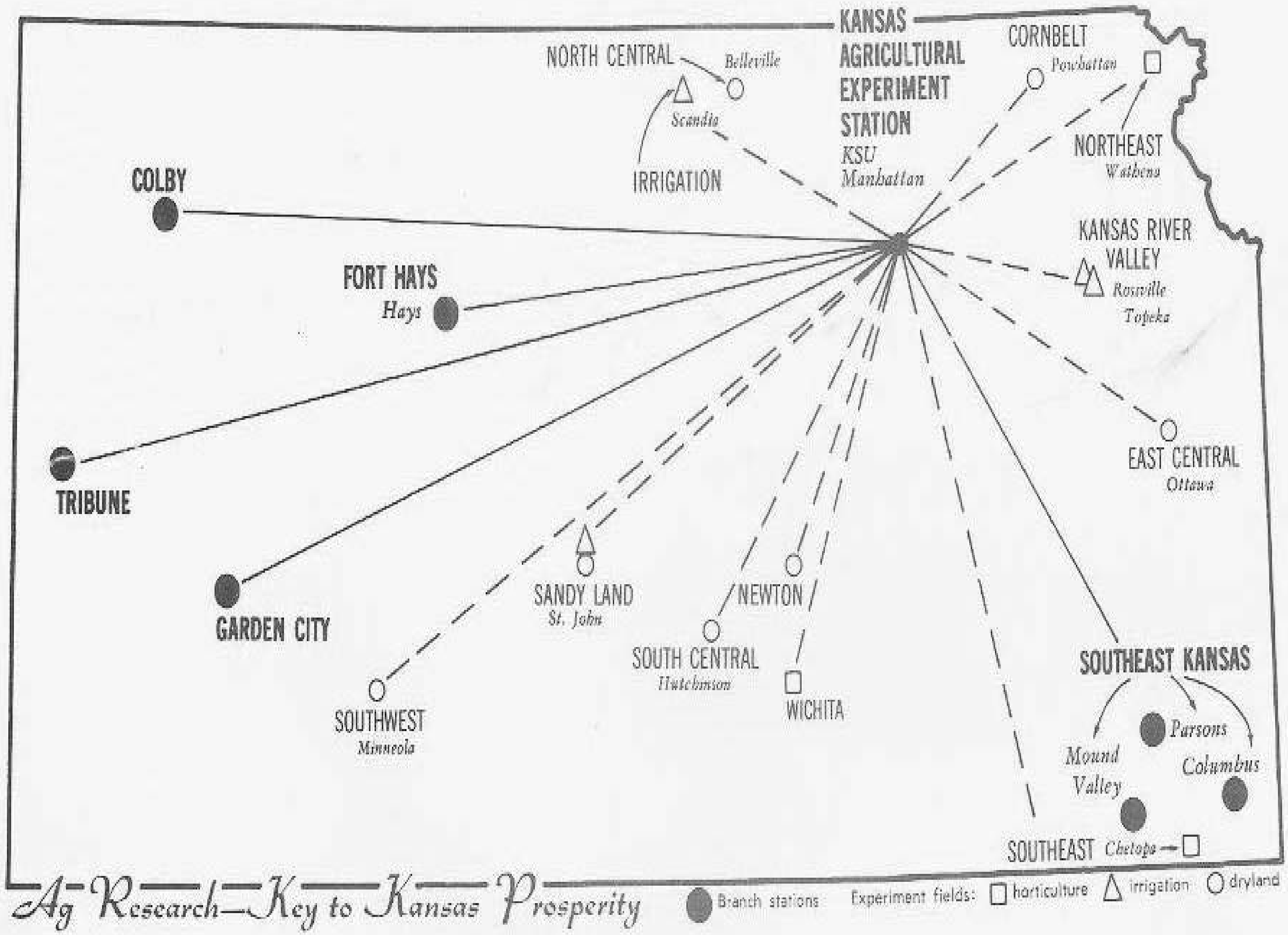
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