CATTLEMEN'S DAY 1977 • March 4,1977 • 64th Annual • Report of Progress 291 • Department of Animal Science & Industry • Weber Hall • Agricultural Experiment Station • Kansas State University, Manhattan • Floyd W. Smith, director

What's Ahead for Cattlemen?

Contribution 527-S, Department of Animal Science and Industry, 1632-S, Department of Agronomy, and 51-S Southeastern Kansas Branch, Agricultural Experiment Station, Kansas State University of Agriculture and Applied Sciences, Floyd W. Smith, director.

C O N T E N T S

64th ANNUAL CATTLEMEN'S DAY

FRIDAY, MARCH 4, 1977

8:00 a.m. Weber Hall Arena

Registrations—Exhibits
(Coffee and Donuts served)

Sorting Chute: Your questions for K-State Specialists

9:45 a.m. Weber Hall Arena

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

Welcome: Dr. John O. Dunbar, Director, Kansas Cooperative Extension Service

Cow-Calf Panel
Moderator, Dr. Keith Zoellner, Department of Animal Science and Industry, KSU

Early Weaning of Beef Calves—Dr. Miles McKee, Department of Animal Science and Industry, KSU

Implanting Nursing Calves—Dr. Larry Corah, Department of Animal Science and Industry, KSU

Environmental Effects on Beef Cattle Feeding—Dr. David Ames, Department of Animal Science and Industry, KSU

Integrating from Cow-Calf Through Feedlot—Mr. Sid Warner, Cimmarron, Kansas

Stocker-Feeder-Feedlot Panel
Moderator, Dr. Ed Smith, Department of Animal Science and Industry, KSU

RUMENSIN for Grazing Cattle—Dr. Jack Riley, Department of Animal Science and Industry, KSU

Cereal Crop Utilization—Dr. Keith Bolsen, Department of Animal Science and Industry, KSU

Economics of Cereal Crop Utilization—Dr. Roy Bogle, Department of Agricultural Economics, KSU

Efficiency End Point for Slaughter Cattle—Dr. Ben Brent, Department of Animal Science and Industry, KSU

12:15 p.m. Weber Hall Arena

Lunch: Roast Beef—Served by Block & Bridle Club
Sorting Chute Continued

1:00 p.m. Weber Hall Arena

Introduction of Guest Speakers:
Dr. Don L. Good

Greetings: The Honorable Robert F. Bennett, Governor of Kansas

Remarks
Mr. Jack Vanier, President, Kansas Livestock Association, Brookville, Kansas

What's Ahead for Cattlemen:

- View of a Feedlot Manager by Jerry Peterson, Manager, Circle E Feedlot, Potwin, Kansas
- View of a Market Analyst by Topper Thorpe, General Manager, CATTLE-FAX, Denver, Colorado

2:00 p.m. Tour at Beef Research Center

(about 2 miles north at end of College Avenue)
Research, Outlook, Health and Production topics

FOR THE LADIES

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

Coffee

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

"Romance of Lace"
Zoe Slinkman, Extension Specialist, Cultural Art

12:15 p.m. Weber Hall Arena

Lunch: Roast Beef—Served by Block & Bridle Club

Testosterone-Treated Cows to Aid in Heat Detection

G. N. Laaser and G. H. Kiracofe

Summary

Eight cull Hereford cows were given 200-mg. injections of testosterone proprionate repository (Haver-Lockhart, Shawnee, Ks.) every other day for 20 days (10 injections). Four cows were given weekly booster injections with the same testosterone proprionate; the other four were injected every three weeks with testosterone enanthate (Sigma Chemical Co., St. Louis, Mo.). Each cow was equipped with a chin-ball marker and each was used to detect heat in other cows. The detection period lasted approximately 45 days. Testosterone-treated cows served satisfactorily as heat detectors; those given boosters of testosterone proprionate marked more cows in heat than those given testosterone enanthate.

Introduction

For artificial insemination to be effective, time and effort must be minimized detecting heat without overlooking cows in heat. Many heat detection aids have been developed, among them are "detector" animals equipped with markers that identify cows that have been ridden.

"Detector" animals in the past have been primarily gomer bulls prepared in various ways to prevent copulation or fertilization. They include penectomy, which involves severing or removing a portion of the penis; penal blocks inserted into the prepuce to prevent extension of the penis; deflecting the penis (side-winders) by putting a hole in the side of the sheath; and putting a ring in the sigmoid flexure to prevent extension of the penis. All methods have disadvantages such as cost of surgery, maintenance, becoming sore, and various reasons for not working.

Researchers at Michigan State University discovered that treating cull cows with testosterone induced bull behavior to the point that the cows made good heat detectors. They injected testosterone enanthate after a "warm-up" period of 10 injections every other day with 200 mgs. testosterone propionate. A cull cow thus used can be disposed of after the breeding season.

Because testosterone enanthate is difficult to obtain and expensive, we tried using testosterone proprionate throughout the detection period.

Experimental Procedure

Eight cull Hereford cows were injected with 200 mgs. testosterone proprionate every other day for twenty days (10 injections). Cows were then equipped with chin-ball markers and placed in pastures with cows to be bred. Four of the experimental cows were then injected with 200 mgs. testosterone proprionate weekly, and four were injected with 1 gm testosterone enanthate every three weeks. Each pasture had approximately the same number of cows to be bred and a detector cow from each treatment. Cows with different testosterone had different color dye in the marker so the number of cows marked by each testosterone treatment could be counted. All cows were checked for marks twice a day. The treated cows were rectally palpated once a week for structures on their ovaries.

Results and Discussion

The testosterone proprionate-treated cows marked more cows than the testosterone enanthate-treated cows. Nine cows were marked by the testosterone proprionate cows that the testosterone enanthate cows did not mark. The testosterone enanthate-treated cows marked only 2 cows that weren't marked by the testosterone-treated cows. Cows quit working for 2 days after testosterone enanthate injection and then came in heat. They still worked while in heat, but the possibility of false mounting exists when that happens.

Palpations indicated that the testosterone enanthate-treated cows were cycling. Ovarian structures of the testosterone proprionate-treated varied. Some quit cycling due to lack of ovulation or a retained corpus luteum; others continued to cycle.

At the time of this study, one testosterone enanthate dose cost as much as five testosterone proprionate doses, but testosterone proprionate has to be injected more often.

Testosterone-treated cows served satisfactorily as heat detectors for other cows. Aggressive cull cows in good condition should do a better job as detectors than timid cows or cows in poor condition would.

Conception Rates in Synchronized Heifers Bred at Various Times After Onset of Estrus

R. C. DeBenedetti, G. H. Kiracofe,
H. S. Ward, and R. M. McKee

Summary

One hundred seven of 112 heifers were in estrus 1 to 5 days after an injection of prostaglandin $F_{2\alpha}$ given when a 7-day syncronization implant was removed. Checks for estrus were made every four hours and heifers were bred 6, 10, 14, 18, 22, or 26 hours after being detected in estrus. Eight heifers were not bred on schedule. Sixty-seven of 99 (67.7%) bred on schedule conceived to first artificial insemination. Conception rates were similar in heifers bred 6 to 26 hours after being detected in estrus; no differences were noted in conception rates between A.M. and P.M. breedings.

Introduction

We previously reported synchronization of estrus with no effect on conception rate in heifers given prostaglandin $F_{2\alpha}$. This study was to determine if conception rates would be changed by breeding 6 to 26 hours after the onset of estrus in synchronized heifers and if conception varies between A.M. and P.M. breedings.

Experimental Procedure

Syncro-mate B (6 mgs., G. D. Searle Co.) was implanted in one ear of 112 cycling heifers to prevent estrus. Seven days later prostaglandin $F_{2\alpha}$ (33.3 mgs. THAM salt, The UpJohn Co.) was injected intramuscularly after the implant was removed from 56 of the heifers in the morning (AM) and 56 heifers that night (PM). The heifers, confined to drylot, were observed for estrus every four hours during a five-day period. Heifers were then bred artificially 6, 10, 14, 18, 22, or 26 hours after being detected in estrus. Heifers detected in estrus at each time were divided into A.M. and P.M. breedings. Conception rates were determined by rectal palpation.

Results and Discussion

Ninety-four of the 112 heifers (83.9%) were in estrus in a three-day period and 107 of 112 (95.5%), in a five-day period. Three of the 107 synchronized heifers were not bred at their first synchronized estrus. Seventy-two of the 104 heifers (69.2%) synchronized and bred conceived the first insemination. Five of the 104 heifers were not bred according to the experimental breeding schedule. Conception rates for the remaining 99 in the 6, 10, 14, 18, 22 and 26 hour breeding groups were 67, 60, 71, 68, 53 and 87 percent, respectively.

The synchronization results do not differ from those reported in previous years. This procedure resulted in approximately 95% of cycling heifers showing estrus in a four-day period. The results suggest that there is no difference in conception rates from breeding in the morning or evening. Also, we can breed as early as 6 hours or as late as 26 hours after onset of estrus and still get a good first-service conception rate.

Table 2.1 . Estrus and conception rates in heifers treated with Syncro-mate B and prostaglandin.

Days post treatment[a]	1	2	3	4	5	Total
No. in estrus	26	47	21	12	1	107[b]
No. conceived 1st service	16	30	16	9	1	72
1st service conception	61.5	63.8	76.2	75.0	100.0	69.2[c]

[a]Implant removed day 0.

[b]Five of 112 heifers showed no signs of estrus during the 5 days.

[c]Three heifers found in heat were not bred and are not included in first service conception data.

Table 2.2 . Conception rates of synchronized heifers bred at indicated times after onset of estrus.

Hours bred after estrus detected[a]	6	10	14	18	22	26	Total
No. of heifers bred at: 8 a.m.	6	9	6	12	7	10	50
8 p.m.	12	6	11	7	8	5	49
% Conception 1st service of heifers bred at: 8 a.m.	67	56	67	67	57	100	70
8 p.m.	67	67	73	71	50	60	65
% Conception by breeding period	67	60	71	68	53	87	67.6

[a]Estrus checked every four hours.

Synchronization of Estrus and Insemination Time in Beef Cows

M. D. Heekin, G. H. Kiracofe,
R. R. Schalles, and H. S. Ward

Summary

We used 76 cows to determine the effect of inseminating at different times after detecting estrus and to evaluate Synchronmate B as an estrus synchronizing agent.

Cows were divided into five groups: (1) nonsynchronized bred naturally; (2) nonsynchronized bred once a day approximately 12 to 24 hours after detecting estrus; (3) nonsynchronized bred twice a day approximately 12 hours after estrus; (4) synchronized bred once a day, and (5) synchronized bred twice a day.

Synchronizing did not affect conception rate with twice-a-day breeding, but did with once-a-day breeding.

Conception rates during the first 25 days of the breeding season were 63.6, 70.0, 69.2, 40.0, 80.0 for groups 1 through 5, respectively.

Introduction

Synchronmate B is the trade name for an experimental compound developed by G. D. Searle Company to synchronize estrus in cattle.

Last year we found that neither synchronizing nor artificially inseminating lowered conception of cows bred twice-a-day, twelve hours after their estrus was observed.

This year we wanted to repeat last year's experiment as well as compare conception rates with the labor saving procedure of breeding cows once-a-day, instead of the traditional twice-a-day breeding.

Synchronized and nonsynchronized cows were bred once a day and compared with cows bred twice-a-day.

Experimental Procedure

Seventy-six Polled Hereford cows 15 to 87 days post partum (average 58 days) were used for this experiment. Eighty-four percent were lactating and fifty-seven percent were cycling when implanted. Cycling was determined by visual heat detection and ovary palpation.

The cows were divided into five groups:

Group 1. Cows were allowed to mate naturally with a bull wearing a chin ball marker. Cows were checked daily and breeding dates were recorded.

Group 2. Cows were artificially inseminated once a day approximately 12 to 24 hours after detected in heat. Those detected in heat in the morning and evening of one day were bred the next morning. After a 25-day artificial inseminating season, a bull wearing a chin ball marker was placed with the cows. Cows were checked daily and breeding dates were recorded.

Group 3. Cows were bred twice a day, approximately 12 hours after estrus was observed. Those in heat in the morning were bred in the evening and those in heat in the evening were bred the next morning. After a 25-day A.I. breeding season, cows were treated as in group 2.

Group 4. Cows were synchronized using a 6 mg. SC21009 ear implant and an intramuscular injection of estradiol valerate (6 mg.), with SC21009 (3 mg., a synthetic progestin) when implanted. Nine days later the implants were removed. Checks for estrus were made twice daily. Cows were bred only in the morning; 12 or 24 hours after estrus was observed within the 4-day synchronized period. A bull wearing a chin ball marker was then placed with the cows for 16 days. Cows returning to estrus within the next five days were artificially bred the morning following detected estrus.

Following the 2nd A.I. breeding period, a bull wearing a chin ball marker was placed with the cows for the remainder of the breeding season. Cows were checked daily and breeding dates were recorded.

Group 5. Cows were synchronized with the same treatment given to group 4. Cows in group 5 were treated as those in group 4, except they were bred twice a day approximately 12 hours after estrus was observed.

All cows were kept on range for the duration of the experiment. Bulls were removed after a 55-day breeding season (including A.I.). Pregnancy was determined by rectal palpation.

Results and Discussion

Neither synchronizing nor artificial insemination depressed conception rate, which agrees with last year's results.

There was essentially no difference in first service conception between nonsynchronized cows bred once-a-day and nonsynchronized cows bred twice-a-day.

Conception was depressed in the synchronized cows that were bred only once-a-day. This experiment indicated that breeding once-a-day is practical with nonsynchronized cows.

Table 3.1. Conception rates in cows after estrous synchronization - once-a-day and twice-a-day breeding compared.

		% conceived		
		of those bred		of total herd
Group	No. of cows	Synchronization period	25 days	55 days
Nonsynchronized bred naturally	11	----	63.6	81.8
Nonsynchronized bred once-a-day	16	----	70.0	81.8
Nonsynchronized bred twice-a-day	17	----	69.2	88.2
Synchronized bred once-a-day	14	20.0	40	85.8
Synchronized bred twice-a-day	18	67.0	80	88.9

Induced Calving in Beef Cattle

V. Hultine, G. H. Kiracofe, R. R. Schalles,
R. M. McKee and R. C. DeBenedetti

Summary

Calving was induced in 26 of 29 Polled Hereford cows that were injected between 271 and 287 days of gestation intramuscularly with 20 mgs. of dexamethasone (Azium) and 10 mgs. ECP (estradiol cypionate).

Oxytocin, given to cows that had not calved by 40 hours after dexamethasone injection, shortened the average interval to calving (15.4 hours if returned to pasture, 16.1 if in confinement compared with 32.6 hours with no oxytocin). Three cows did not respond to treatment.

ECP did not reduce retained placentas; 77% of the cows induced to calve retained membranes.

Introduction

Inducing parturition in farm animals, especially beef cattle, is a management tool in cow/calf production systems. Any stimulus used to promote parturition before the end of gestation is called induced parturition. Dexamethasone has effectively induced calving late in gestation; however, calving is still scattered over several days. The high incidence of retained placenta by induced cows is a serious disadvantage.

In this experiment we attempted to shorten the interval to calving by injecting oxytocin after injecting dexamethasone and to determine if ECP would reduce retained placenta.

Experimental Procedure

Twenty-nine Polled Hereford cows were injected intramuscularly with 20 mgs. dexamethasone (Azium, Shering Corp., Kenilworth, N.J.), 10 mgs. ECP (estradiol cypionate, The UpJohn Co., Kalamazoo, Mi.) and 10 cc. combiotic. Cows that had not calved by 40 hours post-injection were allotted into three groups. All three groups received 10 mgs. ECP and two groups received 100 u.s.p. units of oxytocin (Med-Tech Inc., Elwood, Ks.). One oxytocin group was returned to pasture while the other was held in confinement. Cows were 271 to 287 days gestation when injected with dexamethasone.

Calving assistance was given when necessary. Cows that had not expelled the placenta within the 96-hour experimental period were treated with 20 cc. combiotic for two consecutive days.

Results and Discussion

Times of calving for each treatment group are shown in table 4.1 . Five cows calved within 40 hours after dexamethasone was injected (avg. 31.7 hrs.). Six of eight cows receiving only ECP after dexamethasone calved an average of 32.6 hours post injection. Oxytocin in addition to the ECP shortened the average interval from injection to calving; confinement had no affect. Two cows in the ECP only group and one in the confinement group did not calve in response to treatment.

Eight percent (or 2 of 26) of the induced cows required assistance when calving. Seventy-seven percent of the induced cows retained placenta, indicating that ECP was not effective.

Table 4.1. Results of Induced Calving with Dexamethasone (DEXA) and Estradiol Cypionate (ECP).

COWS CALVING WITHIN 40 HOURS AFTER DEXA AND ECP

Cow No.	Hours from DEXA to fetal expulsion	Placenta
006	21.0	clean
311	32.5	clean
932	35.0	clean
2106	35.5	clean
3100	34.5	clean
	31.7 average	

COWS INJECTED WITH ECP 40 HOURS AFTER DEXA

Cow No.	Hours from DEXA to fetal expulsion	Hours from ECP to fetal expulsion	Placenta
135	50.0	10.0	retained
289	70.0	30.0	retained
360	90.0	56.5	retained
590	70.5	30.5	retained
905	70.5	30.5	retained
949	20.0 days	18.0 days	----
2108	78.5	38.5	retained
3128	15.0 days	13.0 days	----
	65.3 average	32.6 average	

(averages for 6 of 8 calving within 96 hrs.)

COWS INJECTED WITH ECP AND OXYTOCIN 40 HOURS AFTER DEXA AND RETURNED TO PASTURE

Cow No.	Hours from DEXA to fetal expulsion	Hours from OXYTOCIN to fetal expulsion	Placenta
173	62.5	22.5	retained
268	42.5	2.5	retained
301	58.0	18.0	partially ret.
310	52.5	12.5	retained
520	89.5	49.5	retained
957	48.0	8.0	retained
963	47.5	7.5	retained
2116	43.0	3.0	retained
	55.4 average	15.4 average	

(averages for 8 of 8 calving within 96 hrs.)

COWS INJECTED WITH ECP AND OXYTOCIN 40 HOURS AFTER DEXA AND HELD IN CONFINEMENT

Cow No.	Hours from DEXA to fetal expulsion	Hours from OXYTOCIN to fetal expulsion	Placenta
048	41.0	1.0	clean
069	43.5	3.5	retained
169	80.5	40.5	retained
172	44.5	4.5	retained
305	76.0	36.0	retained
495	63.5	23.5	retained
946	8.0 days	6.0 days	----
1107	43.5	3.5	retained
	56.1 average	16.1 average	

(averages for 7 of 8 calving within 96 hrs.)

Early Weaning and Creep Feeding Calves in Drylot

Kris Kimple, Miles McKee, Galen Fink, and Ken Conway

Summary

Performances of 125 commercial Hereford-cross and percentage Simmental calves were evaluated by comparing early weaning at 50 days of age (±25), nursing calves receiving a creep in drylot, and calves nursing in drylot without creep. Both a starter and growing creep were tested.

Early weaned calves gained more (261 lbs., 299 lbs.) than either creep fed (251 lbs., 277 lbs.) or noncreep fed (107 lbs., 125 lbs.) calves during the 107-day trial. The best combined energy efficiency of dam and calf was for the early weaned group, and dams of early weaned calves began cycling sooner in the breeding season.

Introduction

Reducing cow feed costs is a major obstacle facing confinement systems. Since intake of confinement cows may be closely controlled, early weaning of calves permits lower quality, less expensive maintenance rations to be fed while calf needs are being met by creep feed. Other potential uses of early weaning could include: (1) emergency situations such as drought, (2) induced twinning, (3) fall calving where heavy winter feeding would be required, and (4) to accelerate rebreeding of first- and second-calf heifers.

Experimental Procedure

Ninety commercial calves from Hereford dams and Angus, Charolais, and Hereford bulls and 35 percentage Simmental calves were used in a 107-day trial (May 10 to August 25). All calves were born in confinement and were allotted by age, sex (59 heifers and 66 males), and breed among three treatment groups: (1) early weaned at 50 days of age (±25), (2) continued nursing on creep, and (3) continued nursing without creep. Within each management group commercial calves were further divided by age and sire into three sub-treatments: (1) implanted once with Ralgro, (2) implanted and re-implanted 60 days later, and (3) no implants.

Cows were allotted by calf treatment, with Simmental and Hereford cows grouped separately (6 total groups). Cow weight and condition changes from a pre-calving record (February 12) were similar for each group. Cows were weighed on and off test after 12 hr. fasts and were condition scored visually each time. Calves were weighed monthly (5 times).

Early weaned calves were housed indoors for 18 days with access to a free-choice starter creep (table 5.1) and fresh water. Calves were then moved outside and were shifted gradually to the standard creep beginning 50 days post-weaning. Approximately 6 lbs/hd/day of prairie hay was also provided the last month on test. Calves on creep nursing their mothers had access to the standard creep (table 5.1) throughout the test. Cows were fed three different silages during the summer (table 5.2). Wheat straw was fed in addition to silage during July. Milo and a protein supplement[a] were also fed throughout the trial to meet requirements. Additional energy was offered cows whose calves were not on creep toward the end of the test.

Results and Discussion

Early-weaned and creep-fed calves gained significantly more than non-creep fed nursing calves for both dam-breed groups. Calves receiving no creep also had more eye infections, which apparently were nutritionally related. Serious problems were not encountered in weaning at 50 days; calf gains were highest for that group. Nursing calves receiving creep feed did not respond to implants.

All cows, except for Simmentals whose calves received no creep, were in gaining condition throughout the summer, indicating above maintenance nutrition. Performance indicates that dry cows could have been further restricted, which would have increased energy efficiency of the group weaned early (6.8 lbs. TDN/lb. of calf produced) over the creep fed (7.3 lbs. TDN/lb. calf produced) and noncreep (14.3 lbs. TDN/lb. calf produced) groups. Cows whose calves were weaned early also began cycling earlier in the breeding season.

These data indicate that creep feeding may be beneficial in drylot cow-calf production.

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[a]Supplement formulation lbs/ton: SBOM, 1070; rolled milo, 491; salt, 200; bone meal, 134; urea, 64; Z-10 trace mineral, 20; aurofac 10, 15; vitamin A, 6; wet molasses, 40.

Table 5.1. Creep rations for nursing and early-weaned calves.

Ingredient	Starter creep ration (lbs.)	Standard creep ration (lbs.)
Rolled oats	436	1300
Rolled corn	742	366
Dehydrated alfalfa		92
Calf Manna[a]	305	
Wet molasses	65	61
Dicalcium phosphate	11	
Limestone	11	
Soybean oil meal	436	84
Dry molasses		51
Pre-mix[b]	22	
Salt	22	10
Aureo-10	15	14
		1998

[a]Calf Manna milk replacer is made by Albers Milling Co.

[b]Pre-mix, lbs. per 1000 lbs.: soybean oil meal, 444; ground oats, 443; vitamin A, 33; Auremycin-10, 30; trace mineral, 50.

Table 5.2 . Feed consumed (per head per day) by calves and dams[1] (lbs.).

Item	Weaned early[2]			Creep fed[2]			Not creep fed[2]		
	Calf	Dam^S	Dam^H	Calf	Dam^S	Dam^H	Calf	Dam^S	Dam^H
Calves									
Starter creep	5.5								
Standard creep	9.9			4.08					
Average creep consumption	7.8			4.08					
Average TDN consumption	6.2			3.1					
Dams									
Sorghum silage (5/10-6/1)		40	35		50	40		50	40
Straw-alfalfa silage (6/2-7/31)		18.3	15.6		27.4	18.4		27.4	18.4
Excreta silage (8/1-9/2)		38.7	34.5		45.5	50		54.5	60
Milo[3]		4	4		6	6		6	6
Supplement		1	1		1.5	1.5		1.5	1.5
Average TDN consumption		11.5	10.5		16	13		16.5	13.5
Combination (Breed differences averaged)									
Cow + Calf TDN consumption[4]		17.2			17.6			15	
Total Cow-Calf TDN/lbs. calf gain		6.8			7.3			14.3	

[1]Dam feed consumption is to September 2 (115 days) and calf consumption is to August 25 (107).

[2]Dam^S = Simmental; Dam^H = Hereford.

[3]Actual levels changed during test: dry cows (2-4); creep cows (4-6); non-creep (4-8).

[4]Feed TDN, calculated from crude fiber and NRC values, were: sorghum silage, 67%; straw-alfalfa, 53%; excreta silage, 55%; starter creep, 82%; standard creep, 76%; wheat straw, 30% (fed in addition to straw-alfalfa silage 18 days).

Table 5.3. Performances of calves weaned early (107 days on test).

Breed and Weaning Treatment	No. of calves	Age on test	Weight May 10 (lbs.)	Weight Aug 25 (lbs.)	Total gain (lbs.)	ADG (lbs.)
Early-weaned calves						
Commercial	30	50	125	386	261	2.41
Simmental	15	50	162	461	299	2.77
Creep-fed calves						
Commercial	30	47	125	376	251	2.35
Simmental	10	50	156	433	277	2.59
Not creep-fed calves						
Commercial	30	49	128	235	107	1.00
Simmental	10	47	152	277	125	1.17

Table 5.4. Indicated effects on dams of calves weaned early.

Calf Treatment	Weight May 10	Weight change[4]	Condition[1] May 10	Condition change	Cycling[2] %	Conceived[3] %
Early weaned, commercial	942	61	5.0	.6	100	86
Early weaned, Simmental	1121	31	6.2	-.3	100	81
Creep fed, commercial	878	97	4.7	.7	67	76
Creep fed, Simmental	1110	41	6.3	0.3	80	80
Not creep fed, commercial	946	45	5.2	.2	83	80
Not creep fed, Simmental	1056	-45	5.8	-1.0	80	80

[1]Condition scores visually appraised on a scale of 1-10; 1 = extremely thin, 10 = extremely fleshy.

[2]% cycling represents those observed in estrus May 20 - June 20, 1976.

[3]% conceived is calculated from rectal palpation October 8, 1976.

[4]Final cow weights were recorded September 2 (115 days).

Effect of Using One Versus Two Growth Promoting Implants on the Gains of Nursing Calves

Larry R. Corah, Miles McKee, and R. R. Schalles

Summary

One hundred twenty-seven suckling calves were allotted to one of three treatments:

(1) Control group - not implanted
(2) Implanted (Ralgro) once during sucking period
(3) Implanted (Ralgro) twice during sucking period - at average age of 44 days and 70 days later

Using one Ralgro implant improved the weight at weaning by 8.4 pounds, while re-implanting, thus utilizing two implants during the suckling phase, resulted in an extra 43.0 pounds.

Introduction

Previous research published by Kansas State University and other Universities has shown that either DES or Ralgro will improve the weight gains of suckling calves 15 to 25 pounds. In most cases, calves are left on cows for 200 to 250 days, while the normal life span of most implants is 80 to 100 days.

Thus this trial was designed to compare the effect of using one versus two implants during the suckling phase. The implants used in the trial were 36 mg Ralgro implants.

Experimental Procedure

Forty-nine steer and 87 heifers, Polled Hereford or crossbreed calves, were divided into three groups based on breed, age, and sex. Sex of the calf had no effect on response to implanting so no further reference is made to calf sex. The three treatments were:

Treatment 1. Control group - not implanted

Treatment 2. One implant used during the suckling period when the calves were approximately 2½ months old.

Treatment 3. Two implants used during the suckling period. Initial implant when the calves were an average age of 44 days and re-implanted approximately 70 days later.

Two groups of calves were used. One group was suckling cows on native grass; the other group was suckling cows confined in drylot.

The calves that received one implant were implanted for a total of 114 days before weaning. Calves receiving two implants were implanted a total of 149 days during the suckling period.

Results and Discussion

Calves receiving one implant gained 8.4 pounds more than non-implanted calves at the end of the suckling period. This response is slightly under what has normally been shown in other research tests. Calves implanted when they averaged 1½ months and again approximately 70 days later, weighed 43.0 pounds more at weaning than calves not implanted.

No side effects were noted on any of the calves receiving one or two Ralgro implants during the suckling period.

Table 6.1 Results from using 0, 1, and 2 implants during suckling period of calves.

	No. calves	Average age at initial implanting	No. days implanting to weaning	Birth wt. lbs.	Weaning wt.*	Gain lbs.*	Treatment advantage
Not implanted control	41	---	---	72	372.6	300.6	---
One implant during suckling period	43	79 days	114 days	71	380.0	309.0	+8.4
Two implants during suckling period	43	44 days	149 days	71	414.6**	343.6**	+43.0**

* Weaning weights and lbs. gained were adjusted based on calf age.

**$P<0.05$.

Selecting for Feed Conversion

R. R. Schalles, Josef K. Blum and Walter H. Smith

Summary

Selecting animals for decreased feed per unit of gain has made small changes in feed conversion over a four-year period. Adjusting for maintenance requirements by using mid weight to 0.75 power was not entirely satisfactory as that ignores differences in growth patterns. Favorable genetic relationships were found between feed conversion and most other economically important traits, especially yearling growth traits.

Introduction

Energy costs increasing make efficient energy use more important. There has always been some natural selection for animal efficiency because animals not able to convert available feed efficiently often failed to reproduce or reproduced at a reduced rate.

In recent years more cattlemen have become interested in direct selection for improved feed conversion. Selecting for feed conversion is expensive because it is necessary to know individual feed intake. Also some common mistakes need to be avoided.

This experiment was initiated to study genetic changes in a herd selected for efficient feed conversion and to evaluate the feasibility of such selection.

Experimental Procedure

Performance data were collected on 257 bull calves and 247 heifer calves from the Polled Hereford herd from 1969 through 1975. This herd was initiated in 1967 when Polled Hereford breeders donated cattle from 34 herds. These cows were used to build the Polled Hereford herd to its present size of about 160 cows in the selection herd and 73 in the control herd.

For the 1971 breeding season cows were randomly assigned to either the selection or control line. Since 1969 two bulls with the best feed conversion have been selected annually for the selection herd and used for two consecutive years.

Bulls for the control herd were randomly selected and remained in the herd six years or as long as possible. Since 1970 both lines have been closed, and no other breeding material has been introduced. To reduce the increase of inbreeding, least related matings have been used. Cows were maintained on native pasture all year, and different energy and protein levels have been fed during the winter (1974 Cattlemen's Day Report).

Cows were bred to calve in March and April, and calves were weaned when approximately 200 days old. After a 3- to 4-week weaning period, bulls were put on a 140-day, individually-fed performance test. The ration was 25% prairie hay, 15% dehydrated alfalfa, 43% corn, 12½% soybean meal, 4% molasses and ½% salt. At the end of the test, two bulls were selected for the selection herd. The criterion selected for was feed conversion (F/G_{adj}) adjusted for both maintenance (mid weight to 0.75 power or metabolic size) and age on test. We have computed partial regression coefficients every year, using all previous data to make adjustments for each individual's F/G ratio to an average age and average maintenance requirement.

Heifers were group fed. Bulls were weighed monthly; heifers, bimonthly. Heifers were not selected for feed conversion. Essentially, all heifers have been kept to build up the herd and for replacements. Culling was according to the following criteria: (1) not pregnant at the end of the breeding season, (2) severe structural damages, and (3) horned.

Results and Discussion

The individual's deviation from the herd's average feed conversion was calculated within years. In 1969, 1970, and 1971 selection and control line were a single herd. Therefore, individual deviations have been calculated as deviations from the entire herd. In 1972 the two lines were completely separated, then individual deviations became the difference between the selection line mean and the individual's performance. Year-to-year fluctuations have been large. Individual deviations of selected bulls tend to decrease in later years.

From 1969 to 1971 the mean accumulated selection differential of the parents was zero, because they were unselected. It was also zero for one bull in 1972 because he was selected from the control herd. In 1974 offsprings of selected bulls started calving, giving an increase in the mean accumulated selection differential from the dam side.

Table7.1 shows least square means and differences in feed conversion between selection and control herd. The differences are genetic because both herds are kept under the same environment, and no genetic changes are assumed to have taken place in the control herd. Selected bulls improved feed conversion about 0.35 lb. per lb. gain. With an average 400 lb. gain on test, that is 140 lb. less feed consumed on a 140-day test. The regression of least square means on years indicates a decrease per year of $0.141 \pm .567$ lb. feed per lb. of gain in the selection line and $0.067 \pm .551$ in the control line (figure 7.1).

Birth weight and 205-day weight were lowered by selecting for feed conversion. Calves in the selection line were lighter at birth than calves in the control line. In 1972 the difference was 5.25 lb. ($P<0.05$) for heifers and in 1974, 4.16 lb. ($P<0.05$) for bulls. The decrease in birth weight and 205-day weight was consistent for both sexes. Yearling weight was not changed by selecting for feed conversion. Changes in shape of the growth curve from birth to yearling are shown for both sexes in figure 7.2 . Average daily gain from birth to weaning tended to be decreased ($P<0.10$). Adjusted weaning weight was significantly decreased and average daily gain from weaning to yearling was significantly increased. Both lines had the same yearling weight. An analysis of ADG on test by 4-week intervals showed control line calves to start with higher gain per day . Toward the end of the test, however, calves in the selection line gained more rapidly than control line calves. No inference could be made about the shape of the growth curve beyond yearling.

The decrease in 205-day weight suggests that our adjustment for maintenance did not remove all the variation in feed per gain due to maintenance. Examination of individual's performances suggests that selection may have been on two independent traits. Bulls that grew slowly during the first half of the test and quickly during the last part of the test were favored because of lower maintenance requirement than we adjusted for by using (mid weight)$^{3/4}$. Bulls that gained faster throughout the test or much faster during the early part of the test than at the end were selected either because of superior efficiency or because of the high correlation between ADG on test and feed conversion. We fitted a quadratic regression, for 28-day weights on days-on-test for each animal. The area under the regression curve divided by 140 was the "average weight maintained" by each bull during the 140-day test period. This appears to be a better method of adjusting for maintenance differences.

No significant changes in backfat thickness or loin eye area resulted from selecting for F/G_{adj}, although we expect future generation animals in the selection line to be less fat, because it takes seven times more energy to put on fat than protein tissue.

Total feed consumption has not been significantly changed, which agrees with the near zero genetic correlations between F/G_{adj} and feed consumption.

Yearling height was not significantly affected, but was generally lower in the selection line. The genetic correlation between F/G_{adj} and yearling height indicates a low negative genetic relationship ($r = -.23$).

Heritability estimates of 14 performance traits are given in table 7.2. Heritability for birth weight was 0.42. Estimates in the literature are similar. Age of dam, birth month, and winter nutrition of the cow affected birth weight significantly.

Weaning weight and average daily gain from birth to weaning are largely affected by the maternal ability of the dam, and genetic variation is lower than for birth weight or 365-day weight. Heritabilities found in this study were 0.31 for 205-day weight and 0.37 for ADG from birth to weaning. The heritability estimate for 365 day weight was 0.41.

Average daily gain from 205- to 365-days of age and average daily gain on test measure essentially the same. Heritability estimates for both traits were 0.30, lower than those reported by most other researchers.

Yearling height at the shoulder, a measure of body size, gained in importance the last few years as producers searched for growthier animals. Our heritability estimate was 0.56 for bulls and 0.66 for a pooled estimate of heifers and bulls.

Loin eye area (LEA) and backfat thickness (BF) measurements on live animals involve more measuring errors than those taken on carcasses, which may explain the low heritabilities for LEA (h^2 = 0.15) compared with estimates from carcass data.

Genetic correlations are primarily the result of the same genes affecting both traits. Part-whole relationships, as among birth weight and 205-day weight or 365-day weight, gave high positive genetic correlations (table 7.2). Postweaning average daily gain correlated highly with all other weight measurements. Average daily gain from birth to weaning had a low genetic correlation with birth weight (r = 0.26), ADG from weaning to yearling (r = 0.20), ADG on test (r = 0.0), and yearling height (r = -.05).

Loin eye area and growth measurements were generally positively correlated, except for the correlation between ADG from birth to weaning and LEA, where the estimated value was -.32. Backfat thickness and growth characters correlated negatively. Exceptions were correlations between ADG from birth to weaning and BF (r = 0.06) and 205-day weight and BF (r = 0.14). LEA was highly positive correlated with post-weaning daily gain (r = 0.49) and final weight (r = 0.54). Feed consumption was positively correlated with weights at all stages and also with ADG on test (r = 0.56).

F/G_{adj} correlated negatively with birth weight (r = -.15) and 365-day weight (r = -.68). On the other hand, 205-day weight correlated positively with F/G_{adj}.

The correlation between ADG on test and feed conversion were -.39 not adjusted for maintenance, and -.53 when feed conversion was adjusted for maintenance.

The correlation between feed consumption and F/G not adjusted for maintenance is expected to be positive, because higher feed consumption is primarily attributed to higher maintenance requirements. When we adjust for maintenance, the correlation is 0.06, suggesting feed conversion cannot be improved by selecting for feed consumption. Selecting for F/G_{adj} slightly (nonsignificantly) decreased feed consumption, which suggests a slight positive relationship.

Table 7.1 . Line averages and differences in feed conversion between selected and control line animals.

Year	No. of bulls	Selection line mean	No. of bulls	Control line mean	Response to selection for F/G_{adj}
1969			20	6.64 ± .21	
1970			23	6.83 ± .15	
1971			33	6.33 ± .13	
1972	12	5.12 ± .22	25	5.53 ± .15	- .41 ± .23
1973	27	6.03 ± .14	12	6.10 ± .21	- .07 ± .21
1974	36	6.16 ± .12	27	6.82 ± .14	- .66 ± .14
1975	36	5.87 ± .13	21	6.10 ± .15	- .23 ± .16

Table 7.2. Heritabilities (On Diagonal) And Genetic Correlations (Below Diagonal) For Growth And Efficiency Traits[e]

		BW	205 WT	365 WT	ADG(B-W)	ADG(W-Y)	ADG(T)	Y HT	FC	$F/G_{adj.}$	LEA	BF
BW	d	0.42±.21										
205 WT	a	0.96±.81	0.31±.18									
365 WT	b	0.77±.44	0.64±.26	0.41±.21								
ADG(B-W)	a	0.26±.22	0.99±.01	0.60±.27	0.37±.20							
ADG(W-Y)	b	0.87±.22	0.45±.44	0.97±.03	0.20±.42	0.30±.18						
ADG(T)	b	0.80±.25	0.24±.55	0.94±.05	0.00±.54	0.88±.10	0.30±.18					
Y HT	c	0.22±.19	0.09±.28	0.52±.30	-.05±.39	0.39±.31	0.48±.34	0.56±.31				
FC	b	0.85±.26	0.09±.16	0.59±.23	-.22±.46	0.36±.29	0.56±.24	0.11±.24	0.40±.20			
$F/G_{adj.}$	b	-.15±.41	0.08±.62	-.68±.24	0.05±.51	-.84±.19	-.53±.31	-.23±.11	0.06±.43	0.23±.16		
LEA	c	0.68±.50	0.31±.29	0.73±.44	-.32±2.2	0.93±.43	0.77±.46	0.01±1.6	0.16±.54	-1.08±.52	0.11±.13	
BF	c	-.26±.40	0.14±.75	-.07±.15	0.06±.63	-.12±.45	-.20±.51	-.54±.22	0.37±.51	-.05±.54	-.03±.52	0.18±.15

a adjusted for age of dam, winter nutrition of dam and birth weight
b adjusted for age on test and weight on test
c adjusted for age and weight at anscan
d adjusted for age of dam, winter nutrition of dam and birth month
e all traits had 257 observations except yearling height which had 154

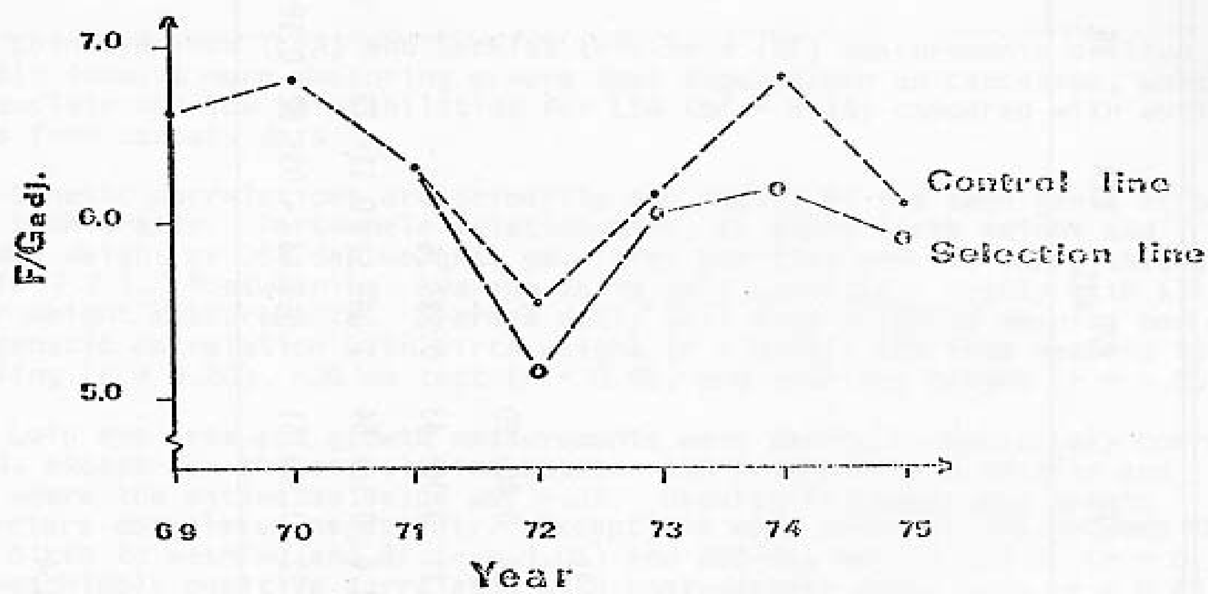

Figure 7.1. Change in feed conversion.

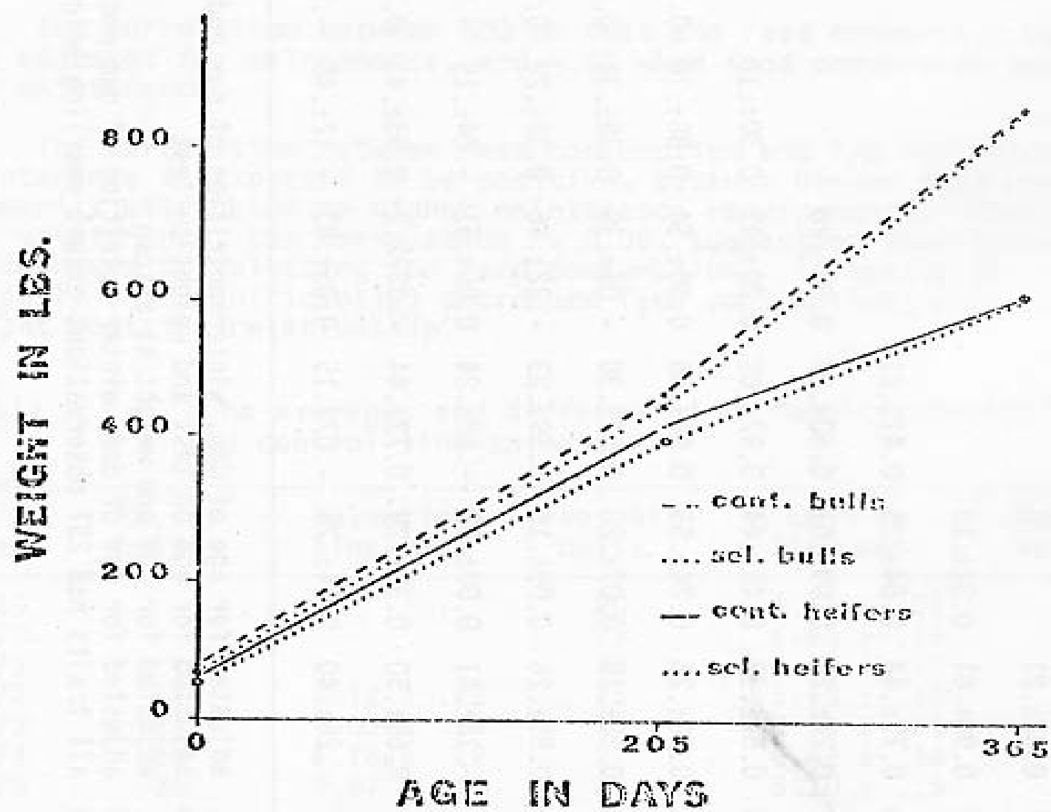

Figure 7.2. Growth curve in selection and control line by sex.

Weaning Calves' Response to a Medicated Top Dressing

A. A. Fleck, R. R. Schalles, Jack Riley,
G. Fink and D. S. O'Banion

Summary

Adding a medicated top dressing to a weaning calf ration did not reduce calf sickness, but increased weight gains the second and third weeks of a three-week weaning trial.

Introduction

Beef industry economics is forcing beef producers to get calves on feed and gaining as soon after weaning as possible. There are many types of starter rations, top dressing, and management practices but the value of some is questionable. This trial was designed to compare the performance of post-weaning calves receiving a medicated top dressing with those that did not.

Experimental Procedure

The trial began September 30, 1976, when 168 Polled Hereford calves born in March and April were weighed and weaned. At weaning all calves were shipped approximately six miles then randomly allotted into four lots.

All lots received the same basic ration (Table 8.1) plus 2 lbs/hd/day of molasses. Two lots (84 head) received ½ lb/hd/day of medicated top dressing in addition. The other two lots (84 head) received ½ lb/hd/day rolled milo in addition to make the rations TDN equivalent. All cattle received the same amount of feed.

Calves were judged sick when rectal temperatures exceeded 103 F. Those with an elevated temperature were treated according to veterinarian recommendations. Temperatures were taken at all slight indications of sickness. Temperatures were taken daily of calves with raised temperatures until temperature returned to normal. All lots received the same clinical treatments.

The calves were weighed every seven days. The calf height was taken with the last weight to establish a weight-height ratio--a measure of fatness.

Results and Discussion

Calves receiving the medicated top dressing had higher average daily gains (ADG) and mean weights when compared to the non-medicated groups. (Table 8.2). The differences became larger as the trial progressed, but the medicated top dressing had no significant effect on number of calves that became sick. All calves that were judged sick were treated and recovered.

Data of all calves showed the weight-to-height ratio (measure of conditioning) was slightly related ($P<.07$) to the number of sick calves. The more conditioned calves were less susceptible to sickness.

In this trial the addition of a medicated top dressing to a calf weaning ration resulted in increased weight gains.

Table 8.1 . Rations used in test of medicated top dressing.

Item	Lots A and C (Controls)		Lots B and D	
Basic ration	Prairie hay	30%	Prairie hay	30%
	Rolled oats	42%	Rolled oats	42%
	Rolled milo	20.5%	Rolled milo	20.5%
	Soy bean meal	7.3%	Soy bean meal	7.3%
	Molasses	2 lb/hd/day	Molasses	2 lb/hd/day
Top dressing	Rolled milo	100%	Rolled milo	49.38%
			Milk replacer	46.91%
			Oreomycin 700	2.22%
			Vitamin A	0.49%
			Animal fat	0.99%

Milk Replacer Content: (Milk fat .01%), (Protein 27.037%), (Ash 6.149%), (Sodium .371%), (Carbohydrate 62.519%), (Potassium 1.186%), (Thiamine Hydrocloride .00037%), (Riboflavin .00074%), (Nicotinamide .0037%), (Pyridoxine Hydrocloride .00018%), (Calcium Pantothenate .0037%), (Folic Acid .00009%), (Ascorbic Acid .05555%).

Table 8.2 . Performance Chart.

Item	Period	Top Dressing Non-medicated	Top Dressing Medicated
ADG	1st week	-1.071 lbs/day	-1.072 lbs/day
	2nd week	1.454 lbs/day	2.848 lbs/day
	3rd week	.568 lbs/day	1.828 lbs/day
Mean	1st week	344.1 lbs.	343.1 lbs.
	2nd week	345.1 lbs.	363.7 lbs.
	3rd week	358.4 lbs.	376.5 lbs.

Results of Kansas Demonstrations on Implanting Suckling Calves and Yearlings

Larry Corah, Frank Schwartz, Frank Brazle,
Tom Orwig, and Gene Francis

Summary

To encourage greater use of implants in beef cattle industry in Kansas, 62 implant demonstrations were conducted in 31 different counties in Kansas. 1,402 implanted suckling calves gained an average of 15.1 pounds more than 694 non-implanted calves. In 19 yearling trials, 616 implanted yearling steers and heifers gained 20.0 pounds more than 365 yearlings.

The results suggest utilizing implants as a regular management practice for suckling steer calves and yearling steers and heifers.

Introduction

Research at Kansas State University and other Universities has shown that implanting both suckling calves and yearling steers and heifers on summer grass is an excellent management practice. Research results have shown that implanting suckling steer and heifer calves with either DES or Ralgro usually improves weaning weights by 15 to 20 pounds. Likewise, implanting yearling cattle with either Synovex S or H, DES, or Ralgro improves summer gains on grass by 15 to 30 pounds.

Despite those research results, the percentage of implanted suckling calves and yearling cattle on growing programs in Kansas are still very low. To get further information on implanting, as well as to demonstrate the use of implants, a series of demonstrations were set up in all the Extension districts of Kansas.

Appreciation is expressed to the following County Extension Agents for conducting implant demonstrations:

Northwest District: Paul Wilson, Barton; Roger Hendershot, Ellis; Steve Tonn, Graham; Ross Nelson, Logan; Clifford Meireis, Norton; Tom Rutherford, Rawlins; Warren Harding, Rooks; Gene Algrim, Rush; Del Jepsen, Russell; Jim Grider, Sheridan; Wilber Dunavan, Smith; Don McWilliams, Wallace; Darrell Hager, Cheyenne

Southwest District: John Robertson, Comanche

South-central District: Kent Springer, Saline; Milton Krainbill, Lincoln; Virgil Carlson, Ellsworth; Ben McCully, Harper; Steve Westfahl, Sedgwick

Northeast District: Jim Adams, Atchison; Darrel Hosie, Cloud; Julian Toney, Douglas

Southeast District: Glenn Gottlob, Crawford, Ted Wary, Cherokee; Mike Holder, Chase; Duane Jeffrey, Chautauqua; Tom Maxwell, Allen; Bob Bozworth, Franklin; Dan Shively, Labette; Dale Ladd, Morris

Demonstration Procedure

County Agents and Area Livestock Specialists in all areas of Kansas worked with cooperating livestock producers to set up 43 demonstrations on implanting suckling calves, and 19 demonstrations in four districts implanting yearling cattle primarily on summer grass. In most of the demonstrations conducted, Ralgro implants were used, but in some of the demonstrations, the cattle were allotted so that some were implanted with Ralgro and some with DES. Since the response to both DES and Ralgro was similar the data is not segregated by implant type. Likewise, results from steers and heifers were similar so sex is ignored.

Weights were recorded directly off pasture when the trials started and ended.

Results and Discussion

In the 43 trials conducted in 23 counties, 1,402 calves were implanted with 694 calves serving as a control. Average increase in weaning weight of the 1,402 calves was 15.1 pounds, very typical of previous research results. Considerable variation in response occurred from ranch to ranch.

The 616 implanted yearling steers and heifers were compared to 365 control calves. The average implant response was 20.0 pounds which again was very consistent with previous research.

Table 9.1. Demonstration results from implanting suckling calves.

Area of state	No. trials	No. counties	No. implanted calves	No. control calves	Average response to implants, lbs.
Southeast	15	6	323	253	+11.3
South-central	2	2	35	18	+14.9
Northeast	9	3	180	129	+14.0
Southwest	1	1	110	12	+31.0
Northwest	16	11	754	282	+14.7
Total	43	23	1,402	694	+15.1

Table 9.2. Demonstration results from implanting yearling steers and heifers.

Area of state	No. trials	No. counties	No. implanted calves	No. control calves	Average response to implants, lbs.
South-central	5	4	136	76	+30.2
Northeast	5	3	192	97	+19.7
Northwest	4	3	161	67	+15.3
Southeast	5	4	127	125	+15.5
Total	19	14	616	365	+20.0

Effect of Feeding Rumensin During the Growing Phase on Subsequent Reproductive Performance of Yearling Heifers[a,b]

Larry Corah, Jack Riley, Keith Bolsen, and Miles McKee

Summary

Seventy five purebred heifers were used to determine whether Monensin, (trade name Rumensin) fed during the initial growing period after weaning, would affect the reproductive performance of yearling heifers. Rumensin had virtually no effect on reproductive performance as determined by the percentage of heifers cycling at the start of the breeding season or the percentage of heifers that conceived at first service and during the breeding season. A slightly higher percentage of the Rumensin fed heifers were cycling at the start of the breeding season.

Although the study shows that replacement heifers on roughage rations can successfully be fed Rumensin, causing both a savings in feed as well as improved growth rate, current clearance of Rumensin does not recommend its use with breeding animals.

Introduction

In the initial research study conducted with Monensin (Rumensin) at Kansas State University (reported in 1976 Cattlemen's Day Report of Progress No. 262) 96 heifers were allotted to either serve as a control or else were fed 200 mg of Rumensin per head per day. These heifers were fed Rumensin 89 days after being weaned until two months before breeding. Use of Rumensin with growing heifers, fed either an all milo stover silage or all forage sorghum silage or a combination of the two silages, resulted in a 7.6% increase in average daily gain and 11.6% improvement in feed efficiency. Seventy five of those 96 heifers were selected to be bred and used as replacements in the University purebred herd. This study analyzes Rumensin's effect on the reproductive performance of those heifers, bred as yearlings.

Procedure

Seventy five Hereford, Polled Hereford, Angus and percentage Simmental heifers ranging from seven to ten months of age were fed Rumensin at the rate of 200 mg per head per day during the growing period after weaning; 36 of the 75 heifers were fed Rumensin for an 89-day period (from December

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[a]Rumensin and partial assistance provided by Ely Lily Company. Rumensin is a trade name of Elanco Products Co.

[b]Appreciation is expressed to Ruth Schwitzer, student in Animal Science and Industry, who helped compile this information.

10, 1974 to March 10, 1975). The remaining 39 heifers were fed identical rations except the Rumensin was omitted.

The rations that all the heifers were fed contained 73% roughage (which was either 100% milo stover silage, 67% milo stover silage and 33% forage sorghum silage, 33% stover silage and 67% forage sorghum silage, or 100% forage sorghum silage) and 27% protein supplement, mineral, and grain.

After the feeding trial was completed March 10, the heifers were grouped and fed similar rations until the start of the breeding season on May 20. For three weeks before the breeding season, the heifers were heat checked twice daily to determine if there was cycling. The heifers were artificially inseminated the first 36 days and then bred naturally an additional 26 days. The heifers were then handled similarly from breeding until calving.

Results and Discussion

The breeding performance of the yearling heifers is shown in Table 10.1. Nine percent more heifers were cycling, or having reached puberty by May 20 when they were fed Rumensin during the growing period. However, no difference in first service conception rates or net conception rates during the breeding season was observed. The average breeding dates of the heifers conceiving was May 30 for those fed Rumensin during the growing period and May 28 for control heifers.

Results of this study suggest that the new feed additive, Rumensin, can be safely fed to growing heifers that will be retained as herd replacements without any adverse effect on reproductive performance.

Table 10.1. Effect of Rumensin on reproduction in first calf heifers.

	Treatment	
	Rumensin	Control
Number of heifers	36	39
% cycling, May 20	75	66
% 1st service conception	63	63
% 2nd service conception	24	30
% total conception	91	87
Average breeding date	May 30	May 28

Feeding Monensin to Yearling Cattle on Summer Grass

Frank Schwartz, Ed Smith, Jack Riley and Larry Corah

Summary

Two grazing trials conducted at different locations in Kansas evaluated feeding Monensin to grazing yearling cattle. In one trial Monensin was fed with and without implant treatments of diethylstilbestrol or Ralgro. Monensin increased weight gain on summer grass; diethylstilbestrol and Ralgro implants also increased weight gains, and the combination of Monensin with either implant was more effective than Monensin alone.

Introduction

Previous research conducted at Kansas State with the newly released feed additive, Monensin showed average daily gain of cattle on growing rations increased by 5-8% and feed efficiency improved by 10-12%.

The current experiments reported here were conducted during the summer grazing season of 1976 at two locations in Kansas to study the effect of feeding Monensin to yearling cattle during the grazing season.

Experimental Procedure

Trial 1

Thirty-six Hereford and Angus-Santa Gertrudis cross steers were randomly allotted into two groups. Both groups were implanted with Ralgro and each grazed a 60-acre native bluestem pasture from April 28 to October 6, 1976. They had available in covered boxes commercial feed blocks[1] composed primarily of cane molasses; soybean meal feed, 20%; salt, 16-20%; and other feed ingredients. One group had Monensin added to the feed block at 327 mg. per pound. All steers were gathered the first of each month, penned overnight without feed or water, weighed the next morning, and rotated between pastures each month.

Trial 2

Sixty-two yearling cattle of mixed origin were allotted at random to

[1]Feed blocks supplied by A. E. Staley Mfg. Co., Decatur, Ill., whose support is greatly appreciated.

two pasture groups at a ranch in northwestern Kansas.[2] The yearling cattle consisted of 52 steers and 10 heifers with the heifers randomly dispersed through the treatments. They were weighed directly off pasture initially and at the end of the trial. When weighed initially they were implanted, wormed, and vaccinated for black leg. Approximately one-third of the cattle in each pasture group received no implant, one-third were implanted with 30 mg. of diethylstilbestrol (DES), and one-third with Ralgro. The pasture was a typical northwestern Kansas short grass pasture; the two pasture groups were separated by an electric fence.

Two lbs of cracked corn were hand fed daily per head to both pasture groups. Monensin was mixed with the cracked corn to provide 100 mg. per animal per day to one of the pasture groups. The trial started May 2 with the cattle weighed directly off pasture July 21. The Monensin and grain were initially fed to cattle May 17 and then daily through July 21. Thus, Monensin was fed only for 65 days while the implanting comparison covered the full 80-day growing period.

Results and Discussion

Trial 1

Gain by steers getting Monensin on native bluestem pasture was 1.60 lbs. per steer daily compared with 1.32 for those not getting Monensin (Table 11.1). Intake of feed blocks available free choice averaged 0.32 lb. per steer daily for the Monensin group, slightly less for the non-Monensin. At that level steers received 123 mg. of Monensin per steer daily.

Trial 2

Use of Monensin over a 65-day trial increased the average daily gain .26 lb. which resulted in an extra 20.5 lbs. for the full 80-day trial period (Table 11.2). DES and Ralgro implants increased summer gains per animal 12.5 and 18.4 lbs., respectively (Table 11.3). Implants and Monensin in combination gave the best improvement in summer gains--37.6 extra pounds with the DES-Monensin and 35.2 extra pounds with Ralgro-Monensin (Table 11.4).

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[2]Appreciation is expressed to Mr. Stan Albers and Ed Karnes, Hoxie, Kansas, for providing the cattle and pasture and to Sheridan County Extension Agent, Jim Grider, for assistance in conducting the trial.

Table 11.1. Feeding Monensin to steers on summer bluestem pasture - Trial 1.

	No Monensin lbs.	Monensin lbs.
Initial weight	471	476
Final weight	683	733
Daily gain	1.32**	1.60**
Feed block, lbs. consumed per steer daily		
May	0.17	0.23
June	0.22	0.23
July	0.26	0.46
Aug.	0.43	0.30
Sept.	0.24	0.40
Avg.	0.26	0.32

** Differ significantly (P<0.01).

Table 11.2. Effect of Monensin on summer gains - Trial 2.

	Treatment	
	Control	100 mg. Monensin/ hd/day
No. cattle	31	31
Starting weight, lbs.	533	514
Final weight, lbs.	681.9	683.4
Lbs. gained	148.9*	169.4*
Average daily gain, lbs.	1.86*	2.12*
Treatment response, lbs.		+20.5

*P<0.05.

Table 11.3. Effect of implants on summer gains - Trial 2.

	Treatment		
	Control	DES	Ralgro
No. cattle	19	20	23
Starting weight, lbs.	503.8	535.5	528.0
Final weight, lbs.	652.4	696.6	695.0
Lbs. gained	148.6[a]	161.1[b]	167.0[b]
Average daily gain, lbs.	1.86[a]	2.01[b]	2.09[b]
Treatment response, lbs.		+12.5	+18.4

[ab]Means followed by dissimilar letters differ significantly (P<0.05).

Table 11.4 Effect of using Monensin and implants in combination - Trial 2.

	Control	DES and Monensin	Ralgro and Monensin
No. cattle	10	10	12
Starting weight, lbs.	510	524.5	517.5
Final weight, lbs.	646	698.1	688.7
Lbs. gained	136[a]	173.6[b]	171.2[b]
Average daily gain, lbs.	1.70[a]	2.17[b]	2.14[b]
Treatment response, lbs.		+37.6*	+35.2*

[ab]Means followed by dissimilar letters differ (P<0.05).

Sources of Supplemental Protein for Cows Wintered on Milo Stubble

Miles McKee, Kris Kimple, and Ken Conway

Summary

We used 63 pregnant Hereford cows in mid gestation to evaluate need and source of supplemental protein on milo stubble. Cows fed free choice a 16% experimental nonprotein-nitrogen-based liquid supplement lost significantly more weight than cows receiving 2 lbs/head/day of a 16% natural protein cube or cows getting no protein supplement. Cows with access free choice to an 18% commercial nonprotein-nitrogen-based liquid supplement lost significantly more than cows receiving 2 lbs/head/day of 16% natural protein cube.

Introduction

Milo stubble is economically important to cow herd operators. Type of protein supplement for cows grazing milo stubble is a part of the total program.

Experimental Procedure

Ninety-four acres of milo stubble was divided into four equivalent areas for grazing. Sixty-three pregnant Hereford cows were allotted into three groups of 16 and one of 15 to graze the stubble. Grazing started November 20, 1975, and ended January 12, 1976 (53 days). Snow cover one day necessitated feeding 400 pounds of wheat straw to each group. Cows were weighed on and off test. At weighing each cow was visually appraised for condition by three persons. Scores of the three were averaged to assign each cow a condition score.

One group of cows went through the test without protein supplementation. A second group was fed 2 lbs/head/day of 16% natural protein cube. The third and fourth groups had free access to non-protein-nitrogen-based liquid supplements. One of the supplements was an 18% protein equivalent provided by a commercial products group, the other was a 16% protein equivalent experimental mixture.

Results

Cow performances are shown in Table 12.1. The cows receiving the cubes had the least change in visual condition score and gained 13 pounds (average). That weight change differed significantly ($P<.01$) from either group on liquid supplement. The cows without supplementation lost less weight and had less change in condition than either group on liquid supplement.

Table 12.1. Performance of cows supplemented with different protein sources while grazing milo stubble (20 Nov. '75 to 12 Jan. '76 - 53 days).

Protein source	No. cows	Avg. daily consumption	Cow weights, lbs.[1]			Condition scores[2]		
			Initial	Ending	Change[1]	Initial	Ending	Change
16% natural protein cube	16	2 lbs	996	1009	+13[a]	5.63	5.18	-.45
No supplement	16	-----	986	982	-4[ab]	5.56	4.91	-.65
18% commercial NPN-based liquid supplement	15	7 lbs	1035	1007	-28[bc]	5.87	4.65	-1.22
16% experimental NPN-based liquid supplement	16	7 lbs	994	947	-47[c]	5.44	4.41	-1.03

[1] Average weights with different superscripts differ significantly (P<.01).

[2] Condition scores visually assigned on scale of 1-10; 1 = extremely thin, 10 = extremely fleshy.

Large-package and Ensiled Milo Stover for Maintaining Pregnant Cows

Kris Kimple, Miles McKee, and Galen Fink

Summary

One hundred-two mature Simmental and Hereford cows in mid to late gestation were used to compare three maintenance rations during an 83-day trial: (1) milo stover silage, (2) large package milo stover (stacks and bales), and (3) forage sorghum silage. Each breed was represented by a pen of 17 cows in each of the forage groups. Cows fed forage sorghum silage gained significantly more than cows on other rations. Cows receiving milo stover silage lost heavily early because amounts were inadequate. They gained when stover silage was increased. Cows fed ad libitum on dry milo stover lost weight during the last 30 days of the trial.

Introduction

Increased production costs and depressed grain and livestock prices have increased interest in using corn and milo crop residues for beef cow systems. Recent development of large, package-harvesting systems add another possibility.

Previous work here showed milo stover silage worth 85 to 90 percent as much as forage sorghum silage for maintaining cows in late gestation. Work at other stations with corn residues indicated superior performance from ensiled residue over dry harvested corn residue. This trial evaluated milo crop residue for winter cow maintenance and compared harvesting methods by cow performance.

Experimental Procedure

Milo stover and forage sorghum silages were harvested after a killing frost in October, 1975, with a two-inch recutter screen. Milo stover silage was ensiled in a trench silo; forage sorghum silage, in a 10 x 50 ft. concrete stave silo. Dry milo stover was packaged in late October with a Hesston Stakhand 10 (stack weight 2000 lbs) and Hesston 5600 Baler (bale weight 1200 lbs.).

One hundred two mature cows in mid gestation maintained in drylot year-round were allotted by weight and condition into three forage treatment groups. Cows were divided by breed into two pens per forage treatment during the 83-day trial and were weighed on and off trial with no feed before weighing.

Forage and milo stover silages estimated to be 67 and 57 percent TDN, respectively, were fed at maintenance levels. Dry stacks were fed ad libitum through collapsable feeding panels. A standard cow supplement was fed daily[a] (1.25 lbs. first 53 days; 1.5 lbs. final 30 days). All cows received 2 lbs. of corn per head daily the first 20 days.

Results and Discussion

Cow performances are shown in Table 13.1. During the first 53 days, Hereford and Simmental cows fed dry milo stover gained 29 and 17 lbs., respectively. Both groups lost weight and condition the last 30 days with corresponding decreases in dry matter intake.

Cows receiving forage sorghum silage were adequately maintained early and gained weight during the latter part of the trial, so they gained significantly more than other groups through the total trial.

Milo stover silage cows lost weight (-71 and -97 lbs.) the first 53 days. We think we overestimated stover silage energy and underfed dry matter the first 53 days. Feeding the silage close to ad libitum the last 30 days brought dry matter intake up to adequate levels so both groups were gaining at the trial's close.

Late winter weight loss by cows on dry stover may reflect: (1) decreased intake, (2) increasing cow requirements, (3) decreasing stack nutrients as storage time increased, and (4) decreasing palatability due to mold or low moisture.

The mild winter provided ideal feeding conditions and minimized stack waste to 10-15 percent. Results indicate that milo stover silage could adequately maintain cows in late gestation if fed near ad libitum. Dry stacked milo stover may require supplemental energy in late gestation due to depressed intake of the drier material.

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[a] Supplement formulation lbs/ton: SBOM 1070; rolled milo, 491, salt, 200; bone meal, 134; urea, 64; Z-10 trace mineral, 20; aurofac 10, 15; vitamin A, 6; wet molasses, 40.

Table 13.1. Daily intake and cow response to forage sorghum silage and ensiled or dry harvested milo stover.

	Cow treatment groups					
	Dry stacked milo stover		Milo stover silage		Forage sorghum silage	
	Hereford	Simmental	Hereford	Simmental	Hereford	Simmental
No. of cows	16	18	17	17	17	17
Average starting weight, (lbs.)	1009	1172	999	1171	1013	1172
Average starting condition[b]	5.5	5.7	5.4	5.7	5.4	5.7
November 20 to January 12 (53 days)						
Dry matter intake (lbs.) daily	23.5[a]	24.2[a]	15.2	15.6	13.5	13.9
Weight change (lbs.)	29	17	-71	-97	14	-7
Condition change[b]	-.1	.15	-1.0	-.3	.0	.2
January 13 to February 12 (30 days)						
Dry matter intake (lbs.) daily	18.5	18.4	20.6	21.4	11.6	12
Weight change (lbs.)	-28	-40	79	37	42	37
Condition change[b]	-.3	-.65	.35	.35	.0	.05
Summary						
Total weight change (lbs.)	1	-23	8	-60	56	30
Total condition change[b]	-.4	-.5	-.65	.05	.0	.25
Calf birth weight (lbs.)	67	84	75	91.0	75	90
% cycling at breeding[c]	81.5%		86.7%		90%	

[a] For dry stacks, disappearance is assumed as intake (waste estimated at 10-15%).

[b] Condition score is an average visual appraisal by three men with 1 = extremely thin and 10 = extremely fleshy.

[c] Represents percentage of cows remaining in the herd that cycled from May 20 to June 20.

Table 13.2 . Compositions of the roughages fed cows in dry lot.

Item	Milo stover silage	Dry harvested milo stover		Forage sorghum silage
		bales	stacks	
Dry matter, %	29.7	63.8	65.0	29.0
		%, dry matter basis		
Crude protein	5.2	5.0	5.1	7.6
Crude fiber	29.6	29.2	33.0	25.0
Ether extract	1.4	2.2	2.0	1.9
Ash	14.2	13.0	10.9	8.1
TDN[1]	59.0	58.0	56.2	62.2

[1] TDN calculated from crude fiber.

A New Tool For Evaluating forages

L. H. Harbers, F. K. Brazle and C. E. Owensby

Summary

The scanning electron microscope has been used to observe the digestion of alfalfa hay and warm- and cool-season grasses. Photomicrographs show that leaves of all species are digested by bacteria and protozoa attacking either the upper part of the leaf or exposed edges; lower leaf surfaces are never attacked. Intake of a forage depends on how rapidly rumen bacteria and protozoa can enter the upper leaf surface and digest underlying material (mesophyll) leaving most of the highly lignified nutrient-carrying vessels (vascular tissue) undigested.

Introduction

A new type of microscope, purchased by the Kansas Agriculture Experiment Station and supervised and directed by Dr. C. W. Pitts, Entomology, scans the surface of material with an electron beam so that three dimensional images can be obtained at high magnifications. It helps scientists study such diverse agricultural materials as insects, soils, plants, grains, pollen, bacteria, and animal tissues.

Over the past several years, using this microscope, we have been able to study the digestion of grains and forages. The photomicrographs presented here show how alfalfa hay (leaves and stems) and leaves of cool-season grasses (brome and fescue) and leaves of warm-season grasses (big and little bluestem) are digested.

Materials and Methods

Leaves and stems were collected and frozen in liquid nitrogen to keep all structures intact. They were put into nylon bags and digested in rumen fistulated steers for various times. They were then preserved, dried, and mounted for observation under the scanning electron microscope (SEM).

Results and Discussion

Leaves of alfalfa hay (figure 14.1a) are rapidly digested by rumen bacteria as shown in figure 14.1b. The upper surface (cuticle) is rapidly and randomly sloughed, and underlying tissue is digested by 24 hours leaving only lower cuticle and its hair.

Alfalfa stems (figure 14.2a) are rapidly digested by sloughing of the outer surface and breakdown of the dense layer beneath. Further digestion of the stem is slight (figure 14.2b).

Brome and fescue are digested more slowly than alfalfa leaves, as in figure 14.3. Approximately 90% of the upper surface of brome is attacked by bacteria. It appears that silica or cutin or both limit digestion to 50% of the upper surface of fescue (K-31) so it takes longer than brome to reach and digest underlying material. Vascular tissue is not attacked in either grass so the amount of vascular tissue and structural inhibitors in the upper surface influence intake and rate of digestion even though chemical analyses may be similar.

Further inhibition by silica bodies and cutin are shown by the slow penetration of bacteria and protozoa into bluestem (figure 14.4).

The SEM studies show that chemical analyses and digestibility cannot always accurately explain differences in utilization of forages. The type of cutin and distribution of silica appear to be more important than the quantity of either. The amount of vascular tissue (major lignin component) in both grasses and legumes serves as an endpoint of digestion rather than an inhibitor of digestion.

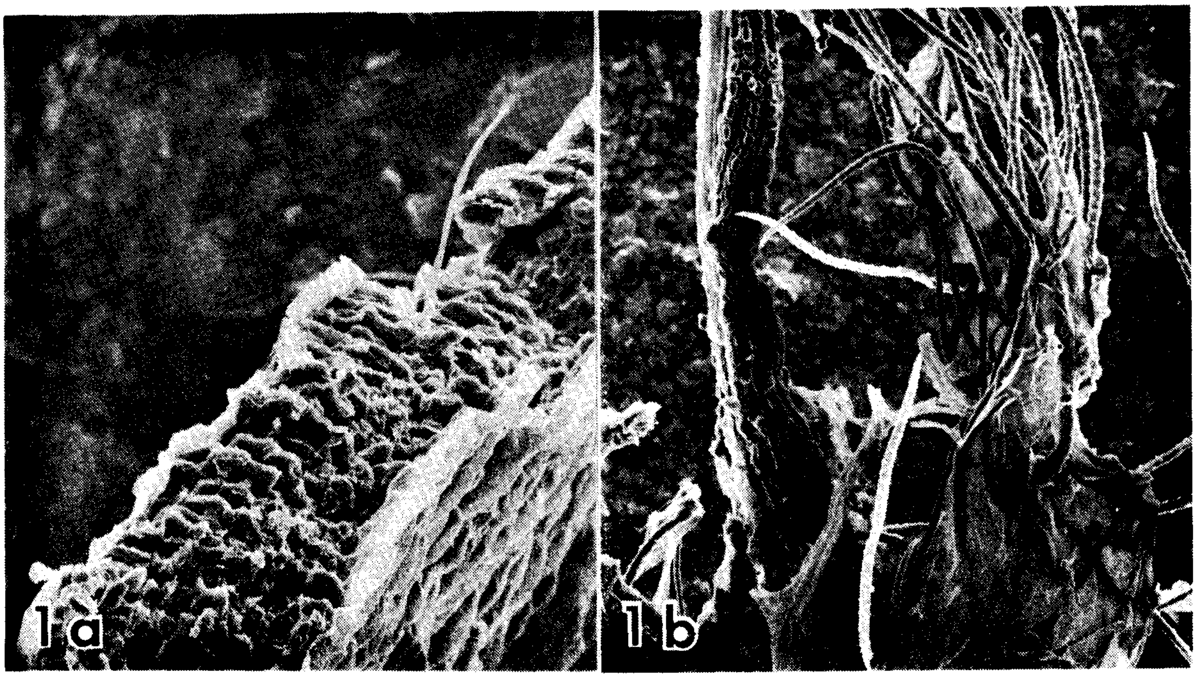

Figure 14.1 Alfalfa leaf. a) Cross-section of alfalfa leaf before being digested. b) Remains of alfalfa leaf after 24 hours' digestion shows upper cuticle (left) and lower cuticle with hair.

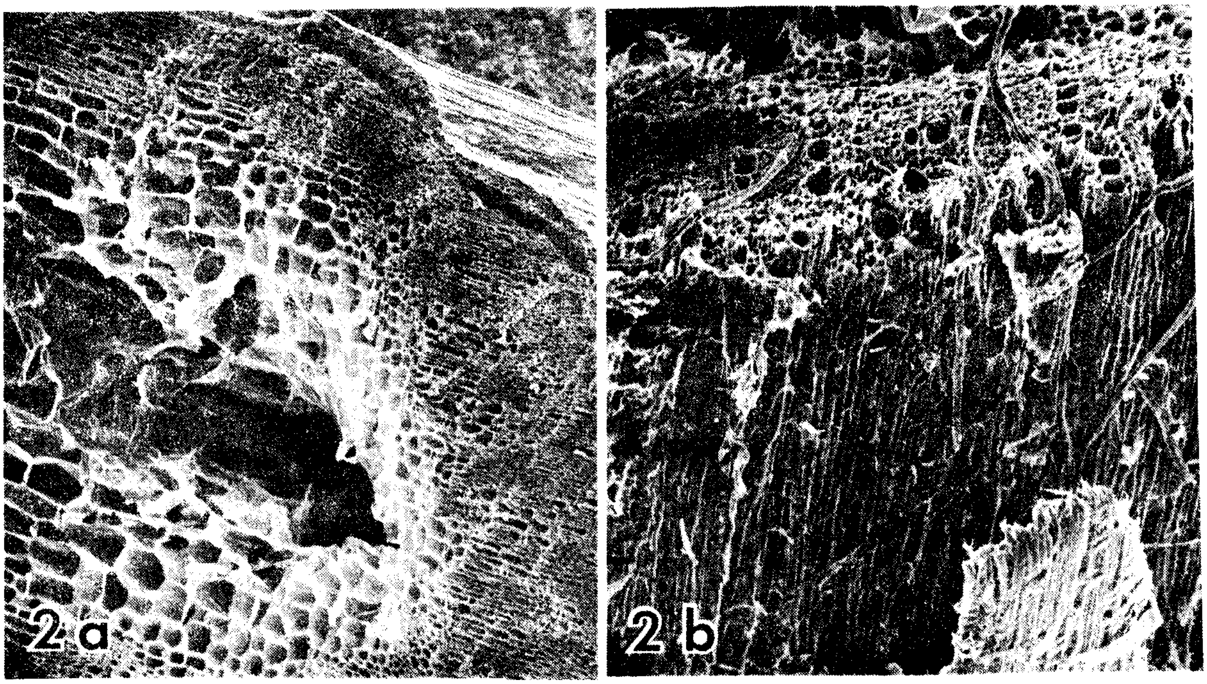

Figure 14.2 Alfalfa stems. a) Cross-section of alfalfa stem before being digested. b) Cross-section after 48 hours.

Figure 14.3 Digestion of fescue after 48 hours in the rumen.

Figure 14.4 Digestion of big bluestem.

In Vitro Digestibility of Flint Hill Rangeland Forages

J. E. Umoh, L. H. Harbers, E. F. Smith,
D. Boggs, and J. Whitney

Summary

We used an *in vitro* digestibility technique to determine the nutritive value of predominately native bluestem forage on burned and nonburned Flint Hills pastures. We also collected forage samples via esophageal fistulas to get what the animals consumed while grazing selectively.

Dry matter (DM) digestibilities for 11 months by both techniques followed changes in climatic conditions. The lowest DM digestibility averaged about 65% in October, 1975, and June, 1976; the highest (about 80%) was between February and March 1976. The grass selected by animals was usually more digestible than that harvested by hand. However, *in vitro* digestibility of the extrusa may be higher than actual digestibility in the animals when both solid and liquid fractions of the extrusa are collected.

Introduction

Range pasture varies widely in quality and botanical composition. Most US rangelands are semi-arid with seasonal variation in precipitation and temperature. The growth characteristics, quality, and availability of grass govern the time animals graze. Various factors have been recommended to measure forage quality, growth characteristics, and availability.

The esophageal fistula permits sampling the grazed forage. In this report, *in vitro* digestibility of esophageal fistulated grass samples was used to assess forage quality of Flint Hills rangeland.

Experimental Procedure

The rangeland used is 4 miles northwest of Manhattan. Most of the pastures are grazed by Hereford beef-cows with calves. In 1975, 9 pastures totaling 492 acres were selected for burned and nonburned treatments. Five were burned April 22, 1975. Two esophageal fistulated steers were used to collect grass samples once a month from one burned and one nonburned pasture. The steers were fasted 24 hours before entering pastures for grazing/sampling. Canvas bags with wire-mesh bottoms were suspended below the esophageal fistulas to collect the grass as they grazed. The samples were dried at 55F, ground, and used for *in vitro* digestibility of dry matter (DM) and organic matter (OM) measurements. 1975, sampling started in October and continued into 1976.

In the spring of 1976, burned pastures were burned April 23. Sampling continued as in 1975. Burning in 1976 was sporadic because most of the pasture had already turned green, which permitted continuous sampling.

Results and Discussion

Preliminary results of the *in vitro* digestibility studies are summarized in Figure 15.l.

The figures appear rather high but *in vitro* digestibility figures are higher than actual digestion, when the extrusa used to determine the digestibility contains both solid and liquid fractions. Also, grazing animals usually select more nutritive and more digestible grass than that randomly harvested by hand.

The trend in Figure 15.l shows how the DM digestibility varied with seasons and climatic conditions. In burned and nonburned pastures digestibility gradually increased from November to January and on to a peak between March and April, 1976. The first spring lush grass harvested was responsible for the peak. Then digestibility declined to the lowest point between June and July, the hottest months of the year. Autumn regrowth started in August after the only good rainfall in August.

On the whole, DM digestibility of the burned pasture exceeded that of the nonburned pastures.

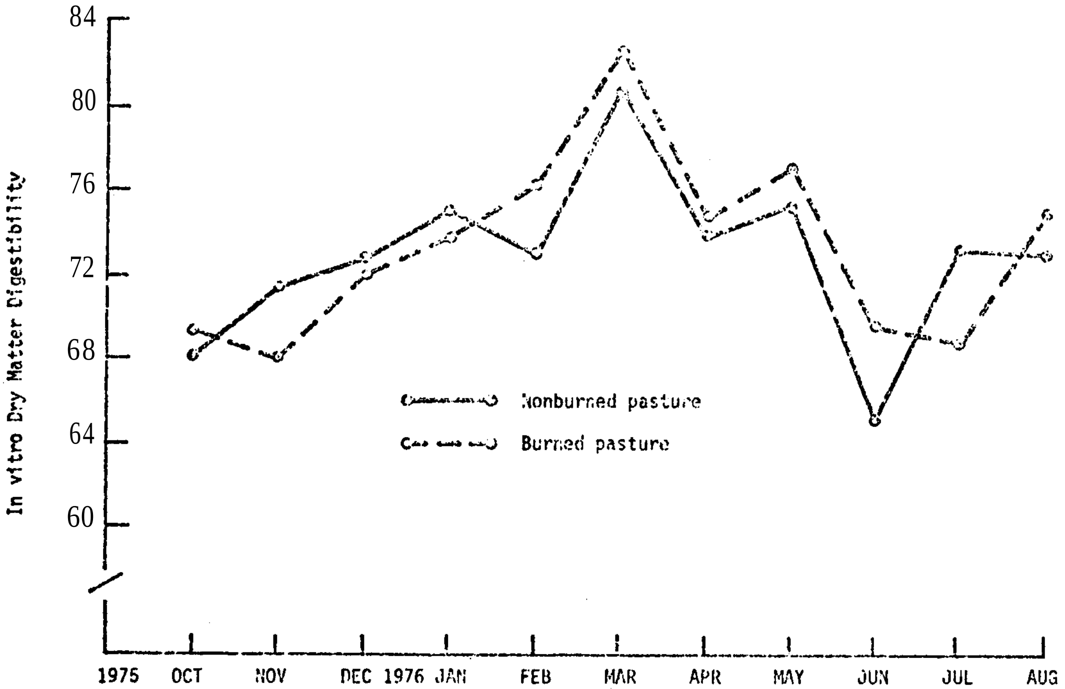

Figure 15.1. Effect of month on steer digestibility of native range.

Forage Intake as one Estimate of the Nutritive Value of Flint Hills Rangeland Forage

J. E. Umoh, L. H. Harbers and E. F. Smith

Summary

Forage intake was used as an estimate of the nutritive value of Flint Hills pastures. The organic matter intake (OMI) ranged from 16.3 lb. to 22.05 lb. (7.40 to 10.0 kg) between June-August, 1976, and there was no clear difference between the burned and nonburned pastures. Intake seems to fluctuate with maturity of grass, digestibility, and as grazing season progresses. More data are still needed for computing the nutritive value of Flint Hill pastures.

Introduction

Intake and digestibility are important factors in nutritive value of forages for ruminants. Crampton (1957) showed that the feeding value of a forage depends more on the amount consumed than on its chemical composition. That concept led to a "Nutritive Value Index" for forages based on cattle's voluntary intake and the digestibility of the forage.

Various techniques and schemes have been used to determine the intake of a grazing animal. Such information is necessary for adequate by managing range livestock. To a certain extent, voluntary intake of forage varies with forage digestibility, and nutrient contents of forage vary with maturity so knowing forage intake would help range managers know when to feed supplements to cattle or when to reduce the number of cattle on ranges.

We are measuring forage intake from Flint Hill range pasture by a fecal nitrogen technique. Preliminary results are reported here.

Experimental Procedure

This study started in June, 1975. The equation used to estimate forage intake was derived in 1972 after harvesting forage from the range.

Two pastures (one burned on April 23, 1976) were used for this study. Two Hereford steers, weighing about 900 lbs. each, were used in each of the 2 pastures to measure forage intake. After a week on pasture the steers were harnessed with canvas collection bags, and confined to a small area. Then all defecation except urine was collected for 24 hours. Feces dry matter was determined by drying a small portion in a forced-air oven at 100C.

The dried feces was milled and analyzed for chemical composition. Nitrogen percentage in the feces and fecal organic matter produced were used in the following equation to estimate organic matter intake (OMI):

$\hat{Y}$ (OMI) = 1.128 + 1.752 x (Fecal nitrogen)(Fecal organic matter).

Results and Discussion

The results of the OMI (kg) for June, July, and August, 1976, are presented in Table 16.1. Intakes in both pastures were less in June than August. The low forage digestibility in June (discussed in another paper in this publication by Umoh et al.), was partially responsible for the low herbage OM intake. A second explanation is that by August steers were more accustomed to the facilities, were consuming more, and behaving normally, which increased fecal organic matter output. Third, and perhaps most important, the steers were growing so their intake was sure to increase.

The three months' measurements gave no clear indication whether intake was higher on burned or nonburned pastures. More data are needed on digestibility and chemical composition to establish the nutritive value of Flint Hills pastures.

Table 16.1. Percentage of fecal nitrogen and kg of fecal organic matter from steers on Flint Hills pastures.

	Nonburned	Burned
	June	
Fecal N (%)	2.030	2.040
Fecal OM (kg)	1.804	2.012
OMI (kg)	7.547	8.279
	July	
Fecal N (%)	1.684	1.733
Fecal OM (kg)	2.601	2.070
OMI (kg)	8.801	7.400
	August	
Fecal N (%)	1.627	1.668
Fecal OM (kg)	3.031	3.040
OMI (kg)	9.778	10.015

Response of Yearling Steers to Burning and Fertilizing Bluestem Pasture and Intensively Stocking Early

E. F. Smith, L. H. Harbers,
C. E. Owensby, and Don Boggs

Summary

Six pastures totaling 328 acres were summer grazed by yearling steers. Four pastures were burned April 23, 1976; two were not burned. One of the burned pastures had 40 lbs. of nitrogen per acre applied aerially April 29, 1976. Another burned pasture was stocked at twice the normal rate (intensively stocked early) from April 28 to July 15. The other pastures were stocked from April 28 to October 6, 1976.

Stocking rates were based on herbage production data from experimental plots under similar treatments. Late spring burning increased daily gain, and nitrogen applied to a burned pastures increased gain per acre primarily by increasing carrying capacity. Intensive early stocking had no effect on daily gain but produced more gain per acre.

Pastures burned annually had better range plant composition than unburned pastures. The best range plant composition was on the intensively stocked early pasture.

Perennial grass left after grazing was comparable under all management schemes but weed and brush production was greater on unburned pastures than on burned ones. Weed and brush production was least on the intensive, early stocked pasture.

Introduction

Late spring burning has increased desirable warm season grasses in bluestem pastures and increased steer gains. Nitrogen fertilization has increased forage production but changed stand composition toward cool-season, lower producing species and weedy forbs. The above treatments have been used separately and in combination to study their effects on forage production and cattle performance. Effects of intensively stocking a burned pasture early are also being studied.

Experimental Procedure

Six native bluestem pastures, totaling 328 acres, five miles northwest of Manhattan were used in the study. All treatments were the same as the previous four years. One burned, nonfertilized pasture, and one nonburned, nonfertilized pasture have had the same treatment the last 26 years, to study long term effects. Burned pastures were burned April 23 and ammonium nitrate (34% nitrogen) was applied aerially April 29.

The pasture receiving nitrogen was stocked at a heavier rate in an attempt to equalize forage utilization. Pastures grazed the entire summer season were stocked from April 28 to October 6. The pasture intensively grazed early was stocked from April 28 to July 15 at twice the normal rate. All were stocked with Hereford and Angus - Santa Gertrudis cross steers averaging 476 lbs. randomly distributed among the pastures. They were implanted with Ralgro April 28. All were gathered the first of each month, penned overnight without feed or water, and weighed the next morning.

Plant census was taken in early summer on loamy upland and breaks range sites in each pasture with modified step-point system. Perennial grass and weeds and brush remaining after grazing were estimated by clipping 15 randomly placed 1/10,000 acre plots in each pasture from loamy upland and breaks range sites.

Results and Discussion

Late spring burning increased daily gain, and nitrogen applied to a burned pasture increased gain per acre primarily by increasing carrying capacity. The intensively stocked-early pasture, stocked at twice the normal rate for only the first half of the season, produced the same daily gain as normal season long stocking, but more gain per acre.

Pastures burned annually had better range plant composition than unburned pastures did. The best range plant composition was on the pasture intensively stocked early.

Perennial grass left after grazing was comparable under all management schemes but weed and brush production was greater on unburned pastures than on burned ones. Weed and brush production was least on the pastures intensively stocked early.

Table 17.1. Effects on steer gains from burning and fertilizing native bluestem pasture and stocked intensively early.

	Daily gain per steer, lbs.	Gain per acres, lbs.	Acres per steer	Steer grazing days per acre
Not burned				
No nitrogen, non-burned for 26 years	1.28	61	3.4	45
No nitrogen	1.14	54	3.4	45
Burned April 23				
No nitrogen, same treatment 26 years	1.40	66	3.4	45
No nitrogen	1.34	63	3.4	45
40 lb. nitrogen per acre	1.47	108	2.2	70
Intensively stocked April 28 to July 15 (78 days)	2.03	93	1.7	46
Normal stocked April 28 to July 15 (78 days)	2.04	47	3.4	23

Table 17.2. Perennial grass and weeds and brush (lb dry matter/acre) remaining after grazing indicated range sites by yearling steers.

Treatment of bluestem range	Perennial grass (lb DM/acre)	Weeds and brush (lb DM/acre)
Unburned, 0-N		
loamy upland	1542	370
breaks	1492	449
Burned, 0-N		
loamy upland	1244	143
breaks	1267	169
Burned, 40 lb. of N		
loamy upland	1335	256
breaks	1664	448
Unburned, 26 years		
loamy upland	1413	349
breaks	746	396
Burned, 26 years		
loamy upland	1025	374
breaks	1392	182
Intensive stocking early (2X) (April 28 - July 15)		
loamy upland	1301	207
breaks	787	78

Table 17.3. Percentages of indicated plant species on bluestem pastures treated as indicated and grazed with yearling steers.

	Unburned 0-N (%)	Burned 0-N (%)	Burned 40#-N (%)	Unburned 26 years (%)	Burned 26 years (%)	Intensive[1] stocking (April 28-July 15)
Big bluestem						
loamy upland	17.9	26.6	21.8	10.7	22.7	30.8
breaks	18.1	26.0	26.6	16.6	33.2	35.8
Little bluestem						
loamy upland	14.6	10.7	6.8	6.2	10.4	9.0
breaks	20.4	17.7	10.6	8.1	11.7	9.6
Indiangrass						
loamy upland	8.4	13.0	12.6	8.9	15.6	20.7
breaks	11.1	18.8	14.1	11.3	19.3	14.8
Sideoats grama						
loamy upland	5.2	9.4	8.7	6.9	9.8	4.2
breaks	12.9	14.4	19.0	11.3	19.3	14.8
Kentucky bluegrass						
loamy upland	20.4	9.3	2.9	33.8	2.9	7.1
breaks	12.3	1.8	0.4	22.7	0.8	1.4
Perennial forbs						
loamy upland	9.7	9.3	5.9	7.7	8.9	5.7
breaks	8.8	7.8	7.9	9.4	3.0	4.6

[1]Twice normal rate for half the grazing season.

Forage and Grain Yields of Barley, Wheat and Oats

Keith Bolsen and Walt Moore[1]

Introduction

Interest in small cereal grain silages for beef cattle has increased in recent years. Two years' research at this station (Prog. Rpt. 262) has shown: (1) winter barley and winter wheat had similar forage yields and (2) forage yields were highest in the dough stage of plant growth and lowest in the boot stage. In this trial, we continued to measure effects of type and variety of cereal grain on forage and grain yields.

Experimental Procedure

Plots were grown at the South Central Kansas Experiment Field near Hutchinson and at the Animal Science and Industry Farm near Manhattan in 1975-76. Two winter barley varieties used were Kanby and Paoli; hard red winter wheat varieties were Eagle and Sage; soft red winter wheat varieties were Abe and Arthur-71 and spring oat varieties were Lodi, Pettis and Trio. Varieties at Hutchinson were replicated four times; at Manhattan varieties were not replicated. All varieties were harvested for forage in the dough stage. Hutchinson plots were hand-harvested by mower - clipping a 60-square-foot area from each plot; Manhattan plots were machine-harvested. Grain yields were determined by hand-harvesting three, 12-square-foot areas from each plot.

Results

Forage and grain yields are shown in Table 18.1. Forage yields are expressed as tons of 60% moisture forage per acre; grain yields are bushels of 12%-moisture grain per acre.

At Manhattan, forage yield was highest for Abe wheat; lowest for Lodi oats. Grain yields were reduced by a late freeze (May 3, 1976), dry weather conditions and an outbreak of barley yellow dwarf.

At Hutchinson, forage yields were not affected by type or variety and were similar to yields obtained in 1975 (Prog. Rpt. 262). The 1976 average forage yield was 9.0 tons for barley, 9.5 tons for wheat and 9.0 tons for oats. The range in forage harvest dates was 29 days at Manhattan (June 2 to July 1) and 33 days at Hutchinson (May 20 to June 22).

[1] Department of Agronomy.

Table 18.1. Forage and grain yields of barley, wheat and oat varieties.

Location and variety	1976 forage harvest date	Forage yield tons/acre[a]	Grain yield bu./acre[b]
		Barley	
Manhattan			
Kanby	June 2	8.27	58.0
Hutchinson			
Kanby	May 20	10.03	77.8
Paoli	May 20	8.78	65.2
		Wheat	
Manhattan			
Abe	June 6	11.38	20.8
Arthur-71	June 6	7.63	22.0
Hutchinson			
Abe	June 4	9.27	54.4
Arthur-71	June 4	9.53	55.6
Eagle	June 4	8.84	41.1
Sage	June 4	9.76	50.1
		Oats	
Manhattan			
Lodi	July 1	6.28	19.9
Trio	June 14	7.07	32.9
Hutchinson			
Lodi	June 22	8.27	34.4
Pettis	June 16	9.64	72.0

[a] Adjusted to a 60% moisture basis.

[b] Adjusted to a 12% moisture basis.

Forage and Grain Sorghum Double-cropped Following Harvest of Small Grain Silages

G. L. Posler[1] and Keith Bolsen

Summary

The attempt to increase total forage TDN per acre by double-cropping was only moderately successful in 1975 and 1976. Limiting factors were relatively poor stands and extremely dry summer growing seasons.

Introduction

This study was conducted primarily to determine potential yield of a forage system when forage sorghum silage is double-cropped after small grain silage. The goal is to maximize the yield of forage TDN per acre and thereby increase profits when integrated with a beef enterprise. A grain sorghum variety was also included to determine if satisfactory yields might be obtained if grain were needed more than forage in the livestock operation. Minimum tillage was also compared with conventional seedbed preparation.

Experimental Procedures

DeKalb C42y hybrid grain sorghum and Asgrow Titan E hybrid forage sorghum were used both years. Plots were 10 feet x 50 feet (four 30-inch rows) with 10 or 20 feet of the center 2 rows harvested for yield. Herbicides were used to control weeds and the plots were fertilized with 60 lbs per acre actual N in 1975 and 80 lbs per acre in 1976.

Two dates of planting were planned for 1975; three for 1976. Untimely rain in late May and early June allowed only a late planting in 1975 (June 20). In 1976, extremely dry weather after the June 2 planting caused us to abandon that planting. The second planting (June 21) was followed by heavy rains and only fair stands resulted. The third planting (July 2) was made after spring oats were harvested.

Results and Discussion

Forage and grain yields are shown in Table 19.1. Yields of both were relatively low, but probably represent the low end of an expected range. Rainfall was extremely limited in both 1975 and 1976, and untimely late spring rainfall delayed planting and contributed to poor stands.

For any double-cropping system to be successful, operations must be timely. Minimum tillage equipment should allow more timely planting and

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[1] Department of Agronomy

thereby increase the percentage of successes. In this study, stands were generally erratic for both minimum and conventional tillage, contributing largely to the low yields. However, when the 10 to 15 tons per acre of forage sorghum silage is added to the 8 to 9 tons per acre of small grain silage harvested earlier (see Forage and Grain Yields of Barley, Wheat and Oats in this Progress Report), the yearly total is quite good for both 1975 and 1976. For comparison, average single crop yields in the 1975 and 1976 Hybrid Forage Sorghum Performance Tests on the same Agronomy Farm at Manhattan were 23.3 and 15.7 tons per acre.[2]

The second essential factor for double-cropping success is somewhat "normal" rainfall. We received virtually no precipitation from late June into August both years and present soil moisture conditions indicate a low probability of double-cropping success in 1977.

Table 19.1. Forage and grain sorghum yields for two tillage methods planted after barley, wheat or spring oats.

Preceding crop and harvest dates	Tillage method	Forage sorghum yield Tons/acre @ 70% moisture		Grain sorghum yield Bu/acre @ 12.5% moisture	
		1975	1976	1975	1976
Wheat and barley silage, June 2	Conventional	16.2	8.3	47.7	25.8
	Buffalo-till	15.3	10.2	46.5	33.7
Spring oat silage, July 1	Conventional	--	14.3	--	20.9
	Buffalo-till	--	8.8	--	25.8

[2]Data supplied by Ted Walter, Department of Agronomy.

Wheat, Barley, Oat and Corn Silage Rations for Growing Steers

Keith Bolsen, Jack Riley and Jim Oltjen

Summary

Eleven wheat, barley, oat and corn silages were evaluated in two steer growing trials in 1975 and 1976. In both trials, steers fed barley or corn silages had similar rate and efficiency of gains. Also, barley and corn silages supported greater performance than any of the seven wheat or oat silages. In the 1976 trial steers fed Trio or Lodi oat silage had the lowest feed consumption and made the slowest and least efficient gains.

For an average of the two trials barley and corn silages had similar feeding values. Wheat silages had 90 and 80% the relative feeding value of corn silage in 1975 and 1976, respectively. Oat silages had only 48% the feeding value of corn silage in 1976.

Introduction

In three years' research with silage growing rations at this station (Prog. Rpt. 210, 230, and 262, Kan. Agr. Expt. Sta.), we have shown: (1) corn and barley silages to have similar feeding values, (2) corn and barley silages superior in feeding value to wheat silages and (3) differences in feeding value between wheat silage varieties.

Our objectives in the two trials (1975 and 1976) were to (1) repeat comparisons of hard red and soft red winter wheat silages, (2) compare silages from grain and forage oat varieties and (3) determine relative feeding values of wheat, barley, oat and corn silages.

Experimental Procedure

Silage descriptions: Whole-plant wheat, barley, oats and corn were harvested and ensiled in the summers of 1975 and 1976.

Silage (Maturity)	Harvest dates 1975	Harvest dates 1976
Corn (Hard-dent)	Aug. 29	Aug. 20
Barley		
Paoli (dough)	June 4	----
Kanby (dough)	----	June 2
Wheat		
Arthur-71 (dough)	June 13	June 7
Eagle (milk)	June 6	----
Eagle (dough)	June 14	----
Sage (dough)	----	June 9
Oats		
Trio (dough)	----	June 17
Lodi (dough)	----	July 2

Paoli and Kanby are awned, winter barleys; Arthur-71 an awnless, soft red winter wheat; Eagle and Sage, awned, hard red winter wheats; Trio an early-maturing grain-type spring oat and Lodi a late-maturing forage-type spring oat.

All forages were direct-cut with a self-propelled forage harvester equipped with a 15-foot cutter bar and two-inch recutter screen. Water was added to the forages, when necessary, to maintain 63 to 67 percent forage moisture in the 10 x 50 ft. concrete silos. Approximate grain yields (bushels per acre) were: corn - 125 for 1975 and 80 for 1976; barley - 80 for 1975 and 55 for 1976; Arthur-71 wheat - 45 for 1975 and 30 for 1976; Eagle wheat - 45 for 1975; Sage wheat - 30 for 1976; Trio oats - 30 for 1976 and Lodi oats - 18 for 1976.

<u>1975 Trial</u>: Seventy-five mixed breed yearling steers averaging 667 lbs. were used in the 87-day trial (October 10, 1975 to January 5, 1976). Three pens of five steers were randomly assigned by breed and weight to each of five silage treatments: (1) corn silage, (2) Paoli barley, (3) Arthur-71 wheat, (4) Eagle wheat (milk) and (5) Eagle wheat (dough). All silages were fed in fixed-percentage rations containing 86% silage, 10% milo-soybean meal mix and 4% supplement on a dry matter basis. Each ration was formulated to 11.9% protein and mixed and fed to appetite twice daily.

<u>1976 Trial</u>: One hundred eight Hereford and Angus yearling steers averaging 643 lbs. were used in the 89-day trial (October 15, 1976 to January 12, 1977). Three pens of six steers were assigned to each of six silage treatments: (1) corn, (2) Kanby barley, (3) Arthur-71 wheat, (4) Sage wheat, (5) Trio oats and (6) Lodi oats. All silages were fed in fixed-percentage rations containing 84% silage, 12% milo-soybean meal mix and 4% supplement on a dry matter basis. Rations for each silage averaged 10.5% protein and were mixed and fed free-choice twice daily.

In both the 1975 and 1976 trials, all steers were fed the same level of silage for two days before beginning and ending weights were taken. All feed and water were withheld 16 hours before weighings.

Results

<u>1975 Trial</u>. Performances of the steers are shown in table 20.2. Steers fed barley silage gained slightly faster (2.70 vs. 2.45 lbs. per day) and more efficiently (7.04 vs. 7.67 lbs. of feed per lb. of gain) than steers fed corn silage. Barley silage supported a faster (P<.05) and more efficient (P<.05) gain than any of the three wheat silages (Arthur, Eagle milk or Eagle dough). Steers fed Arthur wheat silage gained faster (P<.05), consumed more feed (P<.05) and tended to be more efficient than those fed Eagle milk or Eagle dough silages. Silage intake was lowest (P<.05) by steers fed Eagle milk silage.

<u>1976 Trial</u>. Performances of the steers are shown in table 20.3. Steers fed corn silage gained slightly faster (2.52 vs. 2.33 lbs. per day) and more efficiently (7.59 vs. 8.41 lbs. of feed per lb. of gain) than those fed barley silage. Corn, barley and wheat silages were consumed in similar amounts but the wheat silages supported a slower (P<.05) and less

efficient (P<.05) gain than corn or barley silage. Steers fed soft red (Arthur-71) and hard red (Sage) winter wheat silages had similar rate and efficiency of gains. Steers fed Trio or Lodi oat silages had the poorest performance--they consumed about 10 lbs. less wet silage daily and gained .87 to 1.50 lbs. less per day than steers fed any of the other four silages.

Table 20.1. Composition of the 11 silages fed in the 1975 and 1976 trials.

Trial and silage	Dry matter %	Crude protein	Crude fiber
		%, dry matter basis	
1975			
Corn	37.8	7.80	20.35
Paoli barley	35.3	11.48	21.55
Arthur wheat	36.9	10.81	22.90
Eagle milk wheat	33.8	9.94	28.08
Eagle dough wheat	37.6	8.35	26.34
1976			
Corn	37.2	8.29	19.51
Kanby barley	35.7	8.95	22.26
Arthur wheat	39.2	11.16	22.16
Sage wheat	41.2	8.27	25.98
Trio oats	30.1	12.56	31.20
Lodi oats	31.1	10.09	31.02

Table 20.2 Steer performance for the 1975 trial (87 days).

Item	Silages Corn	Barley	Arthur wheat	Eagle wheat milk	Eagle wheat dough
No. of steers	15	15	15	15	15
Initial wt., lbs.	667	670	667	666	666
Final wt., lbs.	880	905	869	837	850
Avg. total gain, lbs.	213	235	202	171	184
Avg. daily gain, lbs.	2.45[a,b]	2.70[a]	2.32[b]	1.97[c]	2.11[c]
Avg. daily feed, lbs.					
silage[1]	46.0	46.5	45.2	39.0	41.4
silage[2]	16.10	16.26	15.81	13.64	14.48
milo-SBM[2]	1.96	1.91	1.77	1.68	1.77
supplement[2]	.77	.77	.70	.66	.69
total[2]	18.83[a]	18.94[a]	18.29[a]	15.98[c]	16.94[b]
Feed/lb. gain, lbs.[2]	7.67[a,b]	7.04[a]	7.87[b]	8.17[b]	8.07[b]

[1] 35% dry matter basis.
[2] 100% dry matter basis.
[a,b,c] Means in the same row with different superscripts differ significantly (P<.05).

Table 20.3. Steer performance for the 1976 trial (89 days).

Item	Silages Corn	Barley	Wheat Arthur	Wheat Sage	Oats Trio	Oats Lodi
No. of steers	18	18	18	18	17	18
Initial wt., lbs.	649	640	644	641	640	645
Final wt., lbs.	873	847	828	816	737	736
Avg. total gain, lbs.	224	207	184	175	97	91
Avg. daily gain, lbs.	2.52[a]	2.33[a,b]	2.06[b,c]	1.96[c]	1.09[d]	1.02[d]
Avg. daily feed, lbs.						
silage[1]	45.9	47.2	45.4	46.6	34.9	35.7
silage[2]	16.05	16.52	15.88	16.33	12.22	12.51
milo-SBM[2]	2.30	2.27	2.16	2.21	1.80	1.69
supplement[2]	.75	.73	.70	.67	.59	.51
total[2]	19.10[a]	19.52[a]	18.74[a]	19.20[a]	14.61[b]	14.72[b]
Feed/lb. of gain, lbs.	7.59[a]	8.41[a,b]	9.10[a,b]	9.86[b]	13.47[c]	14.45[c]

[1] 35% dry matter basis.
[2] 100% dry matter basis.
[a,b,c,d] Means in the same row with different superscripts differ significantly (P<.05).

Milo Stover, Forage Sorghum and Alfalfa Silages for Growing Heifers

Keith Bolsen, Jack Riley and Chuck Grimes

Summary

Ninety heifer calves were used to compare six rations containing various combinations of milo stover, forage sorghum and alfalfa silages. In the 96-day trial, heifers fed 100% forage sorghum silage outperformed heifers fed 100% milo stover silage. Adding forage sorghum or alfalfa silage to the 100% milo stover silage ration improved rate and efficiency of gain. Observed gains and efficiencies for the 67% milo stover + 33% forage sorghum and for the 33% milo stover + 67% forage sorghum silage rations exceeded predicted gains and efficiencies an average of 10.7% and 11.5%, respectively.

Introduction

We compared milo stover and forage sorghum silages in three previous heifer growing trials at this station (Prog. Rpt. 210, 230 and 262, Kansas Agr. Expt. Sta.). Results showed: (1) growing calves fed milo stover silage should gain about 1.0 lb. per day and require 10 to 14 lbs. of dry feed per lb. of gain, (2) milo stover silage has a feeding value of 63 to 67% that of forage sorghum silage and (3) milo stover silage seems to be a better feed for growing calves when it is fed in combination with forage sorghum silage than when it is fed alone.

Our objective in this trial was to verify previous results by feeding various combinations of milo stover, forage sorghum and alfalfa silages in rations for growing heifers calves.

Experimental Procedure

Milo stover, forage sorghum (high-grain variety) and alfalfa (about ½ bloom) were each obtained from a single source near Manhattan in the summer and fall of 1975. All three forages were ensiled in concrete silos (10 ft. x 50 ft.). The forage harvester was equipped with a two-inch recutter screen. Moisture contents of the milo stover and forage sorghum were about 68 to 70%; that of the alfalfa was about 58 to 60 percent.

Ninety heifer calves of Angus, Hereford, Angus x Hereford and Simmental x Hereford breeding averaging 444 lbs. were used in the 96-day trial (November 14, 1975 to February 18, 1976). They were allotted by breed and weight into 18 pens of five heifers each. Three pens were assigned to each of these milo stover (MS), forage sorghum (FS) and alfalfa silage combinations: (1) 100% MS, (2) 67% MS + 33% FS, (3) 33% MS + 67% FS, (4) 100% FS (5) 67% MS + 33% alfalfa and (6) 33% MS + 67% alfalfa.

Compositions of the six rations and their supplements are shown in table 21.1. All rations were formulated on a fixed percentage basis to be equal in crude protein (13%), minerals, vitamins and additives. Alfalfa silage provided 33 and 67% of the total ration crude protein in rations 5 and 6, respectively. All rations were mixed twice daily and fed free-choice.

All heifers were fed the same level of silage for 5 days before initial weighing and 2 days before final weighing. All feed and water were withheld 16 hours before weighing.

Results

Dry matter (%), crude protein (% DM basis), and crude fiber (%, DM basis), respectively, for the three silages were: 29.7, 5.4, 30.7 for milo stover; 29.0 7.8, 25.8 for forage sorghum and 42.1, 16.0, 33.6 for alfalfa.

Performances of the heifers are shown in table 21.2. Heifers fed 100% FS or 33% MS + 67% FS silage rations had similar performance and gained faster ($P<.05$) and more efficiently ($P<.05$) than heifers fed any of the other four rations. In general, as FS and alfalfa silages replaced MS silage in the ration, rate of gain and feed consumption increased ($P<.05$) and feed required per lb. of gain decreased ($P<.05$). Alfalfa silage was an effective source of both supplemental energy and protein for the milo stover silage.

Observed gains and feed efficiencies for 100% MS and 100% FS silage rations were used to calculate predicted gains and efficiencies for the two combinations of MS and FS silages (table 21.3). Observed gains exceeded predicted gains by .16 and .14 lb. per day for the 67% MS + 33% FS and for the 33% MS + 67% FS rations, respectively. Observed feed efficiencies exceeded predicted efficiencies by 1.20 and .96 lbs. for the 67% MS + 33% FS and for the 33% MS + 67% FS silage rations. On the average, combining MS and FS silages improved gain 10.7% and feed efficiency 11.5%.

Table 21.1. Compositions of rations and supplements used to compare milo stover, forage sorghum and alfalfa silages.

Ingredient	Rations[1]					
	100% MS	67% MS 33% FS	33% MS 67% FS	100% FS	67% MS 33% alfalfa	33% MS 67% alfalfa
Milo stover silage	73.0	48.9	24.1	----	48.9	24.1
Forage sorghum silage	----	24.1	48.9	73.0	----	----
Alfalfa silage	----	----	----	----	24.1	48.9
Milo	7.0	12.0	12.0	12.0	12.0	12.0
Soybean meal	5.0	----	----	----	----	----
Supplement A	15.0	----	----	----	----	----
Supplement B	----	15.0	----	----	----	----
Supplement C	----	----	15.0	----	----	----
Supplement D	----	----	----	15.0	----	----
Supplement E	----	----	---	----	15.0	----
Supplement F	----	----	----	----	----	15.0

	Supplements[2]					
	A	B	C	D	E	F
Soybean meal	1338	1836	1646	1460	1028	68
Milo	512	15	212	408	838	1756
Dicalcium phosphate	42	42	50	40	50	92
Limestone	24	20	7	8	----	----
Salt	32	32	32	32	32	32
Molasses	40	40	40	40	40	40
Aureomycin[3]	+	+	+	+	+	+
Trace mineral premix	4	4	4	4	4	4
Vitamin A premix[4]	+	+	+	+	+	+

[1] % on a 100% dry matter basis.
[2] 1bs. ton on an as-mixed basis.
[3] added to supply 70 mg per heifer per day.
[4] added to supply 30,000 IU per heifer per day.

Table 21.2. Heifer performance for the 96-day trial.

Item	Ration: 100% MS	67% MS 33% FS	33% MS 67% FS	100% FS	67% MS 33% alfalfa	33% MS 67% alfalfa
No. of heifers	15	15	15	15	15	15
Initial wt., lbs.	446	448	437	449	441	443
Final wt., lbs.	549	588	599	619	558	578
Avg. total gain, lbs.	103	140	162	170	117	135
Avg. daily gain, lbs.	1.07 [c]	1.46 [b]	1.68 [a]	1.77 [a]	1.22 [c]	1.41 [b]
Avg. daily feed, lbs.	11.68 [d]	12.62 [bc]	13.17 [ab]	13.63 [a]	11.88 [cd]	13.23 [ab]
Feed/lb. of gain, lbs.	11.01 [d]	8.71 [b]	7.86 [a]	7.72 [a]	9.74 [c]	9.47 [bc]

[1] 100% dry matter basis.

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

Table 21.3. Observed vs. predicted rates and efficiencies of gain for heifers fed combinations of MS and FS silages.

Item	Ration: 100% MS	67% MS 33% FS	33% MS 67% FS	100% FS
Avg. daily gain, lbs.				
Observed	1.07	1.46	1.68	1.77
Predicted	----	1.30	1.54	----
Improvement, lbs.[1]		+.16	+.14	
Improvement, %		+12.3	+9.1	
Feed/lb. of gain, lbs.				
Observed	11.01	8.71	7.86	7.72
Predicted	----	9.91	8.82	----
Improvement, lbs.[1]		-1.20	-.96	
Improvement, %		+12.1	+10.9	

[1] Observed minus predicted.

Micronized Milo, Urea and Prairie Hay for Growing Beef Heifers

Keith Bolsen, Jim Oltjen and Jack Riley

Summary

Twenty-four individually fed heifers were used in two heifer trials to evaluate four combinations of micronized or dry-rolled milo and soybean meal or urea supplements in prairie hay growing rations. Feeding 4 to 5 lbs. of micronized milo produced an average of 17% faster and 16% more efficient gains than feeding 4 to 5 lbs. of dry-rolled milo.

Introduction

Previous research at Kansas State University and other midwest research stations has shown properly gelatinized milo superior to dry-rolled milo in high-grain, beef finishing rations. Also, soybean meal and urea supplements have generally given similar performance in high-grain rations; in high-roughage or silage rations, soybean meal has supported faster and more efficient gains than urea. Limited data are available comparing gelatinized milo and dry-rolled milo in high-roughage, beef cattle growing rations.

Our objective in this trial was to repeat a previous trial (Prog. Rpt. 262, Kan. Agr. Expt. Sta., 1976) evaluating four combinations of micronized or dry-rolled milo and soybean meal or urea supplements in hay rations for growing beef heifers.

Experimental Procedures and Results

Twenty-four Hereford and Hereford-Simmental heifers were allocated by breed and weight to sheltered, individual feeding pens. Six pens were assigned to each of these four treatments:

	Milo		Supplement
1.	dry-rolled	+	soybean meal (SBM)
2.	dry-rolled	+	urea
3.	micronized	+	soybean meal (SBM)
4.	micronized	+	urea

All heifers were fed twice daily and received chopped prairie hay to appetite, 4 lbs. of the appropriate milo and 2 lbs. of the appropriate supplement daily. Both supplements contained 32% crude protein (as-fed basis).[a] Initial and final weights of the heifers were taken after they

[a]Soybean meal supplement: rolled milo, 688 lbs.; soybean meal, 1186 lbs.; dicalcium phosphate, 54 lbs.; salt, 42 lbs.; trace minerals, 8 lbs.; soybean oil, 21 lbs.; and vitamin A, 1 lb. Urea supplement: urea mix (100% CP), 514 lbs.; cane molasses, 390 lbs.; calcium lignin sulfate, 423 lbs.; trace minerals, 2 lbs.; 10-34-0, 70 lbs.; distillers' solubles, 600 lbs. and vitamin A, 1 lb.

had gone 15 hrs. without feed or water. The 98-day trial was conducted during the summer of 1976 with results shown in Table 22.1 (parts a and b).

Data from the 1975 and 1976 trials are compared in Table 22.2. In the 1975 trial, the heifers received 5 lbs. of milo daily and were fed 84 days. Results of the two trials were similar, although differences between treatments were smaller in 1976. Over both trials, heifers fed micronized milo + SBM or micronized milo + urea gained faster than heifers fed dry-rolled milo + urea (Table 22.2; part a). Heifers receiving micronized milo + SBM were more efficient than those receiving dry-rolled milo + urea.

Heifers receiving micronized milo gained faster and more efficiently than heifers receiving dry-rolled over both trials (Table 22.2; part b). Heifers fed SBM gained .07 lb. per day faster and required .82 lb. less dry matter per lb. of gain than those fed urea. Heifers fed the urea-containing liquid supplement consumed more hay than heifers fed the SBM supplement (10.55 vs. 10.15 lbs. daily in 1975; 11.24 vs. 10.53 lbs. daily in 1976). However, the higher moisture content of the urea supplement compared with the SBM supplement (45% vs. 13%), resulted in similar total dry matter consumptions.

Table 22.1. Performance of yearling heifers fed dry-rolled or micronized milo with soybean meal (SBM) or urea.[1]

Part a:	Dry-rolled milo		Micronized milo	
	SBM	Urea	SBM	Urea
No. of heifers	6	6	6	6
Initial wt., lbs.	618.0	614.3	606.3	610.0
Final wt., lbs.	757.7	746.0	757.7	761.0
Avg. daily gain, lbs.	1.42	1.34	1.54	1.54
Avg. daily feed, lbs.[2]				
prairie hay	10.73	11.25	10.32	11.23
milo	3.63	3.75	3.66	3.80
supplement	1.59	1.10	1.55	1.08
Total	15.96	16.10	15.53	16.11
Feed/lb. of gain, lbs.[2]	11.72	12.72	10.35	10.50

Part b:	Milo		Supplement	
	Dry-rolled	Micronized	SBM	Urea
No. of heifers	12	12	12	12
Avg. daily gains, lbs.	1.38[b]	1.54[a]	1.48	1.44
Avg. daily feed, lbs.[2]				
prairie hay	10.99	10.78	10.53	11.24
milo	3.69	3.73	3.65	3.78
supplement	1.34	1.31	1.57	1.08
Total	16.02	15.82	15.75	16.10
Feed/lb. of gain, lbs.[2]	12.22[b]	10.43[a]	11.03	11.61

[1] 98 days (May 19 to August 25, 1976).

[2] 100% dry matter basis.

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

Table 22.2. Comparison of the 1975 and 1976 heifer trials.

Part a:		Dry-rolled milo		Micronized milo	
		SBM	Urea	SBM	Urea
Avg. daily gain, lbs.	1975	1.31	1.25	1.66	1.50
	1976	1.42	1.34	1.54	1.54
	Avg.	1.36[bc]	1.30[c]	1.60[a]	1.52[ab]
Avg. daily feed, lbs.[1]	1975	15.62	15.77	16.01	15.86
	1976	15.95	16.10	15.53	16.11
	Avg.	15.78	15.92	15.77	15.99
Feed/gain[1]	1975	12.12	12.55	9.69	10.98
	1976	11.72	12.72	10.35	10.50
	Avg.	11.93[ab]	12.63[b]	10.02[a]	10.74[ab]

Part b:		Milo		Supplement	
		Dry-rolled	Micronized	SBM	Urea
Avg. daily gain, lbs.	1975	1.28	1.58	1.48	1.38
	1976	1.38	1.54	1.48	1.44
	Avg.	1.33[b]	1.56[a]	1.48	1.41
Avg. daily feed, lbs.[1]	1975	15.70	15.93	15.81	15.81
	1976	16.02	15.82	15.75	16.10
	Avg.	15.85	15.88	15.78	15.95
Feed/gain[1]	1975	12.55	10.33	10.92	11.96
	1976	12.22	10.43	11.03	11.61
	Avg.	12.38[b]	10.38[a]	10.97	11.79

[1] 100% dry matter basis.

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

Micronized Corn and Urea-liquid Supplements in Growing Rations for Calves

Keith Bolsen[1], Les Chyba[2] and Wes Ibbetson[2]

Summary

In growing rations containing fescue hay, micronized corn + urea-liquid gave: (1) 20.5% faster gains and 11.5% more efficient gains than cracked corn + urea-liquid and (2) similar rate and efficiency of gains as cracked corn + soybean meal.

Introduction

Previous research at Kansas State University with high-grain rations showed micronized milo supporting a 16% more efficient gain than dry rolled milo when fed to finishing steers. In other trials reported here (Micronized Milo, Urea and Prairie Hay for Growing Beef Heifers) calves fed 4 to 5 lbs. of micronized milo gained 17% faster and 16% more efficiently than calves fed 5 lbs. of dry rolled milo. In the same trials, micronized milo plus a urea-liquid supplement supported slightly better performance than dry rolled milo plus a soybean meal supplement.

Our objective in this trial was to compare micronized and cracked corn in hay rations for growing calves.

Experimental Procedures and Results

Fifty Hereford, Angus and HXA steer and heifer calves were allotted by breed, sex and weight to six pens. Two pens were assigned to each of the following corn and supplement treatments:

(1) cracked corn + soybean meal (SBM)
(2) cracked corn + urea-liquid
(3) micronized corn + urea-liquid

All calves were fed twice daily and received long fescue hay to appetite, 4 lbs. of the appropriate corn and 2 lbs. of the appropriate supplement. Both supplements[3] contained 32% crude protein on an as-fed basis.

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[1]Animal Science and Industry Dept., Kansas State University, Manhattan.

[2]Southeast Kansas Branch Experiment Station, Mound Valley.

[3]Soybean meal supplement: rolled milo, 674 lbs.; soybean meal, 1186 lbs.; dicalcium PO_4, 54 lbs.; salt, 42 lbs.; trace minerals, 8 lbs.; molasses, 35 lbs. and vitamin A, 1 lb. Urea supplement: urea mix (100% CP), 514 lbs., cane molasses, 390 lbs.; calcium lignin sulfonate, 423 lbs.; trace minerals, 2 lbs.; 10-34-0, 70 lbs.; distillers' solubles, 600 lbs. and vitamin A, 1 lb.

The 105-day trial was conducted at the Southest Kansas Branch Experiment Station from December 29, 1975 to April 12, 1976 (Table 23.1).

The overall performance of the calves was low, reflecting poor quality fescue hay.

Calves fed micronized corn + urea-liquid tended to gain faster and more efficiently than calves fed cracked corn + urea-liquid. Calves receiving micronized corn + urea-liquid or cracked corn + SBM had similar performance. SBM supported better performance than urea-liquid when each was fed with cracked corn. Calves fed urea-liquid rations consumed less feed ($P<.05$) than those fed SBM.

Table 23.1. Performance of calves fed cracked or micronized corn and SBM or urea-liquid supplements.

	Cracked corn + SBM	Cracked corn + urea-liquid	Micronized corn + urea-liquid
No. of calves	16	18	16
Initial wt., lbs.	509	497	501
Final wt., lbs.	615	578	599
Avg. total gain, lbs.	106	81	98
Avg. daily gain, lbs.	1.01	.78	.94
Avg. daily feed, lbs.[1]			
fescue hay	7.92	6.98	7.53
corn	3.40	3.40	3.60
supplement	1.78	1.10	1.10
Total	13.10[a]	11.48[c]	12.23[b]
Feed/lb. of gain, lbs.[1]	13.06	14.72	13.02

[1] 100% dry matter basis.

[abc] Means on the same line with different superscripts differ significantly ($P<.05$).

Sources of Roughage and Milo for Finishing Steers

Keith Bolsen and Jack Riley

Summary

Steers fed corn silage gained significantly (P<.05) faster than steers fed any other roughage. Wheat silage ranked second with gains significantly (P<.05) more than gains from milo stover silage, alfalfa hay or corn silage-alfalfa hay combination. Corn silage also produced the most efficient gains, which were significantly (P<.05) more efficient than gains from milo stover silage.

Feeding 100% of the grain portion of finishing rations as high moisture milo resulted in 13% faster (P<.05) and 13% more efficient (P<.05) gains than feeding equal parts of high moisture milo and dry rolled milo.

Introduction

Previous feedlot research at Kansas State Univeristy has consistently shown high moisture milo superior to dry rolled milo, however, these earlier studies did not include a combination of high moisture and dry milo. This trial was designed to see if blending of the two sources of milo would improve steer performance.

Corn silage was superior to milo stover silage as a source of roughage in finishing steer rations last year (Prog. Rpt. 262). Additional information was needed to compare other sources of roughage such as alfalfa hay, wheat silage or a mixture of alfalfa hay and corn silage.

Experimental Procedure

One hundred yearling steers averaging 864 lbs. were allotted by weight to 20 pens of five steers each. Four pens were assigned to each of five roughage treatments: (1) corn silage, (2) wheat silage, (3) milo stover silage, (4) chopped alfalfa hay, and (5) equal parts on a dry matter basis of corn silage and chopped alfalfa hay. Ten pens (two from each roughage treatment) were assigned to each of two milo treatments: (1) 100% of the grain portion of the ration as field harvested high moisture milo and (2) equal parts of high moisture milo and dry rolled milo.

The 82-day trial began January 11 and ended April 2, 1976. Composition of the finishing rations are shown in table 24.1. Rations were formulated to 11.5% crude protein, mixed twice daily and fed free-choice. The high moisture milo was ensiled whole in an oxygen-limiting silo and all milo was rolled before being mixed into the ration.

Individual weights were taken at the beginning and end of the trial after steers were without feed or water 15 hours. Final live weights were adjusted to a 60.9 dressing percent. Carcass data were obtained at Dugdale Packing Co., St. Joseph, Mo.

Results

Effects of roughage treatments on feedlot performance are shown in table 24.2. Steers fed corn silage gained faster (P<.05) than steers fed any of the other four roughage treatments and tended to be the most efficient. Steers fed the milo stover silage rations consumed the most dry matter daily but were the least efficient. Blending corn silage and alfalfa hay had no beneficial effect in this trial. Wheat silage was a satisfactory roughage, ranking second to corn silage, and producing faster gains (P<.05) than the remaining three roughages.

Effects of the two milo treatments on steer performance are shown in table 24.3. Steers fed 100% of the grain portion of the ration as high moisture milo gained 13% faster (P<.05) and 13% more efficiently (P<.05) than the group fed equal protions of high moisture and dry rolled milo.

No significant differences were observed in dressing percentages or other carcass measures evaluated.

Table 24.1. Composition of finishing rations.

Ingredient	Source of Roughage: Corn silage	Milo stover silage	Wheat silage	Alfalfa hay	Alfalfa hay & corn silage
Milo, %	77.0	77.0	77.7	79.8	78.6
Roughage, %	13.0	13.0	13.0	13.0	13.0
Supplement,[1] %	5.0	5.0	5.0	5.0	5.0
SBM, %	5.0	5.0	4.3	2.2	3.4

[1]Lbs. per ton, air-dry basis; rolled milo, 1650; limestone, 282; salt, 100; molasses, 40; trace mineral, 10; antibiotic, 14; vitamin A, 4.4.

Table 24.2. Performance of finishing steers fed indicated roughages.[1]

Item	Corn silage	Milo stover silage	Wheat silage	Alfalfa hay	Corn silage and alfalfa hay
No. steers	20	20	20	19	20
Initial wt., lbs.	865	865	865	861	864
Final wt., lbs.[2]	1077	1047	1062	1042	1040
Avg. total gain, lbs.	212	182	197	180	176
Avg. daily gain, lbs.	2.60[a]	2.22[c]	2.41[b]	2.20[c]	2.14[c]
Daily D.M. intake, lbs.	20.50[a]	21.35[a]	20.88[a]	18.91[b]	18.94[b]
Feed/lb. of gain, lbs.	7.99[a]	9.68[b]	8.76[ab]	8.69[ab]	8.84[ab]
Dressing %	61.4	60.9	60.6	61.3	60.6

[1]82 days (January 11 to April 2, 1976).

[2]Adjusted to a 60.9% dress.

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

Table 24.3. Performance of finishing steers fed indicated milo treatments.[1]

Item	Milo Portion of the Ration	
	100% high moisture	50% high moisture 50% dry rolled
No. steers	50	49
Initial wt., lbs.	864	864
Final wt., lbs.[2]	1065	1042
Avg. total gain, lbs.	201	178
Avg. daily gain, lbs.	2.46[a]	2.17[b]
Daily D.M. intake, lbs.	19.94	20.29
Feed/lb. of gain, lbs.	8.17[a]	9.41[b]
Dressing %	61.0	60.8

[1]82 days (January 11 to April 2, 1976).

[2]Adjusted to a 60.9% dress.

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

Effect of Monensin on Performance of Finishing Steers

Jack Riley, Dwight Tobyne and Galen Fink

Summary

We used 72 Hereford and Hereford x Angus cross yearling steers to further evaluate 200 mg monensin (trade name RUMENSIN) per head daily. Monensin improved gain 6.7% and significantly improved efficiency, 12.3%.

Introduction

Monensin has been cleared for use by cattle feeders for 15 months. It is estimated that 65-80% of Kansas cattle feeders are using it in their rations. In two growing-heifer trials and two finishing-steer trials reported last year, daily gain was increased up to 7.5% and efficiency improved as much as 12.2% with monensin.

Procedure

To substantiate previous results, we assigned 72 yearling steers at random to 12 groups of six steers each, and fed six pens control rations and six the same ration plus a premix that provided 200 mg. monensin daily per steer. Composition of the complete ration is shown in Table 25.1.

Results

Steer performance data are summarized in Table 25.2. Feeding 200 mg. monensin improved daily gain 6.7%, reduced feed intake 7.1%, and improved efficiency 12.3%. These results are consistent with previous results and further support the recommendation that Kansas cattle feeders seriously consider using this new feed additive in their feeding programs.

Table 25.1. Composition of ration used in monensin tests.

Ingredient	% Dry matter basis
Haylage or silage	15
Rolled corn	77
Protein supplement	4
Premix[1]	4

[1] Premix was rolled milo. Monensin was incorporated into the premix to provide 200 mg. per steer per day for the treated steers.

Table 25.2 . Effect of monensin on performance and carcass characteristics of finishing steers.

Item	Control	200 mg. monensin
No. steers	36	36
Initial wt., lbs.	643.2	642.5
Final wt., lbs.	1001.9	1021.5
Gain, lbs.	358.6	379.0
Daily gain, lbs.	2.58	2.73
Daily dry matter, lbs.	20.63	19.17
Efficiency	8.00	7.02
Carcass traits:		
Backfat, in.	0.52	.55
Loin eye area, sq. in.	11.82	11.83
USDA grade	Low choice	Low choice
Yield grade	2.83	2.83

Operational Procedures of Kansas Feedyards

Lyle Koons and Jack G. Riley

Summary

Twenty-four Kansas feedyards with 432,000 head capacity participated in a survey on operational procedures. The survey covered five areas: processing, animal health, rations, facilities, and marketing. Methods differed most in processing and starter-ration ingredients.

Introduction

The cattle feeding industry in Kansas is a conglomerate of many individuals with wide ranging viewpoints. The survey was introduced July 15, 1976 at the Kansas Cattle Feeder's Conference in Wichita, Kansas, and the final summary was made in September. This was the first survey in Kansas that attempted to provide an overall view of cattle feeding operations.

Results

Results presented here are from questions we felt were of general interest. The results show general procedures for the 24 feedyards rather than individual operations. They should not be interpreted as recommendations. Certain feedyard representatives referred to commodities by trade names. Our reporting then does not reflect endorsement of them over competing ones.

I. Processing Procedures

A. How soon are cattle processed

68% of feedyards surveyed process within 2 days of arrival
32% of feedyards surveyed process within 7 days of arrival

B. Drugs administered

Infectious Bovine Rhinotracheitis Bovine Viral Diarrhea Leptospirosis	I.M., 2 cc
Blackleg Malignant Edema	Sub Q, 5 cc

II. General Animal Health

A. Most critical time-1st 21 days after arrival

B. 74% of feedyards use a medicated starter ration with an average antibiotic level of 660 mg/hd/day

C. Drugs most commonly used for treatment in this survey

Symptoms	Drug	Amounts
Fever	Oxytetracyclines (TERRAMYCIN &	10 cc/100 lb
	LIQUAMYCIN)	10 cc/100 lb
	Sulfa Boluses	2 boluses
No fever	Tylosin	3 cc/100 lb
(Sick appearance)	AMOPLEX	2 boluses

III. Rations

A. Number of rations used

1 growing ration and 4 finishing rations

B. 58% of the feedyards surveyed were using Rumensin in September.

C. Grain processing

58% Flaked
37% Cracked or Rolled
5% Other methods

D. Percent of concentrate in 4 finishing rations (90% D.M. basis)

1	2	3	4
50	65	77	87

IV. Feedyard Facilities

A. Average capacity of feedyards surveyed

18,000 hd

B. Labor per 1000 head on feed

1.1 persons

V. Marketing

A. Percentage of cattle placed on feed that are native to Kansas

44%

B. Marketing of finished cattle

Live weight and grade - 95%
Rail weight and grade - 5%

C. Hedging is used on 18% of all cattle fed in the 24 feedyards we surveyed.

Protein Adjustments in Heat Stressed Finishing Cattle

D. R. Ames and C. L. Willms

Summary

A summer feedlot trial indicates that protein can be removed from finishing rations in proportion to magnitude of heat stress without causing a decline in average daily gain. Cattle consumed .13 kg/hd/day (.30 lb) less supplemental protein (soybean oil meal) during the 82-day period with no decline in average daily gain when compared to controls.

Introduction

Exposure of feedlot cattle to effective temperatures above the thermal neutral zone (TNZ) increases the need for net energy for maintenance (NEm). Consequently, less net energy for production (NEg) is available and average daily gain (ADG) decreases. Since energy is limiting gain, protein is used for energy and not for the nitrogen needs of new tissue. This causes a decrease in protein efficiency (g protein/g gain). Logically, protein efficiency could be improved by matching protein intake with gain during heat stress. Previous work shows that mean daily temperature (MDT) can be used to predict ADG and that protein efficiency is improved when protein level is adjusted to expected performance level during cold (Cattlemen's Day, 1976).

Procedure

We used 216 head (117 steers, 99 heifers) of mixed breed finishing cattle for 82 days beginning June 3, 1976. Cattle were fed in eight outside lots. Going on test cattle averaged 354 kg (779 lbs). Cattle were fed ad libitum a high concentrate ration (Table 27.1) with protein varied for 110 head and a constant 12.1% crude protein for 106 control cattle. The supplemental protein (soybean oil meal) was handled as a single ingredient so amounts could be varied easily be replacing SBM with milo.

Protein adjustments were based on lowered ADG expected during hot weather. The formula, $ADG = 1.424 + .116\ C - .003\ C^2$ where gain is kilograms and C is temperature in degrees centigrade was used to predict gain during heat.

The equation was derived from data involving approximately 40,00 steers fed outdoors in Kansas. Protein for growth (Protein above maintenance where maintenance protein = $2.79\ W_{kg}^{.75}$) was adjusted according to expected effect of temperature on gain. All adjustements were made so that the rations would contain the same caloric value (see sample calculation). No attempt was made to lower protein more than removing all supplement. Daily temperature was recorded by a thermograph at the feedlot. Temperature at feeding time was used to determine protein fed each day.

Results and Discussion

ADG did not significantly ($P<.05$) differ between cattle consuming a constant percentage of protein (control) and those whose protein was adjusted for expected lower ADG during heat (Table 27.2). Steers adjusted on protein consumed .13 kg/hd/day (.30 lb) less than control steers. Theoretically, more protein could have been withdrawn but we removed only the amount included in the supplemental soybean oil meal.

Temperatures ranged from 52 F to 105 F during the test period; mean daily temperature was 78.5 F. Temperatures recorded at feeding time averaged 71.3 F for mornings and 89.0 F for afternoons.

The idea of changing rations to match environment is relatively new, although it has been long known that adverse weather decreases performance. To use energy and protein efficiently it is important to maintain constant protein:calorie ratio of protein and energy above amounts required for maintenance. This must be done with concurrent increases in net energy for maintenance and decreased voluntary intake during hot weather.

To refine the procedure more work is needed to establish accurate equations relating performance and environment. Because protein requirements are higher for growing cattle than for finishing cattle, changing protein in proportion to heat stress may work better with growing cattle than with finishing cattle. Higher protein requirements also would allow more protein to be replaced with grain during heat stress.

Table 27.1 . Basic ration fed cattle in heat stress tests.

	Dry Matter Composition %	Crude Protein %	Digestible Protein %
Milo	82.4	11.3	6.5
Sorghum silage	10.0	7.1	1.9
SBM	3.6	49.4	42.0
Trace mineral supplement (milo carrier)	4.0	8.4	4.8
Ration		12.1	7.3

[1]Calculated using NRC digestion coefficients.

Table 27.2. Effect of adjusting protein for expected ADG by finising cattle.

Treatment	CP %	ADG kg	ADG lb	SBM removed kg/hd/day kg	SBM removed kg/hd/day lb
Control	12.1	1.11	2.44	0	0
Adjusted	varied	1.14	2.50	.13	.30

Example of Calulating Protein Adjustment

Assumptions

Critical temperature = 60 F (15.6 C)
Mean daily temperature = 85 F (29.4 C)
Digestible protein intake = 800 g (Ration DP x DM Intake)
Weight = 800 lbs (363.6 kg; $83.25 W_{kg}^{.75}$)
SBM digestible protein = 40 %
Milo digestible protein = 7.1 %

Step I: Decline in Gain

$$\text{Maximum gain} = 1.424 + .116\ (15.6) - .003\ (15.6)^2 = 2.503$$

$$\text{Predicted gain} = 1.424 + .166\ (29.4) - .003\ (29.4)^2 = 2.239$$

$$\text{Decline in gain} = 1 - \frac{2.239}{2.503} = .105 \text{ or } 10.5\%$$

Step II: Digestible Protein for Growth

DP Intake = 800 g

$$DP_m = 2.79 W_{kg}^{.75} = 2.79 \times 83.25 = 232 \text{ g}$$

$$DP_g = \text{DP Intake} - DP_m = 800 - 232 = 568 \text{ g}$$

Step III: Replacement Factor

$$\text{R.F.} = 1 - \frac{\text{DP milo}}{\text{DP SBM}} = 1 - \frac{.071}{.40} = .83$$

Step IV: Substitute

$$\text{SBM replaced} = \frac{(DP_p)\ (\text{Decline in gain})}{(\text{R.F.})\ (\text{SBM DP})} = \frac{(568)(.105)}{(.83)(.40)} = 180 \text{ g}$$

Value of Sprinkling Feedlot Cattle During Heat

D. R. Ames and C. Willms

Summary

Four lots of growing-finishing cattle were sprinkled when dry bulb temperature exceeded 80 F the summer of 1976 and compared with lots not sprinkled. Sprinkled lots gained significantly (P<.01) more (1.20 kg per day compared with 1.04) (2.64 vs. 2.29 lbs.) than controls. Sprinkling also improved feed efficiency (F/G).

Introduction

Performance of feedlot cattle is diminished during heat stress because they eat less and their maintenance requirement is higher. Both factors increase in importance as heat stress increases. The non-proportional decline in performance with increased temperature suggests than eliminating severe heat stress can improve performance. Sprinklers are an inexpensive method of reducing heat stress used successfully in the Southwest. Sprinkling increases evaporative heat loss from the animal and, to some extent, reduces ground temperature, which reduces radiant heat gain. For sprinkling to be effective the water must evaporate, so low humidity and air movement are desirable. In addition, it is necessary to allow animals to dry between sprinkling periods. (Note: Foggers or mist applied to livestock continuously cause high humidity and poor drying. They are, therefore, not recommended.)

Procedure

We used eight outside dirt lots averaging 27 head of finishing cattle each in the sprinkling study. Sprinklers were timed to operate 2 min. then remain off 28 min. when temperature exceeded 80 F. When temperature fell below 80 F, the sprinkling system did not function. Each lot had a 706 sq. ft. area wetted. The trial began June 3 and ended August 23, 1976.

Results and Discussion

Average daily gain (ADG) was significantly (P<.01) improved by sprinkling (1.20 vs. 1.04 kg per day) Table 28.1. The gain is similar to that reported by California workers (.1 to .3 kg per day more for sprinklers). Feed per gain also was inproved by sprinkling. High temperature and low humidity associated with the California studies improve the value of sprinklers more than where humidity is higher.

Although mud in sprinkled area has been a concern of feedlot managers, mud was not a problem during this study. Lots had wet but no muddy areas and mud was absent from the cattle in sprinkled lots. Likely, moisture evaporated from the soil surface lowered soil surface temperature, thus reducing radiant heat gain. Feed to gain ratio did not differ significantly.

Although results from this trial indicate that feedlot sprinkling can be valuable in reducing heat stress of feedlot cattle in Kansas, more work involving area sprinkled per animal, ratio of sprinkling time to drying time, amount of water per unit area, and other variables is needed to describe the best way to use feedlot sprinklers.

Table 28.1. Performance of sprinkled versus nonsprinkled feedlot cattle.

Treatment	F/G	ADG	
		kg	lb
Sprinkled	9.2	1.20	2.65**
Non-sprinkled	11.2	1.04	2.29

[1] Unit of feed per unit of gain.

**(P<.01)

Animal Performance Changes Related to Time on Feed

Allan Chestnut and B. E. Brent

Summary

We are developing mathematical models to show how feed intake, rate of gain, and feed efficiency change during the finishing period. When finished, the models might be used to predict when to sell cattle to maximize profit or minimize loss, to plan feed inventories, or to predict when animals have reached a desired grade.

Introduction

Cattle feeders know that both rate of gain and feed efficiency deteriorate from the start of the finishing period to the end. Because information on deterioration is usually lacking, single values are given for animal performance that represent only averages from the beginning to the end of the finishing period. This experiment was designed to begin developing mathematical models to define how animal growth and efficiency change during the feeding period.

Experimental Procedure

Twenty Hereford steers were individually fed the ten rations (2 per ration) shown in table 29.1. The trial started when all animals had been adjusted to their final rations. Then, all animals were individually weighed once a week, before the morning feeding. Because a ruminant animal's weight can vary widely depending on how much feed and water is in the gut, individual weights contain considerable error that cannot be eliminated. To overcome that problem, a micro-computer was used to fit the best line through the points to remove most of the error. Animals were killed when a pound of gain required 3.41 therms of net energy for production (NEp).

Results and Discussion

Rate of Gain

The growth curve (weight related to days on feed) of a typical steer (ration 7) is shown in figure29.1a The slope of the growth curve at any point gives the rate of gain at that point. Figure29.1b shows how rate of gain was highest early in the feeding period and decreased to slaughter.

Feed Consumption

Figure29.2a shows the cumulative feed consumed related to time on feed.

Figure 29.2b shows how feed consumed per day changed during the feeding period. Feed per day varied through a rather small range as the example steer grew from 630 lbs. to 1052 lbs., which indicated that estimating an animal's feed consumption as a percentage of its body weight is extremely inexact.

Feed Efficiency

By deriving growth rate and feed consumption curves, we can find how feed efficiency changes during the feeding period (Figure 29.3). Gain is efficient early in the feeding period, and becomes quite poor later.

By multiplying feed cost by feed efficiency, we can estimate the feed cost per unit of gain at any point in the feeding period. From an economic standpoint, animals should continue on feed as long as a dollar's worth of inputs (including feed and fixed costs) yield more than a dollar's worth of products. Unfortunately, the value of the product varies with time and also depends on slaughter grade of the animal.

Table 29.2 shows weights, rates of gain, and feed consumptions for the experiment. The figures were calculated from curves like those in figures 29.1a through 3. Note that some animals continued to be efficient and had not been killed at 308 days. These apparently were extremely efficient at depositing fat. Most, however, became inefficient and were killed at light weights. The end-point used for slaughter produced cattle of mostly low choice grade, with a yield grade of less than 4, except in one case.

Although the system needs several refinements, it is perhaps the best available for finding the proper time to kill experimental cattle. A similar system might be used in the industry when curves could be based on three or four pen weights.

The experiment demonstrates (1) wide variability within a fairly uniform lot of cattle in regard to weights at choice grade, (2) decreases in rate of gain and efficiency as animals finish, and (3) relationships among animal size, roughage-to-concentrate ratio, and expected feed intake.

Table 29.1. Ration fed steers in study of performance changes related to time on feed.

	% Dry Matter				
Ration no.	Corn silage	Cracked corn	Supplement[1]	NEm	NEp
				Therms/100 lbs.	
1	90.40	0.00	9.60	71.76	45.8
2	80.40	9.70	9.90	74.92	48.0
3	70.40	19.40	10.20	78.10	50.1
4	60.40	29.10	10.50	81.26	52.3
5	50.40	38.80	10.80	84.43	54.5
6	40.30	48.60	11.10	87.60	56.6
7	30.20	58.40	11.40	90.77	58.8
8	20.20	68.10	11.70	93.93	61.0
9	10.10	77.90	12.00	97.10	63.1
10	0.00	87.60	12.40	98.36	65.3

[1]Supplement composition was varied to assure adequate protein. Ingredients included soybean meal, ground limestone, dicalcium phosphate, salt, trace minerals and vitamins.

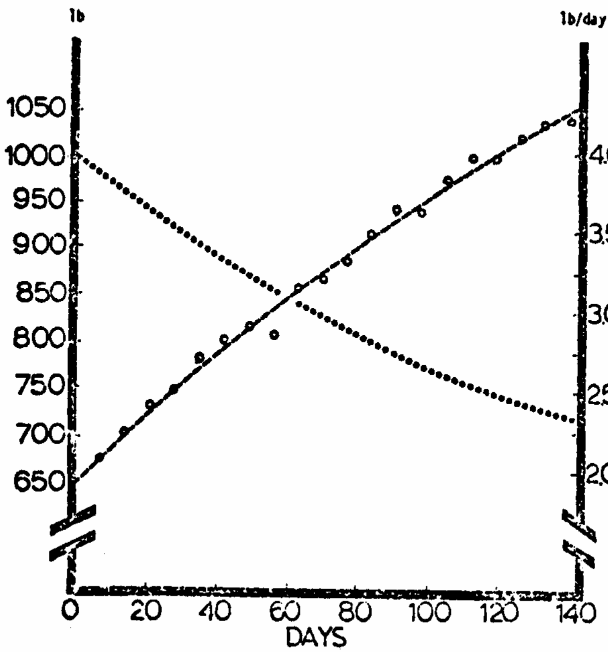
Table 29.2. Animal Performance Data Related to Time on Feed for Ten Concentrate Levels.

Ration No.	Animal No.		DAYS ON FEED 0	28	56	84	112	140	168	196	224	252	280	308
1	1	WT[a]	676	727	776	823	869	913	956	999	1042	1086	1132	1179
		ROG	1.90	1.80	1.71	1.68	1.59	1.56	1.54	1.54	1.56	1.59	1.65	1.72
		FC	16.13	15.75	15.72	15.55	16.32	16.76	17.17	17.43	17.46	17.17	16.44	15.20
		FE	8.49	8.76	9.19	9.70	10.25	10.76	11.13	11.30	11.19	10.77	9.99	8.86
	2	WT	613	676	735	792	846	899	951	1002	1053	1106	1161	1217
		ROG	2.32	2.18	2.07	1.97	1.90	1.86	1.84	1.84	1.86	1.91	1.98	2.07
		FC	15.28	16.00	15.89	16.44	17.00	17.68	18.40	19.09	19.66	20.04	20.15	19.91
		FE	7.02	7.33	7.79	8.33	8.93	9.51	10.02	10.39	10.56	10.50	10.18	9.61
2	3	WT	617	699	769	830	881							
		ROG	3.12	2.71	2.33	1.99	1.69	Killed 119 Days						
		FC	15.53	16.80	18.29	20.08	22.26							
		FE	4.97	6.20	7.83	10.06	13.13	C+[b], 2.75[c]						
	4	WT	555	634	702	763	821	879	939	1001	1065	1131	1194	1253
		ROG	3.08	2.50	2.27	2.11	2.07	2.10	2.10	2.26	2.32	2.31	2.21	1.97
		FC	15.92	15.77	15.91	16.26	16.76	17.35	17.96	18.53	19.00	19.31	19.38	19.61
		FE	5.17	6.11	7.00	7.70	8.11	8.26	8.25	8.20	8.19	8.34	8.77	9.72
3	5	WT	649	744	822	883	926							
		ROG	3.71	3.10	1.48	1.85	1.25	Killed 119 Days						
		FC	19.01	21.24	21.96	22.21	23.07							
		FE	5.11	6.26	8.86	11.91	18.45	C-, 2.15						
	6	WT	618	720	807	879	940	991	1034	Killed 168 Days				
		ROG	4.01	3.38	2.63	2.34	1.97	1.66	1.42	C-, 2.56				
		FC	18.50	19.16	19.34	12.38	15.47	19.92	20.91					
		FE	4.61	5.66	6.84	8.22	9.50	12.00	14.66					
4	7	WT	595	692	778	853	918	977	1031	1083	1137	1193	1256	1327
		ROG	3.88	3.32	2.96	2.48	2.19	2.00	1.69	1.80	1.95	2.12	2.38	2.73
		FC	15.98	17.28	18.13	18.61	18.72	18.87	18.04	18.84	18.56	19.30	19.35	21.01
		FE	4.12	5.20	6.35	7.51	8.59	9.45	9.96	10.04	9.71	9.10	8.39	7.70
	8	WT	597	638	768	840	902	957	1005	1047	1093	Killed 236 Days		
		ROG	3.41	3.05	2.70	2.39	2.10	1.84	1.60	1.29	1.20			
		FC	16.44	17.21	17.79	17.58	18.07	18.05	17.93	17.79	17.63	C + 3.30		
		FE	4.82	5.65	6.54	7.53	8.62	9.84	11.22	12.82	14.66			
5	9	WT	741	849	940	1020	1093	Killed 119 Days						
		ROG	4.21	3.52	3.02	2.70	2.56							
		FC	21.24	20.46	21.03	22.78	25.52	C-, 3.25						
		FE	5.05	5.81	6.97	8.44	9.95							
	10	WT	614	709	830	894	956	1015	1057	Killed 168 Days				
		ROG	3.40	3.33	3.13	2.81	2.36	1.83	1.30					
		FC	20.24	19.09	18.95	19.31	19.33	16.44	15.71	G + 2.86				
		FE	5.94	5.70	6.04	6.87	8.20	10.27	14.23					
6	11	WT	676	769	877	963	1040							
		ROG	3.09	2.94	2.50	3.12	2.13	Killed 119 Days						
		FC	16.83	19.92	20.56	21.89	25.56	C-, 3.37						
		FE	6.29	5.63	5.74	7.60	11.50							
	12	WT	609	704	798	877	930	Killed 112 Days						
		ROG	3.27	3.43	3.36	2.44	1.27							
		FC	14.05	17.60	17.79	17.50	19.60	C-, 3.00						
		FE	4.30	5.12	5.63	7.18	15.43							
7	13	WT	655	767	873	965	1032							
		ROG	4.00	3.95	3.58	2.88	1.66							
		FC	18.86	18.71	20.69	22.48	21.70	Killed 119 Days						
		FE	4.72	4.73	5.78	7.79	11.70	C-, 2.40						
	14	WT	630	735	828	910	984	1051						
		ROG	3.98	3.52	3.13	2.79	2.52	2.20	Killed 140 Days					
		FC	22.60	18.31	17.69	15.56	20.80	21.27						
		FE	5.68	5.20	5.66	5.83	8.27	9.24	C-, 3.6					
8	15	WT	611	736	840	926	997	1057						
		ROG	4.85	4.06	3.37	2.80	2.33	1.97	Killed 140 Days					
		FC	15.48	18.29	20.61	21.75	21.13	20.49						
		FE	3.19	4.43	6.11	7.61	9.07	10.39	C-, 3.80					
	16	WT	618	740	847	941	1024	1058	1163	1224	1281	1335	1389	1443
		ROG	4.62	4.07	3.58	3.15	2.79	2.49	2.25	2.08	1.97	1.92	1.93	2.01
		FC	19.21	20.04	20.31	20.14	19.60	19.05	19.30	17.03	17.52	17.57	18.12	19.32
		FE	4.16	4.93	5.67	6.36	7.05	7.05	8.17	8.59	8.91	9.16	9.38	9.61
9	17	WT	650	705	823	909	951	Killed 112 Days						
		ROG	2.19	3.05	3.08	2.63	.98							
		FC	11.22	14.95	17.97	17.70	15.18	C°, 3.40						
		FE	5.13	4.90	5.32	6.73	15.48							
	18	WT	597	630	797	891	944	Killed 112 Days						
		ROG	2.72	3.71	3.76	2.79	.64							
		FC	8.80	15.60	17.11	16.49	16.83	C-, 3.25						
		FE	3.24	4.18	4.55	5.50	19.99							
10	19	WT	693	787	875	958	1034	1104	1167	1224	1273	1314		
		ROG	3.44	3.25	3.05	2.04	2.61	2.38	2.34	1.87	1.62	1.35		
		FC	10.04	13.84	16.05	16.66	17.03	16.50	15.74	15.09	14.89	15.60		
		FE	2.92	4.26	5.26	5.99	6.52	6.93	7.36	8.00	9.17	11.35	Killed 226 Days	C+, 4.50
	20	WT	621	716	803	884	959	1031	1099	1164	1229	1293	1357	1423
		ROG	3.52	3.24	3.00	2.79	2.62	2.48	2.38	2.32	2.28	2.79	2.33	2.41
		FC	12.90	13.52	14.01	14.40	14.70	14.94	15.14	15.31	15.45	15.68	15.92	16.23
		FE	3.67	4.15	4.60	5.16	5.62	6.02	6.36	6.61	6.65	6.85	6.33	6.74

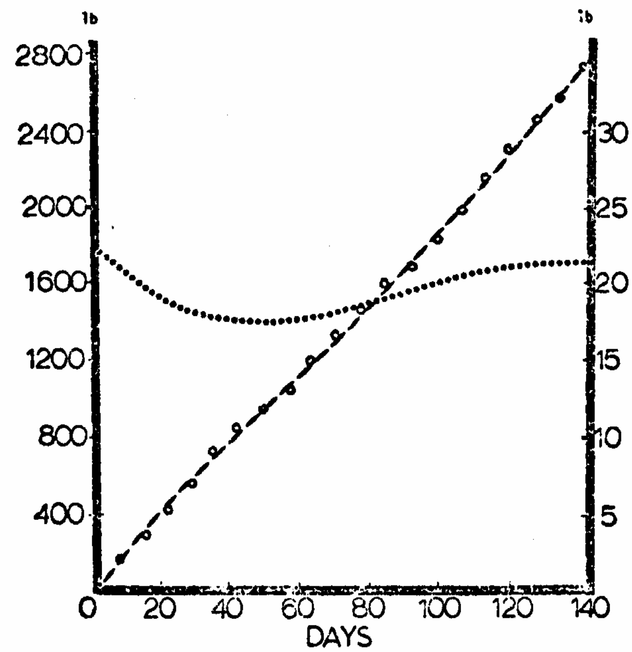
[a] WT. is animal weight in pounds
ROG is rate of gain in pounds per day
FC is feed consumption in pounds of dry matter per day
FE is feed efficiency: units of dry matter per unit of gain

[b] Quality grade to nearest third

[c] Yield grade



GROWTH CURVE-Figure 1a
DAILY GAIN-Figure 1 b



TOTAL FEED CONSUMED-Figure 2a
DAILY FEED CONSUMPTION -Figure 2b

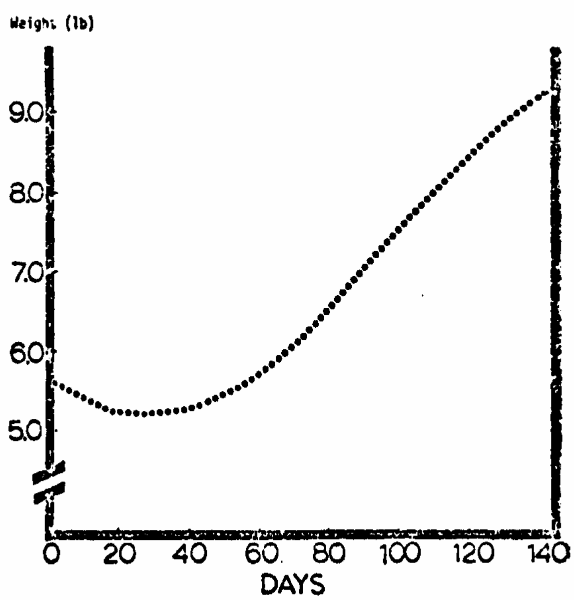


Figure 3. Lb Feed/lb Gain

Sire Breed Effects on Economic Efficiency of a Terminal-Cross Beef Production System

Gerald M. Smith and Michael E. Dikeman

This article was abstracted from a manuscript by Gerald M. Smith, U.S. Meat Animal Research Center, Clay Center, Nebraska which appeared in the December, 1976, issue of the Journal of Animal Science. The carcass and meats research data for the study were coordinated by Dr. Michael E. Dikeman, Kansas State University, so permission was granted to present results of that study here. Performance and carcass characteristics of the cattle were presented in the 1975 Cattlemen's Day Report.

Summary

Economic efficiency was evaluated for a terminal-cross production system in which Hereford and Angus cows were bred to Hereford, Angus, Jersey, South Devon, Limousin, Charolais and Simmental bulls. The analyses included calving difficulty, pre-weaning survival, growth rate, feed efficiency, carcass composition and quality grade.

Ownership of the calves was assumed by the cow/calf man until the carcasses were fabricated into retail cuts. Sire breeds were compared for retail product cost, profit per calf and profit per cow. The comparisons were made separately by age-of-cow for three different slaughter end points: constant age (217 days on feed), constant weight (1035 lb.) and constant grade (5% ribeye fat).

Limousin, Charolais and Simmental crosses were generally favored for all cow ages, slaughter end points and evaluation criteria. South Devon and Hereford-Angus reciprocal crosses tended to have similar merit and ranked intermediate between straightbred Hereford and Angus and the Limousin, Charolais and Simmental crosses. Jersey crosses ranked lowest in all comparisons. Altering grain/forage and choice/good price ratios had little effect on the results. The apparent ability of cattle with increased growth rate, feed efficiency and carcass merit to offset large differences in cost per calf weaned suggested that calves from large, growthy breeds should warrant a market premium.

Introduction

Large, growthy sire breeds have focused attention on calving difficulty and the need to consider all segments of the production cycle when evaluating breeding systems. This study provides an economic evaluation of production efficiency for Hereford and Angus cows mated to seven sire breeds representing a wide range in calving difficulty, growth rate, feed efficiency and carcass composition.

Experimental Procedures

The approach of this study was to make assumptions necessary to quantify the cost of calves entering the feedlot, feedlot costs and carcass value. The primary data came from 2,368 calves born at the U. S. Meat Animal Research Center in 1970-72 as part of a germ plasm evaluation program. The calves were out of Hereford and Angus cows sired by Hereford, Angus, Jersey, South Devon, Limousin, Charolais and Simmental bulls. Postweaning growth, feed efficiency, carcass composition, quality and meat palatability data are from 1,105 steers.

Nonfeed Cow Costs. We used a fixed cost of $45 per cow bred. Labor costs were set at $20 plus $4 per difficult birth. Labor cost included artificial insemination plus 24-hr. surveillance during calving. Replacement costs were calculated under the assumption that all open cows were replaced each fall at palpation at a net cost of $100 per head ($300 replacement cost minus $200 salvage value). The replacement rate was 18% for cows experiencing no calving difficulty and 34% for cows with difficulty. A 2% death rate was assumed for all cows.

Cow Feed Costs. To estimate cow herd feed costs, feed requirements were estimated from book values. Cost of feed of sufficient quality to meet a cow's protein requirements was $.0122 per Mcal of ME ($.02 per lb. TDN). Reproduction and lactation requirements were assumed independent of the calf's sire breed.

Calf Costs. Pre-feedlot calf costs included preweaning feed consumption plus feed consumption and fixed costs during a 25-day conditioning period. Creep consumption for each sire breed by cow age was in proportion to TDN requirements not furnished by milk. The price of creep feed and feed during the 25-day conditioning period was equal to feedlot feed. A $10 per head fixed cost was added to each calf weaned.

Cost per Calf. Total cost per cow bred for each sire breed was divided by weaning percentage of that sire breed to estimate cow herd cost per calf weaned.

Feedlot Costs. Feed requirements for each breed group were measured and ration cost was set at $.0244 per Mcal of ME ($.04 per lb. of TDN).

Slaughter End Points. Three slaughter end points were evaluated: 217 days on feed (constant age), 1035 lb. (constant weight) and 5% ribeye fat (constant grade of low choice).

Evaluation Criteria. To fairly evaluate sire breeds that vary widely in size, growth rate and carcass composition, economic factors from cow herd through retail product were considered.

An Example. An example in table 30.1 compares production of Hereford-Angus (HAx) and Charolais (Cx) crossbred calves from 2-year-old Hereford and Angus cows for the slaughter end point of 217 days on feed. Assumptions made for all costs were used in this example. Calving difficulty of 41% for HAx and 74% for Cx gave different labor and replacement charges. The slightly higher lactation feed charge for HAx reflects fewer early calf deaths (7.0 vs. 13.4%) and, hence, a higher percentage of lactating cows.

The different weaning percentages (89.9 for HAx and 74.0 for Cx) are reflected in the total cost per calf weaned.

A fixed charge of 25¢ per day was assumed to cover interest, feed mixing-handling, veterinary expenses and other nonfeed charges in the feedlot. Prices were set at $1.15/lb. for choice-grade retail product, $1.07 for good-grade retail product and $.02 for fat trim. Those prices roughly correspond to live cattle prices of $45 and $42 per 100 lb.

Results and Discussion

Retail product cost, profit per calf and profit per cow at three slaughter end points are given in table30.2 for each breed-group by cow-age. With only minor exceptions, Limousin (Lx), Charolais (Cx) and Simmental (Sx) crosses were favored for all cow ages, slaughter end points and evaluation criteria. South Devon (SDx) and HAx tended to have similar merit and to rank intermediate between straightbred H and A and the Lx, Cx and Sx. Jersey crosses (Jx) ranked lowest in all comparisons.

The different methods of evaluating had only minor impact on the results. Breed groups with good preweaning livability ranked relatively higher for profit per cow than for profit per calf. The larger, faster growing, leaner breed groups had an advantage for retail product cost at age- and weight-constant slaughter end points.

To examine the possible effects of different grain/forage price ratios, three feedlot ration costs were considered $.0183, $.0244 and $.0305 per Mcal of ME (or $.03, $.04 and $.05 per lb. of TDN). Profit per cow at a grade-constant end point for each feed cost is shown in figure 30.1 . The advantage of Lx, Cx and Sx changed little by those changes in feed costs.

Two values for choice-grade retail product ($1.15 and $1.20 per lb.) and one value for less than choice-grade retail product ($1.07/lb.) were used to examine possible effects of different choice-good price ratios. Figure 30.2 presents profit per cow by breed group when evaluated at the age-constant end point. Increased value of choice-grade retail product favors H&A, HAx, Jx and SDx because of their higher percentages in the choice grade. Nonetheless, for both prices used, Lx, Cx and Sx ranked highest for profit per cow.

The effect on profit per cow of three charges for costs per difficult birth for 2-year-old cows suggest that growth and carcass merit of Lx, Cx and Sx tend to offset substantial costs associated with their increased calving difficultly.

The evaluation of only one system of production limits interpretation of results. For instance, breed groups with a low frequency of calving difficulty may have been more profitable with less intensive management during the calving season. Also, this study assumed that replacement cows were available from outside the production system at a constant cost. Mating systems with younger cows used to produce purebred replacement heifers likely would be better.

In addition, one ownership of the calves was assumed to the point of carcass fabrication into retail cuts; in other words, a cow/calf producer who custom feeds his calves and sells on a grade-and-yield grade basis.

Cattle with increased growth rate, increased feed efficiency and increased carcass value have the ability to offset large differences in cost per calf weaned. Hence, sire breeds of large mature size, high growth rate, good feed efficiency and lean carcass composition apparently have much to offer in terminal-cross production systems.

Table 30.1. An Example Illustrating Key Assumptions[a].

Item	Breed group[a] HAx	Cx
I. Cow Herd Costs (per cow bred)	$	$
A. Nonfeed		
1. Fixed (excluding labor and replacement)	45.00	45.00
2. Labor (20 + 4D[c])	21.64	22.96
3. Replacement 100(1-D)(.18) + 100(D)(.34) + 300(.02)	30.56	35.84
	97.20	103.80
B. Feed		
1. Maintenance and growth	45.37	45.37
2. Lactation	17.80	15.91
3. Pregnancy	7.20	7.20
	70.37	68.48
Total per cow bred	167.57	172.28
Total per calf weaned	186.39	232.81
II. Calf Prefeedlot Costs		
1. Creep feed	7.17	8.19
2. Forage	8.31	9.53
3. Preconditioning feed	7.48	7.24
4. Per head costs	10.00	10.00
	32.96	34.96
Total per calf weaned	219.35	267.77
Total per calf entering feedlot (figures 2% deaths)	223.83	273.23
III. Feedlot Costs (217 days on feed)		
A. Fixed (25¢/day/hd)	54.25	54.25
B. Feed	114.76	118.84
	169.01	173.09
Total cost per slaughter animal	392.84	446.32
Cost per lb. slaughter weight	0.40	0.42
Cost per lb. retail product	1.03	0.98
Sale value per calf	424.05	484.82
Profit per calf	31.21	38.50
Profit per cow	27.50	27.92

[a] Example is for calves from 2-year-old cows fed to an age-constant (217 days on feed) slaughter end point.

[b] HAX equals Hereford x Angus and reciprocal crosses; Cx equals Charolais x Hereford and Charolais x Angus crosses.

[c] D equals the percentage of calves born with difficulty.

Table 30.2. Breed Group by Cow Age Comparisons for Three Evaluation Criteria at Three End Points[a]

Breed Group	Cow Age	Retail product cost, $/lb. 217 days	Retail product cost, $/lb. 1035 lb.	Retail product cost, $/lb. 5%RE fat	Profit/calf, $ 217 days	Profit/calf, $ 1035 lb.	Profit/calf, $ 5%RE fat	Profit/cow, $ 217 days	Profit/cow, $ 1035 lb.	Profit/cow, $ 5%RE fat
HH + AA[b]	2	1.06	1.10	1.05	14	13	26	12	11	22
(H + A)	3	1.01	1.04	1.00	37	36	49	33	33	44
	4	1.01	1.03	.98	41	41	53	38	38	39
	5+	1.00	1.00	.96	53	53	64	49	49	60
	Avg[c]	1.01	1.03	.98	43	42	54	39	39	50
HA + AH	2	1.03	1.05	1.02	31	34	35	28	30	31
(HAx)	3	.99	.99	.97	55	56	57	52	53	54
	4	.98	.98	.96	60	60	61	59	58	59
	5+	.96	.96	.93	71	70	71	69	69	69
	Avg[c]	.98	.98	.96	61	61	62	58	59	59
JH + JA	2	1.08	1.14	1.06	9	4	24	8	4	21
(Jx)	3	1.08	1.12	1.04	15	11	30	14	10	27
	4	1.10	1.12	1.04	14	10	29	13	9	26
	5+	1.05	1.07	.99	32	29	47	30	27	45
	Avg[c]	1.06	1.09	1.01	23	20	38	22	18	36
SDH + SDA	2	1.05	1.07	1.05	18	18	28	14	14	22
(SDx)	3	.98	.98	.96	56	56	66	50	50	58
	4	.95	.93	.92	75	75	85	73	72	82
	5+	.96	.94	.92	72	72	82	64	64	73
	Avg[c]	.98	.96	.95	61	61	71	55	55	63
LH + LA	2	.98	1.00	1.02	44	40	47	34	31	37
(Lx)	3	.88	.89	.92	90	90	98	83	82	90
	4	.91	.90	.93	84	85	93	75	76	84
	5+	.88	.86	.89	100	101	111	94	96	105
	Avg[c]	.90	.89	.92	87	87	96	80	80	89
CH + CA	2	1.00	1.00	1.00	39	38	59	28	27	43
(Cx)	3	.90	.89	.90	90	86	109	78	74	94
	4	.90	.88	.89	96	91	114	86	81	101
	5+	.90	.87	.88	100	94	117	85	80	100
	Avg[c]	.92	.90	.91	88	83	106	75	70	90
SH + SA	2	.99	.99	.98	46	46	64	38	39	54
(Sx)	3	.95	.94	.94	73	68	87	62	58	74
	4	.93	.92	.92	83	76	95	73	67	84
	5+	.91	.89	.89	98	89	108	89	81	99
	Avg[c]	.93	.92	.92	84	77	96	74	69	86

[a] Evaluation made after 217 days on feed, at 1035 lb. live weight and at 5% ribeye (RE) fat.

[b] H = Hereford, A = Angus, J = Jersey, SD = South Devon, L = Limousin, C = Charolais and S = Simmental; HA = Hereford sire x Angus dam, etc.

[c] Weighted average: 16.8% 2-year-olds; 14.6% 3-year-olds; 13.0% 4-year-olds; 55.6% ≥ 5-year-olds.

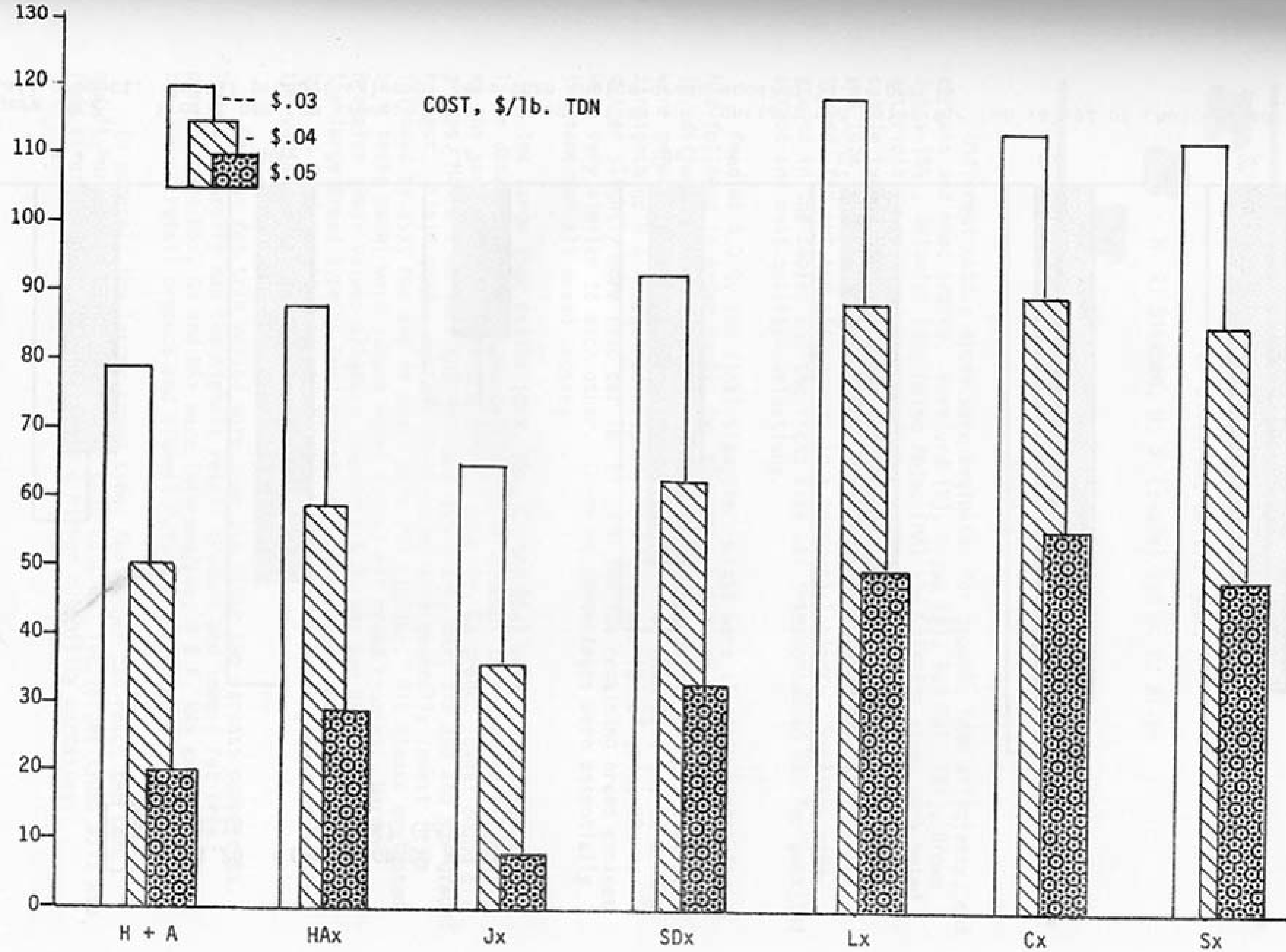


Figure 30.1. Profits per cow averaged across cow age at a grade-constant end point for three growing/finishing feed costs (per lb. of TDN). Feed cost for the cow herd equalled $.02/lb. TDN.

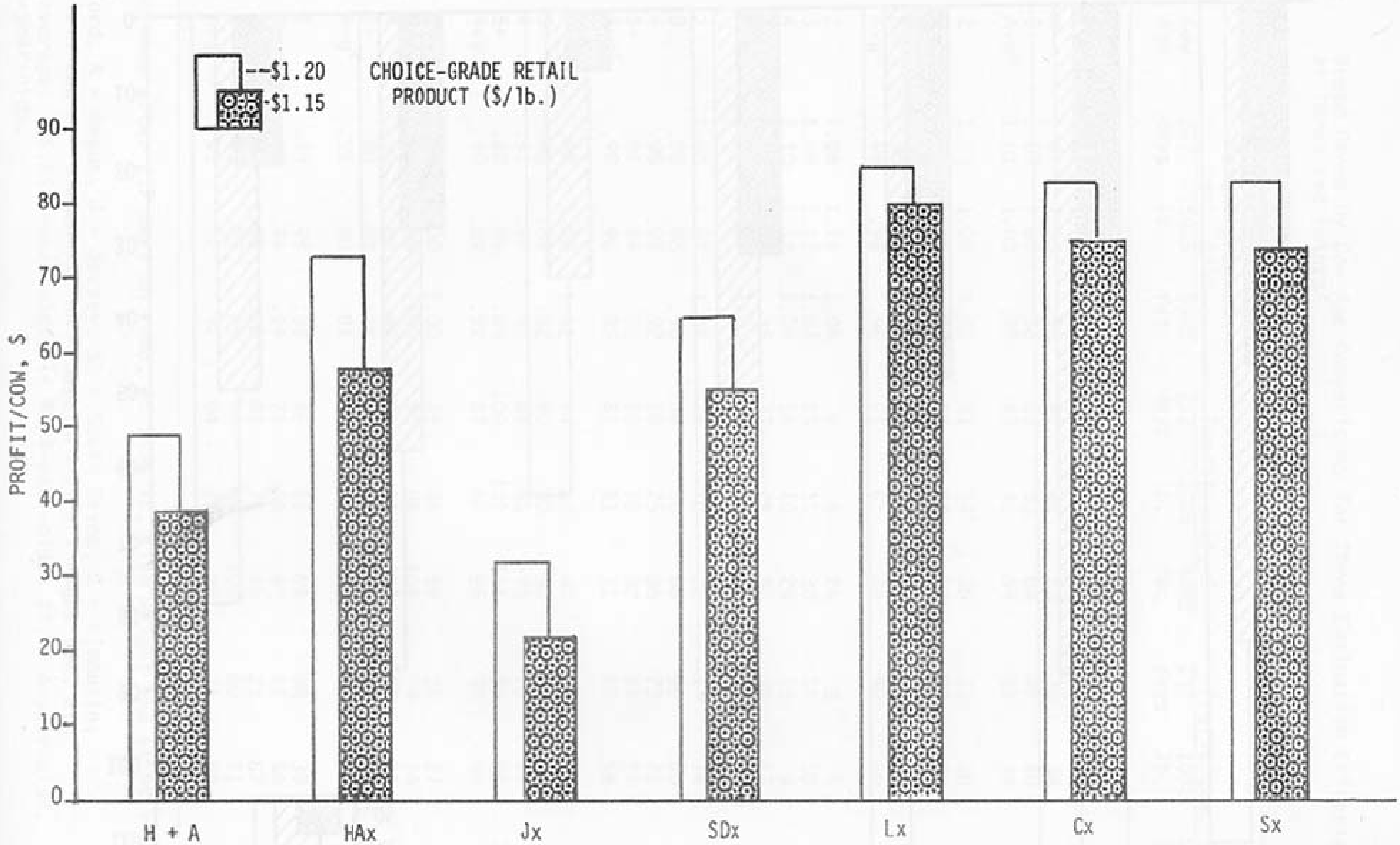


Figure 30.2. Profit per cow averaged over cow age at an age-constant end point for two values of choice-grade retail product. Retail product value of less than choice-grade equaled $1.07 per lb.

Performance and Carcass Characteristics of Different Cattle Types

M. E. Dikeman, H. D. Loveday and D. M. Allen

Summary

Different cattle types were evaluated for growth, feed efficiency, and carcass and meat traits. Hereford (H), Angus (A), Red Poll (RP), Brown Swiss (BS), Gelbvieh (G), Maine Anjou (MA) and Chianina sires were mated artificially to Angus and Hereford cows to obtain different crossbred (X) cattle types. Two calf crops were born in March, April and May of 1973, and 1974, and weaned when 200 days old. All male calves (787) were castrated, fed out and slaughtered in a commercial plant. Carcasses were graded in the cooler and the right side was transported to KSU for detailed cutout and meat quality evaluations.

Feedlot A.D.G. and final slaughter weight were slightly higher for MAx followed in order by Gx, Cx, BSx, HAx, H & A and RPx with about .05 lb. difference in A.D.G. between each descending pair. The HAx controls were generally 55 to 100 lb. lighter at slaughter than BSx, Gx, Cx or MAx. Straightbred H & A required slightly less feed per lb. of gain, RPx required slightly more feed per lb. of gain and the remaining breed crosses were very similar to each other. Dressing percentages were essentially the same for all breed crosses.

The large type cattle (MAx, BSx, Gx and BSx) were slaughtered at later dates than small type cattle--in an attempt to slaughter all cattle at the same quality grade end point. However, Cx graded lowest among all groups, MAx and Gx were intermediate and H & A, HAx, RPx and and BSx graded highest. Yield grades and fat thicknesses were generally lowest in Cx followed by BSx, MAx and Gx which were all similar. Rib steaks evaluated by a taste panel were judged equal across all breed crosses. Warner-Bratzler shear values slightly favored H & A, HAx and RPx compared with the large breed types. Good nutritional background, young age and a long time on feed resulted in equal palatability among breed groups even with the variation in quality grades that existed.

Carcass fat trim varied more than the other two carcass components. The Cx generally had the highest retail product and lowest fat trim percentages; BSx, Gx and MAx were intermediate; H & A, HAx and RPx had the lowest retail product and highest fat trim percentages.

In general, the larger breed types fed longer can reach the same quality grade end point as smaller type cattle. The larger types will use feed as efficiently and will produce higher cutability carcasses.

Introduction

Two-year results from the U.S. Meat Animal Research Center's "cattle germ plasm evaluation program" are reported here. Dr. Keith Gregory, director of the Meat Animal Research Center (MARC), initiated the project. Kansas State University and the Standardization Branch, A.M.S., U.S.D.A. cooperated on the carcass and meat aspects of the study.

The project was designed to characterize breeds from different cattle types by important economic beef production traits.

Data on calving difficulty and pre-weaning performance resulting from the matings in this project were obtained. Also, data on reproduction and maternal traits of the female progeny were studied. This information can be obtained by writing for Progress Reports No. 2 and 4, 1975 and 1976 from the 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, Brown Swiss, Red Poll, Maine Anjou, Gelbvieh and Chianina bulls. The two calf crops were born in March, April and May of 1973 and 1974 and were weaned when approximately 200 days old. All male calves were castrated and fed in a feedlot by sire breed groups to obtain growth and feed efficiency. The steers were fed a corn silage-and-concentrate ration that approximated 80% TDN (total digestible nutrients on a 100% dry matter basis) most of the feeding period for the 1973 calf crop ('73 calves) and 76% TDN for the 1974 calf crop ('74 calves).

Approximately one-third of the '73 straightbred Herefords (H) and Angus (A), Angus-Hereford crosses (HAx) and Red Poll crosses (RPx) were slaughtered at each of three slaughter times (220, 248 and 282 days on feed after weaning). Approximately one-third of the '73 Maine Anjou crosses (MAx), Chianina crosses (Cx) and Gelbvieh crosses (Gx) were slaughtered at each of three slaughter times (248, 282 and 338 days on feed). Brown Swiss crosses (BSx) were slaughtered at all four times. For the '74 calves, H & A, HAx and RPx were slaughtered at each of three slaughter times (254, 282 and 318 days on feed). The MAx, Cx and Gx were slaughtered at each of three slaughter times (318, 352 and 387 days on feed). BSx were slaughtered all five times. The later slaughter schedule for large type cattle (MAx, Gx, Cx and BSx) was an attempt to slaughter all cattle at a similar quality grade or carcass composition rather than at the same age.

Steers were slaughtered in a commercial slaughter plant and carcass data were obtained after a 24-hour chill. Carcasses were evaluated for yield grade and quality grade factors by representatives of the U.S. Meat Animal Research Center; Standardization Branch, A.M.S., U.S.D.A.; and Kansas State University.

The right side of each carcass was transported to Kansas State University for detailed cutout and meat quality evaluations. Each side was cut into essentially boneless, closely trimmed retail cuts. Rib 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; tenderness also was measured by Warner-Bratzler shear.

Results and Discussion

Results from this research are presented in a series of tables, but important observations are also discussed. We should emphasize that most comparisons are made only for slaughter dates common to all breed groups.

Slaughter weights and average daily gains (A.D.G.) are shown in tables 31.1and31.2 for the two calf crops. Maine Anjou crosses generally had the highest A.D.G.'s and final weights, and were followed by Gx, then Cx, then BSx. There was about .05 lb. difference in A.D.G. between each of these groups. The spread in slaughter weights was about 45 lb. from heaviest to lightest. The HAx controls averaged about .07 lb. less A.D.G. than BSx and about .20 lb. less than MAx. However, HAx final weights were about 100 lb. less than MAx, partially because HAx weaning weights were lower.

Red Poll crosses generally were lowest in A.D.G.'s and final weights of all breed crosses. Steers out of Hereford dams gained about .10 lb. more per day than steers out of Angus dams, but their final weights were essentially equal, primarily because steer calves out of Angus dams were heavier at weaning. The '73 calves generally had higher A.D.G.'s than '74 calves primarily because '73 calves were fed a higher energy ration, but there may also have been a year effect on A.D.G.

Feed efficiencies (tables 31.3 and 31.4) among breed crosses did not differ greatly, primarily because breed crosses did not differ greatly in A.D.G.'s and they were compared at similar quality grade end points (except that Cx graded lower than the other breed crosses). The most consistent trends in feed efficiencies were that H & A straightbreds required somewhat less TDN per lb. of gain than all other breed crosses, while RPx required more TDN per lb. of gain than all other breed crosses. The remaining breed crosses had very similar feed efficiencies. The '74 calves were generally less efficient than '73 calves primarily because '74 calves had lower A.D.G.'s so more TDN was used just for their maintenance. Feed efficiency may also have been affected by a difference in year.

Dressing percentages for the two calf crops did not differ among breed crosses. Dressing percentages and meat palatability are the only traits presented in this paper that showed no significant differences.

The large type cattle (MAx, Gx, Cx and BSx) were slaughtered at later dates than small type cattle (H & A, HAx and RPx) in an attempt to slaughter all cattle when they had similar quality grades. As shown in tables 31.5 and 31.6 , quality grades were somewhat similar except that Cx graded lower than all breed crosses. Straightbred H & A, HAx, RPx and BSx were very similar in quality grade. Gelbvieh crosses and MAx were very similar in quality and both were about one marbling degree lower than H & A, HAx, RPx and BSx. The Cx were about 1½ marbling degrees lower than MAx and Gx. The MAx and Gx probably need to weigh 1250 to 1300 lb. for a high percentage to reach low choice, while Cx probably need to reach 1300 to 1400 lb. Breed crosses that were one-half Angus graded about one-third of a grade higher than crosses with no Angus breeding.

Yield grades and fat thickness were lowest in Cx followed by BSx, MAx and Gx which were all very similar. Straightbred H & A, HAx and RPx were all similar and were generally one-half yield grade higher than MAx, BSx and Gx. An interesting comparison between BSx and RPx shows BSx used feed more efficiently to the same quality grade end point and produced heavier carcasses with more desirable yield grades than RPx. That comparison illustrates the affect that superior performance and sufficient time on feed have on carcass merit.

Carcass yields of bone, fat trim and retail product percentages are shown in tables 31.7 and 31.8. The data indicate that carcass fat trim varied the most of the three carcass components. Fat trim percentage ranged about 7% from highest to lowest breed cross each year. Bone percentage ranged only about 2% and retail product percentage ranged about 4 1/2 %. There were significant differences between calf crops in percentages of retail product, fat trim and bone. Cx were highest in retail product percentage followed by BSx, GX and MAx which were all similar. HAx, H & A and RPx were all similar in retail product and lower than BSx, GX and MAx.

Rib steaks evaluated by a taste panel were judged equal across all breed crosses and all breed cross averages were judged as “moderately desirable.” Warner-Bratzler shear values slightly favored H & A, HAx and RPx compared with the large breed types. Even though quality grades varied among breed crosses, the good nutritional background, young age and long time on feed resulted in palatability for all breed crosses.

Table 31.1 Postweaning Average Daily Gains and Adjusted Final Weights for the 1973 Calf Crop.

Breed of Steer		No. Steers[a]					Postweaning Average Daily Gain[b]					Adjusted Final Weight[c]					
Sire	Dam	220	248	282	338	Total	220	248	282	338	Avg.[d]	220	248	282	338	Avg.[d]	Ratio[e]
Hereford	Hereford	4	4	5	..	13	2.53	2.33	2.29	....	2.31	969	986	1045	....	1016	99.1
Angus	Angus	8	7	7	..	22	2.37	2.30	2.24	....	2.27	951	974	1053	....	1014	98.9
	Average	12	11	12	..	35	2.45	2.32	2.26	....	2.29	960	980	1049	....	1015	99.0
Angus	Hereford	8	7	8	..	23	2.47	2.48	2.29	....	2.39	961	1010	1059	....	1035	101.0
Hereford	Angus	9	9	9	..	27	2.25	2.34	2.25	....	2.30	913	984	1047	....	1016	99.1
	Average	17	16	17	..	50	2.36	2.41	2.27	....	2.34	937	997	1053	....	1025	100.0
Red Poll	Hereford	9	7	8	..	24	2.25	2.46	2.19	....	2.33	914	1026	1035	....	1031	100.6
	Angus	8	9	9	..	26	2.10	2.02	1.93	....	1.98	898	943	991	....	967	94.3
	Average	17	16	17	..	50	2.18	2.24	2.06	....	2.15	906	985	1013	....	999	97.5
Brown Swiss	Hereford	4	5	4	7	20	2.61	2.48	2.54	2.55	2.51	998	1035	1156	1310	1096	106.9
	Angus	6	5	5	8	24	2.53	2.57	2.32	2.48	2.45	1010	1084	1099	1315	1092	106.5
	Average	10	10	9	15	44	2.57	2.53	2.43	2.52	2.48	1004	1060	1128	1312	1094	106.7
Gelbvieh	Hereford	..	8	6	7	21	....	2.49	2.48	2.49	2.49	....	1052	1120	1287	1086	106.0
	Angus	..	10	10	10	30	....	2.39	2.34	2.32	2.37	....	1052	1130	1241	1091	106.4
	Average	..	18	16	17	51	....	2.44	2.41	2.41	2.43	....	1052	1125	1264	1089	106.2
Maine Anjou	Hereford	..	3	4	7	14	....	2.63	2.59	2.33	2.61	....	1085	1186	1212	1136	110.8
	Angus	..	8	7	10	25	....	2.61	2.51	2.29	2.56	....	1126	1158	1213	1142	111.4
	Average	..	11	11	17	39	....	2.62	2.55	2.31	2.59	....	1105	1172	1213	1139	111.1
Chianina	Hereford	..	6	6	8	20	....	2.56	2.46	2.39	2.51	....	1084	1114	1264	1099	107.2
	Angus	..	7	7	8	22	....	2.51	2.24	2.38	2.38	....	1092	1105	1294	1099	107.2
	Average	..	13	13	16	42	....	2.53	2.35	2.38	2.44	....	1088	1110	1279	1099	107.2
Average	Hereford	25	40	41	29	135	2.47	2.49	2.41	2.44	2.45	960	1040	1102	1268	1071	104.5
All Sire	Angus	31	55	54	36	176	2.31	2.39	2.26	2.37	2.33	943	1036	1083	1266	1060	103.4
Breeds	Average	56	95	95	65	311	2.39	2.44	2.34	2.40	2.39	952	1038	1093	1267	1066	104.0

[a] Number of steers slaughtered after 220, 248, 282 and 338 days postweaning.
[b] ADG = (actual final wt. - actual weaning wt.) ÷ days on feed.
[c] Adj. final wt. = 200-day wt. + (postwn. ADG x days on feed postwn.).
[d] Average calculated only for dates common to all breed groups.
[e] Ratio relative to 1025 lb. average of Hereford-Angus crossbreds.

Table 31.2 Postweaning Average Daily Gains and Adjusted Final Weights for the 1974 Calf Crop.

Breed of Steer		No. Steers[a]						Postweaning Average Daily Gain[b]						Adjusted Final Weight[c]						
Sire	Dam	254	282	318	352	387	Total	254	282	318	352	387	Avg.[d]	254	282	318	352	387	Avg.[d]	Ratio[e]
Hereford	Hereford	9	10	10	..	..	29	2.12	2.06	2.05	....	....	2.06	928	972	1051	....	....	1012	96.7
Angus	Angus	12	13	13	..	..	38	1.99	1.97	1.94	....	....	1.96	929	980	1059	....	....	1020	97.4
	Average	21	23	23	..	..	67	2.06	2.02	2.00	....	....	2.01	928	976	1055	....	....	1016	97.0
Angus	Hereford	11	11	12	..	..	34	2.22	2.21	2.08	....	....	2.14	997	1033	1078	....	....	1056	100.9
Hereford	Angus	13	12	14	..	..	39	2.10	2.10	1.92	....	....	2.01	981	1030	1045	....	....	1038	99.1
	Average	24	23	26	..	..	73	2.16	2.16	2.00	....	....	2.08	989	1032	1062	....	....	1047	100.0
Red Poll	Hereford	6	6	6	..	..	18	2.04	2.07	1.98	....	....	2.02	931	1001	1054	....	....	1028	98.2
	Angus	13	13	14	..	..	40	1.94	1.92	1.90	....	....	1.91	916	965	1031	....	....	998	95.3
	Average	19	19	20	..	..	58	1.99	2.00	1.94	....	....	1.97	924	983	1042	....	....	1013	96.8
Brown Swiss	Hereford	6	7	6	6	7	32	2.22	2.13	2.24	2.24	2.22	2.18	1011	1060	1152	1221	1297	1106	105.6
	Angus	8	11	11	7	7	44	2.08	2.12	2.03	2.09	2.11	2.08	1026	1065	1095	1188	1270	1080	103.2
	Average	14	18	17	13	14	76	2.15	2.13	2.13	2.16	2.17	2.13	1019	1063	1123	1205	1284	1093	104.4
Gelbvieh	Hereford	..	6	6	5	5	22	....	2.31	2.34	2.38	2.28	2.32	....	1081	1189	1248	1277	1135	108.4
	Angus	..	10	11	8	7	36	....	2.27	2.20	2.17	2.28	2.24	....	1127	1184	1270	1362	1156	110.4
	Average	..	16	17	13	12	58	....	2.29	2.27	2.27	2.28	2.28	....	1104	1186	1259	1320	1145	109.4
Maine Anjou	Hereford	..	8	10	7	7	32	....	2.42	2.29	2.42	2.34	2.36	....	1107	1164	1239	1365	1136	108.5
	Angus	..	10	14	7	7	38	....	2.21	2.22	2.33	2.26	2.22	....	1107	1188	1307	1363	1148	109.6
	Average	..	18	24	14	14	70	....	2.31	2.26	2.37	2.30	2.29	....	1107	1176	1273	1364	1142	109.1
Chianina	Hereford	..	10	11	7	7	35	....	2.26	2.15	2.24	2.25	2.20	....	1057	1123	1208	1320	1090	104.1
	Angus	..	11	15	7	6	39	....	2.25	2.22	2.09	2.21	2.24	....	1103	1162	1227	1332	1132	108.1
	Average	..	21	26	14	13	74	....	2.25	2.18	2.17	2.23	2.22	....	1080	1143	1217	1326	1111	106.1
Average	Hereford	32	58	61	25	26	202	2.15	2.21	2.16	2.32	2.27	2.18	967	1044	1116	1229	1315	1080	103.2
All Sire	Angus	46	80	92	29	27	274	2.02	2.12	2.06	2.17	2.21	2.09	963	1054	1109	1248	1332	1082	103.3
Breeds	Average	78	138	153	54	53	476	2.09	2.16	2.11	2.24	2.24	2.14	965	1049	1113	1239	1323	1081	103.2

[a] Number of steers slaughtered after 254, 282, 318, 352 and 387 days postweaning.
[b] ADG = (actual final wt. - actual weaning wt.) ÷ days on feed.
[c] Adj. final wt. = 200-day wt. + (postwn. ADG x days on feed postwn.).
[d] Average calculated only for dates common to all breed groups (282 and 318 days).
[e] Ratio relative to 1047 lb. average of Hereford-Angus crossbreds.

Table 31.3. Feed Efficiencies and Dressing Percentages for the 1973 Calf Crop.

Breed of Steer		Feed Efficiency (TDN per lb. gain)					Dressing Percent[a]				
Sire	Dam	220	248	282	338	Avg.[b]	220	248	282	338	Avg.[b]
Hereford	Hereford						58.1	59.8	60.5	....	60.2
Angus	Angus						58.8	60.1	60.2	....	60.2
	Average	5.95	6.11	6.23	....	6.10	58.5	60.0	60.4	....	60.2
Angus	Hereford						58.7	59.0	59.6	....	59.3
Hereford	Angus						60.9	59.1	60.3	....	59.7
	Average	6.31	6.44	6.57	....	6.44	59.8	59.1	60.0	....	59.5
Red Poll	Hereford						58.5	58.9	59.7	....	59.3
	Angus						59.2	59.7	59.3	....	59.5
	Average	6.72	6.81	6.94	....	6.82	58.8	59.3	59.5	....	59.4
Brown Swiss	Hereford						58.3	59.2	59.5	60.2	59.4
	Angus						60.2	60.2	60.7	61.9	60.5
	Average	6.31	6.48	6.62	6.71	6.47	59.2	59.7	60.1	61.0	59.9
Gelbvieh	Hereford						....	59.2	59.3	59.8	59.3
	Angus						....	59.7	61.0	60.1	60.4
	Average	6.18	6.44	6.62	6.62	6.41	....	59.4	60.2	59.9	59.8
Maine Anjou	Hereford						....	59.7	60.7	60.7	60.2
	Angus						....	61.9	61.5	61.8	61.7
	Average	5.98	6.34	6.54	6.54	6.29	....	60.8	61.1	61.2	61.0
Chianina	Hereford						....	61.3	60.6	61.6	61.0
	Angus						....	61.8	60.4	62.5	61.1
	Average	6.44	6.65	6.82	6.88	6.64	....	61.5	60.5	62.0	61.0
Average	Hereford						58.4	59.6	60.0	60.6	59.8
All Sire	Angus						59.7	60.3	60.5	61.6	60.4
Breeds	Average	6.27	6.47	6.62	6.69	6.45	59.1	60.0	60.2	61.1	60.1

[a]Dressing percent equals hot carcass weight divided by final weight on feed and water (without shrink).

[b]Average calculated only for dates common to all breed groups.

Table 31.4 Feed Efficiencies and Dressing Percentages for the 1974 Calf Crop.

Breed of Steer		Feed Efficiency (TDN per lb. gain)						Dressing Percent[a]					
Sire	Dam	254	282	318	352	387	Avg.[b]	254	282	318	352	387	Avg.[b]
Hereford	Hereford							57.6	57.2	58.9	....	....	58.0
Angus	Angus							59.0	61.1	60.8	....	....	61.0
	Average	6.42	6.58	6.70	....	....	6.57	58.3	59.2	59.8	....	....	59.5
Angus	Hereford							57.7	59.3	60.1	....	....	59.7
Hereford	Angus							58.4	59.5	60.3	....	....	59.9
	Average	6.76	6.94	7.48	....	....	7.06	58.0	59.4	60.2	....	....	59.8
Red Poll	Hereford							58.1	59.1	59.0	....	....	59.0
	Angus							58.9	60.5	60.5	....	....	60.5
	Average	7.47	7.59	7.93	....	....	7.66	58.5	59.8	59.8	....	....	59.8
Brown Swiss	Hereford							56.8	57.6	59.4	60.2	62.0	58.5
	Angus							58.2	59.1	59.7	59.9	59.4	59.4
	Average	6.87	7.05	7.26	7.21	7.21	7.06	57.5	58.3	59.6	60.1	60.7	59.0
Gelbvieh	Hereford							....	58.6	59.1	60.4	60.1	58.8
	Angus							....	59.5	59.7	61.8	60.5	59.6
	Average	6.74	7.03	7.30	7.27	7.32	7.02	....	59.1	59.4	61.1	60.3	59.2
Maine Anjou	Hereford							....	59.4	58.8	60.1	60.5	59.1
	Angus							....	60.7	60.6	60.6	61.5	60.6
	Average	6.57	7.03	7.20	7.11	7.27	6.93	....	60.0	59.7	60.3	61.0	59.8
Chianina	Hereford							....	60.3	58.7	60.4	59.9	59.5
	Angus							....	60.4	59.6	62.3	59.5	60.0
	Average	6.62	6.90	7.10	7.25	7.08	6.87	....	60.3	59.1	61.3	59.7	59.7
Average	Hereford							57.6	58.8	59.2	60.3	60.6	59.0
All Sire	Angus							58.6	60.1	60.2	61.2	60.2	60.2
Breeds	Average	6.78	7.02	7.28	7.21	7.22	7.02	58.1	59.5	59.7	60.7	60.4	59.6

[a]Dressing percent equals hot carcass weight divided by final weight on feed and water (without shrink).

[b]Average calculated only for dates common to all breed groups (282 and 318 days).

Table 31.5 Quality Grades, Yield Grades and Fat Thicknesses for Carcasses from the 1973 Calf Crop.

Breed of Steer		U.S.D.A. Quality Grade[a]					U.S.D.A. Yield Grade					Fat Thickness, in.				
Sire	Dam	220	248	282	338	Avg.[b]	220	248	282	338	Avg.[b]	220	248	282	338	Avg.[b]
Hereford	Hereford	10.8	11.9	10.9	....	11.4	3.2	3.7	3.7	...	3.7	.53	.65	.63	...	.64
Angus	Angus	12.3	13.5	12.4	....	13.0	3.3	3.8	3.6	...	3.7	.53	.60	.60	...	.60
	Average	11.6	12.7	11.7	....	12.2	3.3	3.8	3.7	...	3.7	.53	.63	.62	...	.62
Angus	Hereford	12.0	11.1	12.8	....	12.0	3.2	3.6	4.1	...	3.9	.54	.55	.75	...	.65
	Angus	11.2	10.6	12.2	....	11.4	3.5	3.4	4.3	...	3.9	.54	.52	.82	...	.67
	Average	11.6	10.9	12.5	....	11.7	3.4	3.5	4.2	...	3.9	.54	.54	.79	...	.66
Red Poll	Hereford	10.4	10.1	11.8	....	11.0	3.1	3.6	4.0	...	3.8	.48	.54	.65	...	.60
	Angus	10.5	12.0	12.3	....	12.2	3.3	3.1	3.6	...	3.4	.47	.41	.52	...	.47
	Average	10.4	11.0	12.1	....	11.6	3.2	3.3	3.8	...	3.6	.47	.48	.59	...	.54
Brown Swiss	Hereford	10.1	11.0	11.8	12.0	11.4	2.7	3.0	3.2	3.8	3.1	.33	.39	.48	.63	.44
	Angus	11.2	12.2	12.7	12.5	12.5	2.9	3.2	3.3	4.1	3.3	.42	.53	.53	.70	.53
	Average	10.6	11.6	12.3	12.2	12.0	2.8	3.1	3.3	4.0	3.2	.38	.46	.51	.67	.49
Gelbvieh	Hereford	....	10.3	10.4	10.8	10.4	...	3.3	2.8	2.9	3.1	...	.44	.36	.46	.40
	Angus	....	10.8	11.8	11.9	11.3	...	2.9	3.8	3.8	3.4	...	.47	.55	.59	.51
	Average	....	10.6	11.1	11.3	10.9	...	3.1	3.3	3.4	3.2	...	.45	.46	.53	.46
Maine Anjou	Hereford	....	11.0	12.3	10.5	11.7	...	2.7	3.6	2.6	3.2	...	.36	.51	.33	.44
	Angus	....	11.2	12.2	12.5	11.7	...	3.1	2.7	4.1	2.9	...	.48	.41	.65	.45
	Average	....	11.1	12.2	11.5	11.7	...	2.9	3.2	3.3	3.1	...	.42	.46	.49	.44
Chianina	Hereford	....	9.1	9.9	10.1	9.5	...	2.9	2.8	3.1	2.9	...	.38	.37	.44	.38
	Angus	....	10.8	11.4	11.7	11.1	...	2.9	2.9	2.8	2.9	...	.43	.41	.39	.42
	Average	....	10.0	10.7	10.9	10.3	...	2.9	2.9	3.0	2.9	...	.41	.39	.42	.40
Average	Hereford	10.8	10.6	11.4	10.8	11.0	3.1	3.3	3.5	3.1	3.4	.47	.47	.54	.47	.51
All Sire	Angus	11.3	11.6	12.2	12.1	11.9	3.2	3.2	3.5	3.7	3.4	.49	.49	.55	.58	.52
Breeds	Average	11.0	11.1	11.8	11.5	11.5	3.2	3.2	3.5	3.4	3.4	.48	.48	.54	.52	.51

[a] U.S.D.A. Quality Grade as revised in 1976. 10 = average good, 11 = high good, 12 = low choice, 13 = average choice, etc.

[b] Average calculated only for dates common to all breed groups.

Table 31.6 Quality Grades, Yield Grades and Fat Thicknesses for Carcasses from the 1974 Calf Crop.

Breed of Steer		U.S.D.A. Quality Grade[a]						U.S.D.A. Yield Grade						Fat Thickness, in.					
Sire	Dam	254	282	318	352	387	Avg.[b]	254	282	318	352	387	Avg.[b]	254	282	318	352	387	Avg.[b]
Hereford	Hereford	9.5	10.1	9.9	....	....	10.0	2.9	3.2	3.2	...	...	3.2	.35	.43	.44	...	...	.44
Angus	Angus	11.7	11.8	12.5	....	....	12.1	3.2	3.4	3.6	...	...	3.5	.43	.49	.53	...	...	.51
	Average	10.6	11.0	11.2	....	....	11.1	3.0	3.3	3.4	...	...	3.4	.39	.46	.48	...	...	.47
Angus	Hereford	10.5	10.9	11.4	....	....	11.1	3.1	3.2	3.8	...	...	3.5	.42	.44	.59	...	...	.52
Hereford	Angus	10.9	11.5	11.3	....	....	11.4	3.2	3.3	3.6	...	...	3.4	.43	.46	.56	...	...	.51
	Average	10.7	11.2	11.4	....	....	11.3	3.2	3.2	3.7	...	...	3.4	.42	.45	.58	...	...	.52
Red Poll	Hereford	10.4	10.4	10.8	....	....	10.6	2.9	3.6	3.3	...	...	3.4	.36	.43	.42	...	...	.42
	Angus	11.1	11.1	11.3	....	....	11.2	3.1	3.0	3.6	...	...	3.3	.38	.38	.46	...	...	.42
	Average	10.8	10.7	11.0	....	....	10.9	3.0	3.3	3.5	...	...	3.4	.37	.40	.44	...	...	.42
Brown Swiss	Hereford	8.2	10.1	10.2	10.9	10.8	10.2	2.2	2.6	2.8	3.0	3.5	2.7	.18	.27	.27	.32	.47	.27
	Angus	10.6	9.9	11.6	11.2	12.2	10.8	2.8	2.9	3.0	3.1	3.6	3.0	.31	.36	.37	.39	.49	.36
	Average	9.4	10.0	10.9	11.0	11.5	10.5	2.5	2.8	2.9	3.1	3.5	2.8	.24	.32	.32	.35	.48	.32
Gelbvieh	Hereford	....	9.6	8.6	11.1	9.5	9.1	...	2.8	2.5	3.1	3.3	2.6	...	.28	.27	.39	.43	.28
	Angus	....	10.8	10.8	12.4	11.8	10.8	...	3.0	2.7	3.8	4.0	2.8	...	.32	.36	.51	.61	.34
	Average	....	10.2	9.7	11.7	10.6	10.0	...	2.9	2.6	3.4	3.6	2.7	...	.30	.31	.45	.52	.31
Maine Anjou	Hereford	....	9.1	9.9	9.8	10.0	9.5	...	2.7	2.5	2.7	3.2	2.6	...	.27	.26	.30	.44	.26
	Angus	....	10.2	11.1	11.5	11.6	10.6	...	3.0	3.1	3.5	3.5	3.0	...	.34	.39	.50	.48	.36
	Average	....	9.6	10.5	10.6	10.8	10.0	...	2.8	2.8	3.1	3.3	2.8	...	.31	.32	.40	.46	.31
Chianina	Hereford	....	8.3	8.5	8.6	9.6	8.4	...	2.3	2.2	2.5	3.2	2.2	...	.21	.20	.23	.39	.20
	Angus	....	9.5	8.6	10.9	10.7	9.0	...	2.7	2.4	2.8	3.1	2.6	...	.31	.29	.34	.43	.30
	Average	....	8.9	8.6	9.8	10.1	8.7	...	2.5	2.3	2.7	3.2	2.4	...	.26	.25	.28	.41	.25
Average	Hereford	9.7	9.8	9.9	10.1	10.0	9.8	2.8	2.9	2.9	2.8	3.3	2.9	.33	.33	.35	.31	.43	.33
All Sire	Angus	11.1	10.7	11.0	11.5	11.6	10.8	3.1	3.0	3.1	3.3	3.6	3.0	.39	.38	.42	.43	.50	.42
Breeds	Average	10.4	10.2	10.5	10.8	10.8	10.3	2.9	3.0	3.0	3.1	3.4	3.0	.36	.36	.39	.37	.47	.38

[a] U.S.D.A. Quality Grade: 10 = average good, 11 = high good, 12 = low choice, 13 = high choice, etc.
[b] Average calculated only for dates common to all breed groups.

Table 31.7 Percentages of Bone, Fat Trim and Retail Product for Carcasses from the 1973 Calf Crop.

Breed of Steer		Bone, %					Fat Trim, %					Retail Product, %[a]				
Sire	Dam	220	248	282	338	Avg.[b]	220	248	282	338	Avg.[b]	220	248	282	338	Avg.[b]
Hereford	Hereford	12.7	12.1	11.8	....	12.0	18.9	22.7	22.4	....	22.6	68.4	65.1	65.8	....	65.5
Angus	Angus	11.8	11.2	11.2	....	11.2	20.6	23.7	23.5	....	23.6	67.6	65.1	65.3	....	65.2
	Average	12.3	11.7	11.5	....	11.6	19.8	23.2	23.0	....	23.1	68.0	65.1	65.5	....	65.3
Angus	Hereford	11.9	11.5	11.4	....	11.5	20.2	23.5	24.4	....	24.0	67.9	65.0	64.3	....	64.7
Hereford	Angus	12.5	12.0	11.0	....	11.5	20.0	21.9	25.1	....	23.5	67.6	66.1	63.9	....	65.0
	Average	12.2	11.8	11.2	....	11.5	20.1	22.7	24.8	....	23.8	67.7	65.6	64.1	....	64.9
Red Poll	Hereford	12.7	12.0	11.8	....	11.9	19.5	22.1	23.9	....	23.0	67.8	65.9	64.3	....	65.1
	Angus	12.2	12.6	11.8	....	12.2	19.2	20.2	23.9	....	22.1	68.6	67.2	64.2	....	65.7
	Average	12.5	12.3	11.8	....	12.1	19.3	21.1	23.9	....	22.5	68.2	66.6	64.3	....	65.4
Brown Swiss	Hereford	13.7	13.6	12.4	11.9	13.0	15.8	18.0	21.8	23.2	19.9	70.5	68.4	65.7	64.9	67.1
	Angus	13.2	12.6	11.7	11.5	12.2	18.0	20.6	22.2	25.1	21.4	68.8	66.8	66.1	63.4	66.5
	Average	13.5	13.1	12.0	11.7	12.6	16.9	19.3	22.0	24.1	20.7	69.7	67.6	65.9	64.1	66.8
Gelbvieh	Hereford	....	12.5	12.2	11.9	12.4	....	20.3	18.6	20.0	19.5	....	67.2	69.2	68.1	68.2
	Angus	....	11.9	11.8	11.3	11.9	....	19.3	22.3	23.5	20.8	....	68.8	65.8	65.1	67.3
	Average	....	12.2	12.0	11.6	12.1	....	19.8	20.5	21.8	20.2	....	68.0	67.5	66.6	67.8
Maine Anjou	Hereford	....	13.6	12.9	13.0	13.3	....	16.0	20.8	16.4	18.4	....	70.4	66.3	70.6	68.4
	Angus	....	12.3	12.0	11.6	12.2	....	20.1	19.5	24.1	19.8	....	67.5	68.6	64.3	68.1
	Average	....	13.0	12.4	12.3	12.7	....	18.1	20.1	20.3	19.1	....	69.0	67.4	67.4	68.2
Chianina	Hereford	....	14.2	14.1	12.6	14.2	....	16.5	15.6	19.5	16.1	....	69.2	70.3	68.0	69.8
	Angus	....	12.6	12.9	12.4	12.8	....	18.5	18.3	18.0	18.4	....	69.0	68.8	69.6	68.9
	Average	....	13.4	13.5	12.5	13.5	....	17.5	17.0	18.7	17.3	....	69.1	69.5	68.8	69.3
Average	Hereford	12.8	12.8	12.4	12.4	12.6	18.6	19.9	21.1	19.8	20.5	68.6	67.3	66.5	67.9	66.9
All Sire	Angus	12.4	12.2	11.8	11.7	12.0	19.4	20.6	22.1	22.7	21.4	68.1	67.2	66.1	65.6	66.7
Breeds	Average	12.6	12.5	12.1	12.0	12.3	19.0	20.2	21.6	21.2	20.9	68.4	67.3	66.3	66.7	66.8

[a] Retail Product, % = Actual yield of boneless, closely trimmed beef from the carcass.
[b] Average calculated only for dates common to all breed groups.

Table 31.8 Percentages of Bone, Fat Trim and Retail Product for Carcasses from the 1974 Calf Crop.

Breed of Steer		Bone, %						Fat Trim, %						Retail Product, %[a]					
Sire	Dam	254	282	318	352	387	Avg.[b]	254	282	318	352	387	Avg.[b]	254	282	318	352	387	Avg.[b]
Hereford	Hereford	13.6	13.4	13.3	....	....	13.4	13.3	15.2	15.6	....	....	15.4	73.1	71.4	71.0	....	....	71.2
Angus	Angus	12.4	12.2	11.9	....	....	12.0	15.3	17.7	18.0	....	....	17.8	72.3	70.2	70.1	....	....	70.2
	Average	13.0	12.8	12.6	....	....	12.7	14.3	16.4	16.8	....	....	16.6	72.7	70.8	70.6	....	....	70.7
Angus	Hereford	12.9	12.8	12.3	....	....	12.6	15.4	15.6	18.2	....	....	16.9	71.7	71.5	69.4	....	....	70.4
Hereford	Angus	12.7	12.6	12.2	....	....	12.4	15.3	15.8	17.8	....	....	16.8	72.0	71.7	70.0	....	....	70.8
	Average	12.8	12.7	12.2	....	....	12.5	15.4	15.7	18.0	....	....	16.8	71.8	71.6	69.7	....	....	70.6
Red Poll	Hereford	13.5	13.5	13.0	....	....	13.2	14.1	16.4	16.9	....	....	16.6	72.4	70.1	70.1	....	....	70.1
	Angus	13.3	12.9	12.5	....	....	12.7	15.0	15.5	18.0	....	....	16.8	71.7	71.6	69.5	....	....	70.6
	Average	13.4	13.2	12.8	....	....	13.0	14.6	15.9	17.4	....	....	16.7	72.0	70.9	69.8	....	....	70.4
Brown Swiss	Hereford	14.7	14.9	14.6	13.7	13.5	14.8	10.8	12.0	12.5	16.0	16.4	12.2	74.5	73.2	72.9	70.3	70.1	73.0
	Angus	14.1	13.7	13.4	13.0	12.8	13.6	12.6	14.1	15.1	16.7	17.1	14.6	73.2	72.3	71.6	70.2	70.0	72.0
	Average	14.4	14.3	14.0	13.3	13.2	14.2	11.7	13.0	13.8	16.4	16.8	13.4	73.9	72.7	72.2	70.3	70.1	72.5
Gelbvieh	Hereford	....	14.0	14.2	13.7	13.1	14.1	....	12.6	13.0	15.6	16.4	12.8	....	73.4	72.8	70.7	70.5	73.1
	Angus	....	13.0	13.3	12.0	12.0	13.2	....	14.9	13.9	19.7	19.0	14.4	....	72.0	72.7	68.4	69.0	72.4
	Average	....	13.5	13.8	12.8	12.6	13.6	....	13.8	13.5	17.6	17.7	13.6	....	72.7	72.8	69.5	69.8	72.8
Maine Anjou	Hereford	....	14.5	14.4	14.0	13.2	14.4	....	13.1	13.2	14.2	15.9	13.2	....	72.5	72.5	71.7	70.9	72.5
	Angus	....	13.5	13.3	12.9	12.9	13.4	....	15.0	16.0	18.0	16.7	15.5	....	71.5	70.6	69.1	70.3	71.0
	Average	....	14.0	13.9	13.5	13.1	14.0	....	14.0	14.6	16.1	16.3	14.3	....	72.0	71.6	70.4	70.6	71.8
Chianina	Hereford	....	15.0	15.5	15.2	14.3	15.2	....	10.4	9.7	11.2	13.6	10.0	....	74.6	74.8	73.6	72.1	74.7
	Angus	....	14.3	14.4	13.7	13.5	14.4	....	12.5	11.1	14.3	14.8	11.8	....	73.2	74.5	72.0	71.7	73.8
	Average	....	14.7	15.0	14.4	13.9	14.8	....	11.5	10.4	12.8	14.2	11.0	....	73.9	74.6	72.8	71.9	74.2
Average All Sire Breeds	Hereford	13.7	14.0	13.9	14.1	13.5	14.0	13.4	13.6	14.2	14.3	15.6	13.9	72.9	72.4	71.9	71.6	70.9	72.2
	Angus	13.1	13.2	13.0	12.9	12.8	13.1	14.6	15.1	15.7	17.2	16.9	15.4	72.3	71.8	71.3	69.9	70.3	71.6
	Average	13.4	13.6	13.5	13.5	13.2	13.6	14.0	14.3	14.9	15.7	16.2	14.6	72.6	72.1	71.6	70.8	70.6	71.9

[a] Retail Product, % = Actual yield of boneless, closely trimmed beef from the carcass.
[b] Average calculated only for dates common to all breed groups (282 and 318 days).

Table 31.9 Percentages of Cutability, Warner-Bratzler Shear Values and Taste Panel Evaluations for Carcasses from the 1973 Calf Crop.

Breed of Steer		Actual Cutability, %[a]					Warner-Bratzler Shear, lb.[b]					Taste Panel Acceptability[c]				
Sire	Dam	220	248	282	338	Avg.[d]	220	248	282	338	Avg.[d]	220	248	282	338	Avg.[d]
Hereford	Hereford	55.5	52.5	52.3	....	52.4	7.6	7.0	6.9	...	7.0	6.8	8.0	7.6	...	7.8
Angus	Angus	53.6	51.4	51.6	....	51.5	7.0	6.9	6.1	...	6.5	6.9	7.9	7.9	...	7.9
	Average	54.5	51.9	51.9	....	51.9	7.3	7.0	6.5	...	6.8	6.9	7.9	7.7	...	7.8
Angus	Hereford	54.3	52.0	51.0	....	51.5	6.5	7.0	6.5	...	6.8	7.5	7.9	7.6	...	7.8
Hereford	Angus	54.4	53.1	50.4	....	51.8	6.6	7.9	7.1	...	7.5	7.4	7.2	7.8	...	7.5
	Average	54.3	52.5	50.7	....	51.6	6.5	7.5	6.8	...	7.2	7.5	7.5	7.7	...	7.6
Red Poll	Hereford	54.5	53.3	51.3	....	52.3	6.9	7.4	6.8	...	7.1	7.8	7.6	7.6	...	7.6
	Angus	54.8	54.2	51.2	....	52.7	7.3	7.7	7.2	...	7.5	6.7	7.3	7.6	...	7.5
	Average	54.6	53.7	51.3	....	52.5	7.1	7.6	7.0	...	7.3	7.3	7.4	7.6	...	7.5
Brown Swiss	Hereford	57.0	55.6	52.7	52.3	54.2	7.8	8.4	7.4	6.1	7.9	7.3	7.3	7.6	7.7	7.5
	Angus	55.8	53.9	52.9	50.6	53.4	6.5	6.8	7.6	6.9	7.2	7.4	7.8	7.6	7.8	7.7
	Average	56.4	54.8	52.8	51.5	53.8	7.1	7.6	7.5	6.5	7.6	7.4	7.6	7.6	7.7	7.6
Gelbvieh	Hereford	....	54.1	55.5	54.9	54.8	...	8.0	6.6	6.3	7.3	...	7.2	7.2	7.7	7.2
	Angus	....	54.7	52.6	52.1	53.7	...	7.3	7.4	6.2	7.4	...	7.4	7.6	7.5	7.5
	Average	....	54.4	54.1	53.5	54.3	...	7.7	7.0	6.3	7.4	...	7.3	7.4	7.6	7.4
Maine Anjou	Hereford	....	57.0	53.5	56.9	55.3	...	6.7	6.5	6.8	6.6	...	7.4	7.6	7.7	7.5
	Angus	....	54.3	55.2	51.2	54.8	...	6.8	6.9	6.9	6.9	...	7.5	7.5	7.7	7.5
	Average	....	55.7	54.3	54.1	55.0	...	6.8	6.7	6.9	6.8	...	7.5	7.5	7.7	7.5
Chianina	Hereford	....	56.8	57.1	55.3	57.0	...	8.3	7.5	6.1	7.9	...	7.3	7.2	7.5	7.3
	Angus	....	55.8	55.7	56.4	55.8	...	7.3	6.6	6.5	7.0	...	7.7	7.5	7.7	7.6
	Average	....	56.3	56.4	55.9	56.4	...	7.8	7.1	6.3	7.5	...	7.5	7.3	7.6	7.4
Average	Hereford	55.3	54.5	53.3	54.9	53.9	7.2	7.6	6.9	6.3	7.2	7.3	7.5	7.5	7.6	7.5
All Sire	Angus	54.7	53.9	52.8	52.6	53.4	6.8	7.2	7.0	6.6	7.1	7.1	7.5	7.6	7.7	7.6
Breeds	Average	55.0	54.2	53.1	53.7	53.7	7.0	7.4	6.9	6.5	7.2	7.2	7.5	7.6	7.7	7.5

a Actual Cutability, % = Actual yield of boneless, closely trimmed beef from the round, loin, rib and chuck.

b A measure of the pounds of force required to shear one-half inch cores of steaks cooked at 350°F to 150°F internal temperature and cooled for 30 minutes at room temperature. Warner-Bratzler shear was obtained from all 311 steers.

c Taste panel scores are based on a 9-point hedonic scale, with higher scores indicating greater acceptability. Taste panel traits were measured on steaks from 4 steers per sire-dam breed group per slaughter date.

d Average calculated only for dates common to all breed groups.

Table 31.10 Percentages of Cutability, Warner-Bratzler Shear Values and Taste Panel Evaluations for Carcasses from the 1974 Calf Crop.

Breed of Steer		Actual Cutability, %[a]						Warner-Bratzler Shear, lb.[b]						Taste Panel Acceptability[c]					
Sire	Dam	254	282	318	352	387	Avg.[d]	254	282	318	352	387	Avg.[d]	254	282	318	352	387	Avg.[d]
Hereford	Hereford	58.3	57.1	56.6	....	....	56.8	7.2	9.0	8.7	...	...	8.8	6.7	6.3	6.4	...	...	6.4
Angus	Angus	57.4	55.5	55.1	....	....	55.3	6.4	7.6	7.2	...	...	7.4	7.3	7.4	6.9	...	...	7.1
	Average	57.8	56.3	55.8	....	....	56.0	6.8	8.3	8.0	...	...	8.1	7.0	6.8	6.6	...	...	6.7
Angus	Hereford	57.3	57.1	54.7	....	....	55.9	7.0	7.8	7.7	...	...	7.8	6.9	6.5	7.1	...	...	6.8
Hereford	Angus	57.8	57.6	55.2	....	....	56.4	7.6	8.1	8.3	...	...	8.2	7.2	7.0	6.8	...	...	6.9
	Average	57.6	57.4	55.0	....	....	56.2	7.3	8.0	8.0	...	...	8.0	7.1	6.8	7.0	...	...	6.9
Red Poll	Hereford	58.0	56.1	56.0	....	....	56.0	10.1	7.2	7.8	...	...	7.5	6.8	7.5	6.8	...	...	7.2
	Angus	57.1	57.4	55.2	....	....	56.3	7.0	8.2	8.3	...	...	8.2	7.4	7.3	6.7	...	...	7.0
	Average	57.6	56.8	55.6	....	....	56.2	8.6	7.7	8.1	...	...	7.9	7.1	7.4	6.8	...	...	7.1
Brown Swiss	Hereford	60.1	59.2	58.7	56.8	56.2	58.9	9.7	8.9	7.8	8.6	7.3	8.4	6.8	6.8	6.7	6.6	7.3	6.8
	Angus	58.9	58.3	57.2	56.7	56.2	57.8	7.6	9.5	8.3	9.3	7.9	8.9	6.2	6.7	7.4	6.4	7.4	7.0
	Average	59.5	58.7	57.9	56.8	56.2	58.3	8.6	9.2	8.0	9.0	7.6	8.6	6.5	6.8	7.0	6.5	7.3	6.9
Gelbvieh	Hereford	....	59.2	58.8	57.2	57.0	59.0	...	9.3	8.8	8.2	6.3	9.0	...	7.2	6.6	6.8	7.0	6.9
	Angus	....	57.8	58.4	54.2	54.4	58.1	...	8.8	8.9	7.7	8.0	8.8	...	6.7	6.6	7.2	6.8	6.6
	Average	....	58.5	58.6	55.7	55.7	58.6	...	9.0	8.8	7.9	7.2	8.9	...	7.0	6.6	7.0	6.9	6.8
Maine Anjou	Hereford	....	58.7	58.1	58.2	57.3	58.4	...	8.4	8.4	8.7	7.4	8.4	...	6.8	7.1	6.4	7.1	7.0
	Angus	....	57.5	55.4	55.1	56.2	56.4	...	8.5	8.8	8.6	7.0	8.6	...	6.5	6.5	6.7	7.4	6.5
	Average	....	58.1	56.8	56.6	56.7	57.4	...	8.5	8.6	8.6	7.2	8.5	...	6.7	6.8	6.5	7.2	6.8
Chianina	Hereford	....	61.3	61.0	60.2	58.3	61.2	...	7.7	9.3	8.8	7.8	8.5	...	7.3	7.3	5.8	7.5	7.3
	Angus	....	59.7	60.3	58.0	57.9	60.0	...	9.0	8.9	8.4	7.9	9.0	...	6.3	6.7	6.9	6.8	6.5
	Average	....	60.5	60.6	59.1	58.1	60.6	...	8.4	9.1	8.6	7.9	8.8	...	6.8	7.0	6.3	7.1	6.9
Average	Hereford	58.4	58.4	57.7	58.1	57.2	58.0	8.5	8.3	8.3	8.6	7.2	8.3	6.8	6.9	6.9	6.4	7.2	6.9
All Sire	Angus	57.8	57.7	56.7	56.0	56.2	57.2	7.1	8.5	8.4	8.5	7.7	8.4	7.0	6.8	6.8	6.8	7.1	6.8
Breeds	Average	58.1	58.0	57.2	57.0	56.7	57.6	7.8	8.4	8.4	8.5	7.5	8.4	6.9	6.9	6.8	6.6	7.1	6.8

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

[b] A measure of the pounds of force required to shear one-half inch cores of steaks cooked at 350°F to 150°F internal temperature and cooled for 30 minutes at room temperature. Warner-Bratzler shear was obtained from all 476 steers.

[c] Taste panel scores are based on a 9-point hedonic scale, with higher scores indicating greater acceptability. Taste panel traits were measured on steaks from 4 steers per sire-dam breed group per slaughter date.

[d] Average calculated only for dates common to all breed groups (282 and 318 days).

Characteristics of Beef Finished on Selected Feeding Regimes

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Summary

Thirty-eight crossbred steers of known background were randomly assigned to four feeding regimes. All initially were fed on a brome and bluestem pasture supplemented during winter with alfalfa and protein. Ten grass-fed animals were slaughtered directly off pasture at the end of summer. Ten steers were fed an additional 49 days (short-fed), and eight 98 days (long-fed) on 80 percent concentrate and 20 percent corn silage. In addition, ten silage-fed animals were fed 60 percent corn silage and 40 percent concentrate for 98 days. Carcass characteristics were evaluated along with shear force (tenderness) and taste panel responses.

Marbling score and quality grade increased with length of feeding. Carcasses from grass-fed and short-fed cattle graded Good. Cattle fed for approximately 100 days on either a high grain or silage ration had an average quality grade of low Choice.

Carcass yield grade did not differ between grass-fed and short-fed cattle, or between silage-fed and long-fed cattle.

Taste panel scores generally supported differences in marbling and quality grade between feeding regimes. Taste panel scores for the grass-fed and short-fed groups were similar and were marginal for juiciness, tenderness, flavor, and over-all acceptability. Panel scores for steaks from the silage-fed and long-fed groups were significantly more desirable than for steaks from grass-fed cattle. Objective measurements of tenderness (shear force) did not differ significantly between feeding regimes.

Cattle fed approximately 100 days had an acceptable yield and quality grade and desirable juiciness, tenderness, and flavor.

Even though grass-fed beef was not evaluated as undesirable, it would probably not be widely accepted by consumers unless improved by processing innovations. The marginal desirability of the short-fed cattle likewise could be improved.

Introduction

Due to fluctuation in feed grain prices, interest has been focused on alternative feed sources and time on feed.

Type of feed and length of finishing influence carcass characteristics and product palatability. Because feeding practices may be altered in the future, we have characterized beef carcasses and are investigating ways of producing acceptable beef from a variety of feeding regimes.

This report includes a summary of carcass, shear force (tenderness), and taste panel characteristics as influenced by feeding regime.

Experimental Procedure

Thirty-eight crossbred steers of known background, obtained from the U.S.D.A. Meat Animal Research Center at Clay Center, Nebraska, were randomly assigned to four feeding regimes. All initially were on a brome and bluestem pasture supplemented in winter with alfalfa and protein. Ten grass-fed animals were slaughtered directly off pasture at the end of summer. Ten steers were fed an additional 49 days (short-fed), and eight 98 days (long-fed) on 80 percent concentrate and 20 percent corn silage. In addition, 10 silage-fed animals were fed 60 percent corn silage and 40 percent concentrate for 98 days.

Average age at slaughter for each group was approximately 18 months.

Beginning at approximately 1.5 hours post-mortem, the right side of each carcass was weighed and chilled at 36 F until 48 hours post-mortem; then evaluated for U.S.D.A. quality and yield grade characteristics.

Four muscles including the biceps femoris and semitendinosus from the bottom round, semimembranosus from the top round, and longissimus (loin eye) were removed at approximately 48 hours post-mortem. Steaks were removed from each muscle for shear-force evaluation. Only the longissimus (loin eye) was evaluated by the taste panel. All cuts were vacuum packaged, frozen, and stored at -15 F. Maximum frozen storage time was 3 weeks.

Steaks for taste panel and shear-force evaluations were thawed at 36 F for 24 hours, removed from the vacuum package, and modified oven broiled at 350 F to an internal temperature of 151 F. A six-member, trained taste panel evaluated warm loin eye samples on the basis of juciness, tenderness, flavor, and over-all acceptability. For Warner-Bratzler shear-force, six 0.5 inch diameter cores were taken from each muscle and sheared once.

Results and Discussion

Average carcass maturity was in the A range regardless of feeding regime. As expected, marbling increased with length of feeding (table 32.1). Carcasses from silage-fed and long-fed cattle had the most marbling; short-fed, intermediate; and grass-fed, the least. Quality of carcasses from grass-fed cattle graded lowest and those from silage-fed and long-fed cattle graded highest (table 32.1). Cattle fed approximately 100 days on either a high grain or silage ration had an average quality grade of low Choice.

Adjusted fat thickness was lowest for carcasses from grass-fed and short-fed cattle and highest for carcasses from silage-fed and long-fed cattle (table 32.2).

Rib eye area (table 32.2) of carcasses from grass-fed cattle was smaller than from short-fed and long-fed cattle, but did not differ from carcasses of silage-fed cattle.

Generally, hot carcass weights, kidney, pelvic, and heart fat, and yield grades increased with length of feeding (table 32.2). Kidney, pelvic, and heart fat percentages were lowest for carcasses from grass-fed and short-fed cattle and highest for carcasses from silage-fed and long-fed cattle.

Yield grades did not differ between carcasses from grass-fed and short-fed cattle or between carcasses from silage-fed and long-fed cattle. However, yield grade of carcasses from short-fed cattle tended to be lower than for carcasses from grass-fed cattle. The difference resulted from a larger rib eye area in the short-fed carcasses.

For each muscle, mean shear force (table 32.3) between feeding regimes did not differ. Apparently, quality grade and marbling differences were not enough to affect shear force of those four muscles.

However, mean taste panel scores (table 32.4) generally supported differences observed in marbling and quality grade between feeding regimes (table 32.1). Juiciness, tenderness, flavor, and over-all acceptability scores increased with marbling scores and quality grade.

Samples from grass-fed cattle were usually less juicy, tender, flavorful, and acceptable than samples from silage-fed and long-fed cattle. Considering the same traits, samples from short-fed cattle were frequently comparable to those from silage-fed and long-fed cattle. Grass-fed cattle were comparable to short-fed cattle considering quality grade, yield grade, shear force (tenderness), and taste panel responses (tables 32.1,2,3,4); however, that was not the case for grass-fed compared with silage-fed or long-fed cattle.

The results indicate that cattle fed approximately 100 days will yield a product of acceptable yield and quality grade and desirable juiciness, tenderness, and flavor. Grass-fed beef was not evaluated as undesirable; however, it would probably not be widely accepted by consumers unless improved by processing innovations. The marginal desirability of the short-fed cattle likewise could be improved.

Table 32.1. Mean carcass quality grade and quality grade factors by feeding regimes.

Trait	Grass-fed	Short-fed	Silage-fed	Long-fed
Maturity	A	A	A	A
Marbling[1]	Traces, 83[a]	Slight, 56[ab]	Small, 75[c]	Small, 49[bc]
Quality grade[2]	Good, 03[a]	Good, 53[ab]	Choice, 14[bc]	Choice, 03[c]

[1,2]Marbling and Quality Grade: 01-33 = Low, 34-66 = Average, 67-100 = High.

[abc]Means within same row with same letter superscript do not differ ($P<.05$).

Table 32.2. Mean carcass yield grade and yield grade factors by feeding regimes.

Trait	Grass-fed	Short-fed	Silage-fed	Long-fed
Adjusted 12th rib fat thickness, in.	.21[a]	.20[a]	.48[b]	.44[b]
Rib eye area, sq. in.	10.2[a]	11.6[b]	11.3[ab]	12.0[b]
Hot carcass weight, lb	578[a]	641[b]	730[c]	733[c]
Kidney-pelvic-heart fat, %	2.7[a]	2.8[ab]	3.5[c]	3.3[bc]
Yield grade	2.0[ab]	1.8[a]	2.9[c]	2.6[bc]

[abc]Means within same row with same letter superscript do not differ (P>.05).

Table 32.3. Mean shear force values for test muscles by feeding regimes.

Muscles	Grass-fed	Short-fed	Silage-fed	Long-fed
Longissimus	6.3	7.0	7.1	7.5
Semitendinosus	9.0	9.1	8.6	8.7
Biceps femoris	13.6	14.3	15.2	12.8
Semimembranosus	10.4	9.7	9.1	9.5

Means within same row do not differ (P>.05).

Table 32.4. Mean taste panel scores[d] for longissimus (loin eye) muscle by feeding regimes.

Trait	Grass-fed	Short-fed	Silage-fed	Long-fed
Juiciness	5.8[a]	6.2[a]	6.9[b]	6.4[ab]
Tenderness	4.8[a]	5.3[ab]	5.9[bc]	6.5[c]
Flavor	5.9[a]	6.2[ab]	6.9[b]	6.9[b]
Over-all acceptability	5.0[a]	5.7[b]	6.2[bc]	6.5[c]

[abc]Means within the same row with same letter superscript do not differ (P>.05).

[d]Juiciness, tenderness, flavor, and over-all acceptability evaluated on 9-point scale (9 = most desirable, 6 = slightly desirable, juicy, tender, flavorful, or acceptable).

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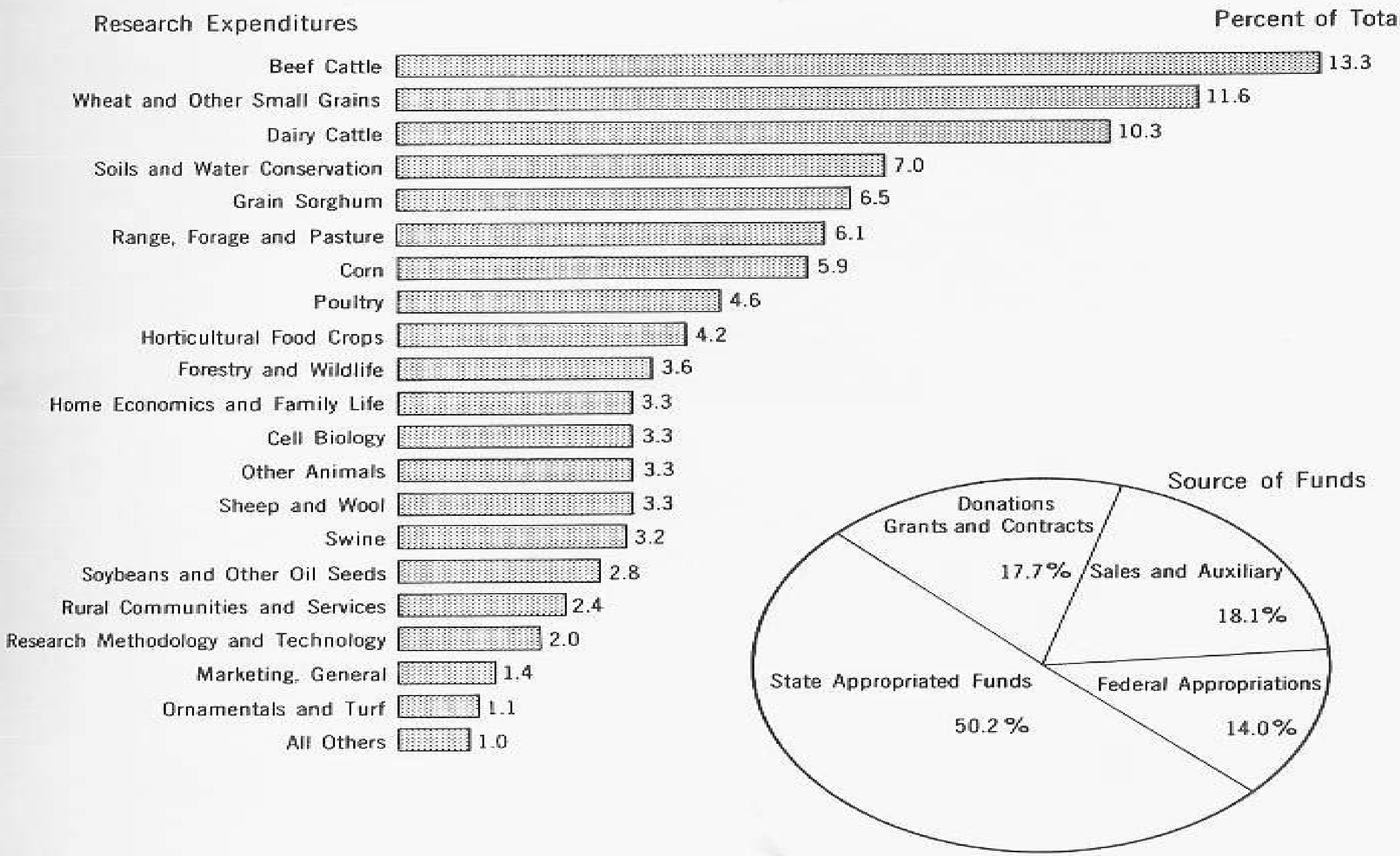
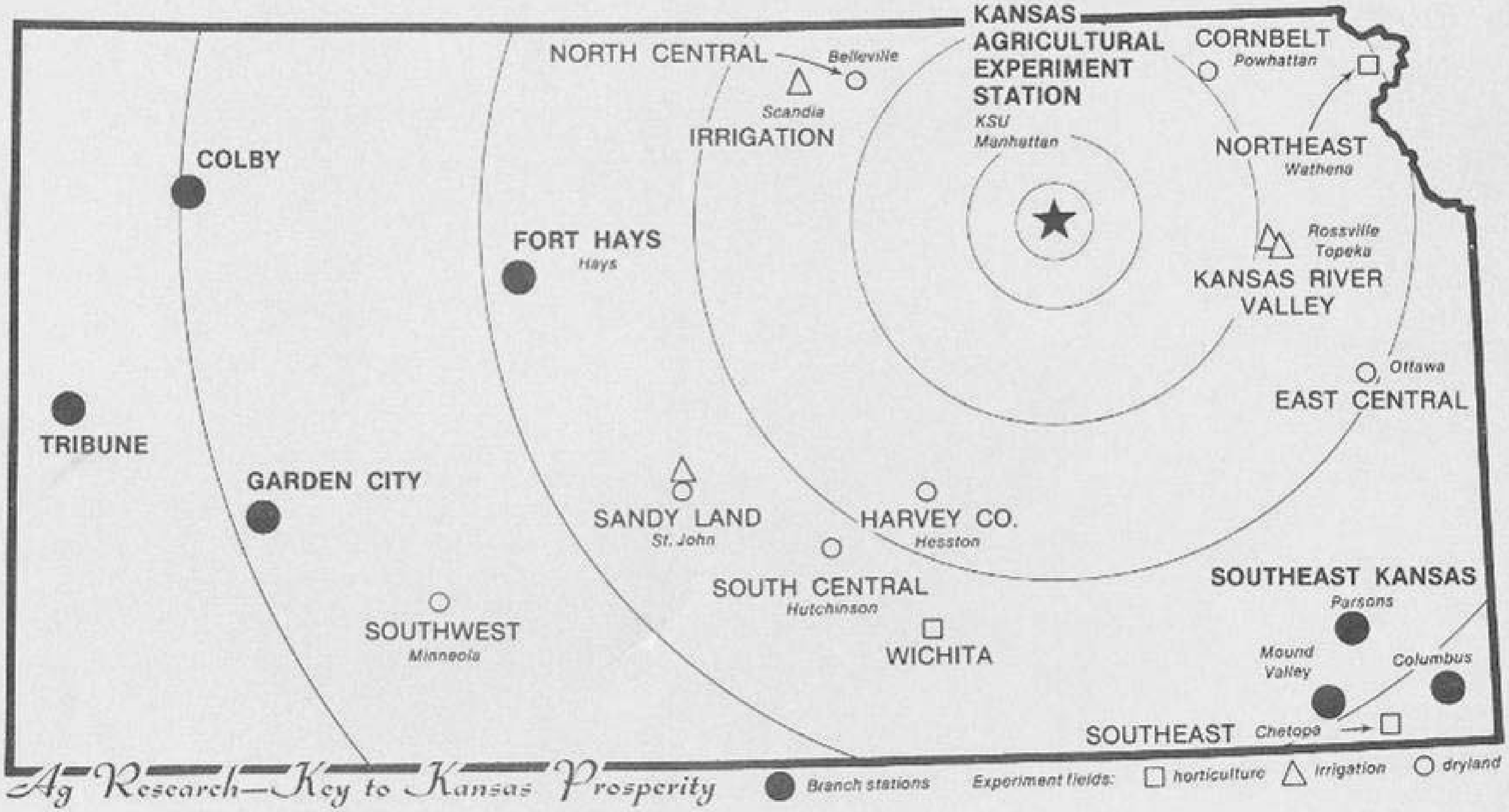
Kansas Agricultural Experiment Station





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