1973

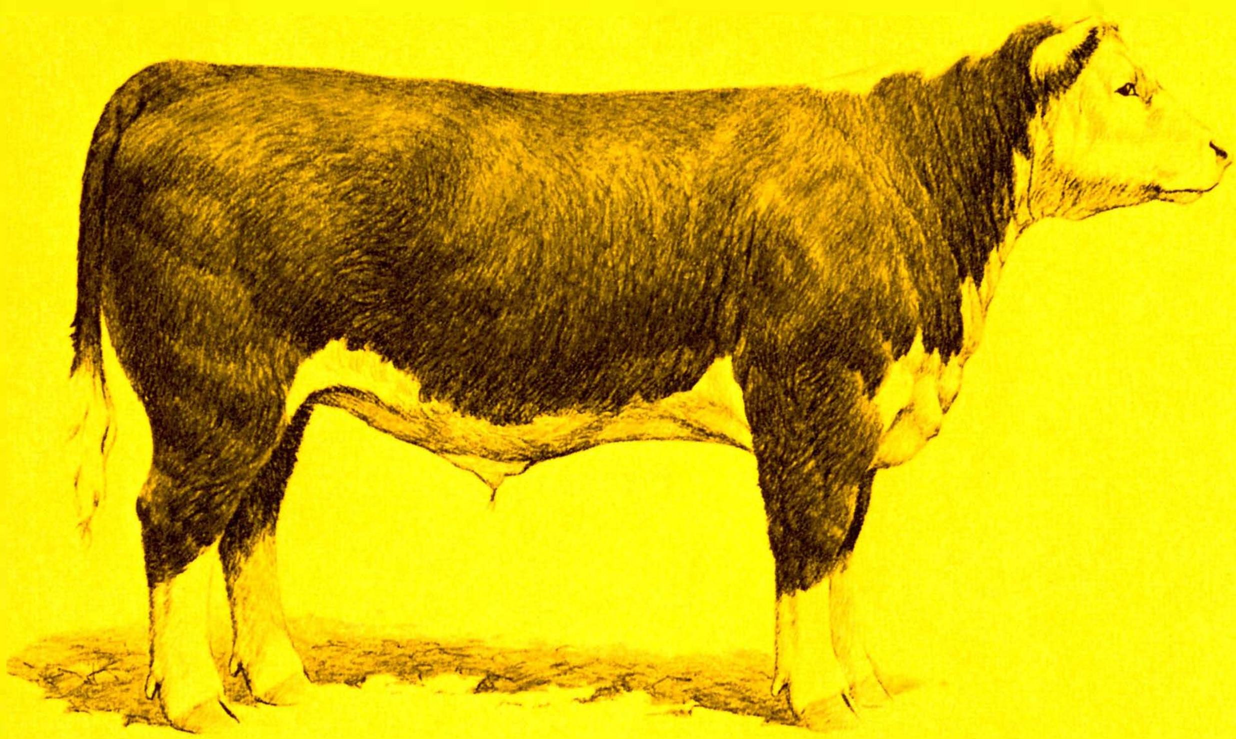
Seventeenth Annual Cattle Feeders Day

Animal Science Department
South Dakota State University

Seventeenth Annual

Cattle Feeders Day

Friday, November 2, 1973



Proceedings and

Research Summaries

Department of Animal Science
Agricultural Experiment Station
Cooperative Extension Service
South Dakota State University
Brookings

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South Dakota State University
Brookings, South Dakota

Department of Animal Science
Agricultural Experiment Station

A.S. Series 73-30

Backgrounding of Feedlot Cattle--Levels of Grain on Pasture

L. B. Embry

Utilization of appreciable quantities of roughage for growing and finishing feedlot cattle means some restriction on rate of production in comparison to that obtained from diets containing more liberal quantities of concentrates. Periods of restricted growth of cattle have been shown to be followed by an accelerated rate of growth with an improvement in feed efficiency in comparison to more liberally fed animals during later finishing periods with high-concentrate diets. Thus, there can be some compensation in both rate and efficiency of gain following periods of restriction. However, the amount of compensation may vary depending upon the comparative degree and length of the periods of restriction and liberal feeding.

Periods of restricted growth may be varied in degree by amounts and types of feeds offered and in length by the time such diets are fed. The reduction in performance should be that resulting from a reduced energy intake rather than from deficient levels of protein, minerals and vitamins. Of primary concern in the degree and length of restriction in the total feeding operation are the effects on amounts of various feeds and total time required to produce slaughter cattle of desirable weight and grade.

Experiments have been conducted at this station during the past 5 years to obtain this kind of information where steers were fed various levels of grain on pasture prior to a high-concentrate finishing phase. Four experiments have been completed and are summarized for this report.

Procedures

Steers used in the four experiments were purchased as calves in the fall and fed wintering rations composed of prairie hay and protein supplement. Rates of wintering gain ranged from about 0.75 to 1.25 lb. daily for various wintering treatments. When the pasture had made sufficient growth in the spring, the calves were trucked to Brookings and the experiments were started.

Pasture Phase

The same pasture area was used in each of the four experiments. It was established the year prior to the first experiment and consisted of alfalfa-grass mixture (bromegrass and intermediate wheatgrass). The pasture was seeded for a stand of about equal parts of alfalfa and the grasses. Alfalfa predominated

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Prepared for the Seventeenth Annual Beef Cattle Feeders Day, November 2, 1973.

the first year with some increase in the grasses in subsequent years. The pasture was fertilized each year in early spring with a typical application being 125 lb. of 18-46-0 per acre.

Levels of rolled corn grain fed daily were 0 (control), 3 lb., 6 lb., and a full feed. Each grain treatment was replicated four times. Acres per replicate (paddock) provided were 5 for the control and 3-lb. groups, 3.75 for the 6-lb. group and 2.5 lb. for those full-fed. The area was of good productivity and ample grazing was available for all groups throughout the grazing season each year.

Steers in all paddocks receiving grain were started at 3 lb. per head daily. The grain was increased at a rate of 1 lb. daily to 6 lb. for this group and until grain remained in the feed bunk at the next feeding for the full-fed group. Grain was fed once daily in feed bunks located near the water supply. Salt and dicalcium phosphate were supplied on a free-choice basis. The steers were implanted with diethylstilbestrol at the beginning of the grazing phase of the experiments.

For the first experiment, eight steers were allotted to each paddock and rotational grazing was not used this year. Some steers were removed during the season to provide ample grazing for those remaining. Those removed were fed alfalfa-bromegrass hay and the same grain treatment level as they received on pasture. Weight gains for this year were based on steers remaining on the pasture throughout the season.

During the subsequent 3 years, procedures were essentially as for the first year except each paddock was divided for rotational grazing. Only four steers were used per paddock and one side was harvested for hay at a typical hay stage. The regrowth was then used in the rotational grazing.

The cattle were weighed at approximately 4-week intervals during the grazing season. The grazing phase of the experiments was terminated when the forage became short or before problems were encountered with freezing of above-ground water lines to the water tanks in years when there was ample forage for late grazing.

High-Concentrate Finishing Phase

Upon termination of the pasture phase of the experiments, the cattle were allotted into replicated pens on basis of previous levels of grain feeding for a high-concentrate finishing phase.

During this phase of the first experiment, whole corn grain was fed with 2 lb. of a 40% protein supplement without roughage for about 2 months. Thereafter, alfalfa-bromegrass haylage was fed at 3 lb. per head daily to prevent consumption of bedding by the cattle. Whole corn was also fed in the second and third experiment, but the corn was rolled for the fourth experiment.

Alfalfa-bromegrass hay was fed at 2 lb. per head daily in the second experiment. In the last two, alfalfa-bromegrass haylage was fed at 3 lb. per head daily. A 32% protein supplement was fed at 2 lb. per head daily in the last three experiments. The steers were fed diethylstilbestrol at 10 mg. daily in the first three experiments and implanted with DES or zeranol in the fourth one.

In the first experiment, the cattle were started on an all-concentrate diet and were increased rapidly to a full feed. In subsequent years, typical starting rates for corn were 3 lb. daily for steers fed no corn or the 3-lb. level on pasture, 6 lb. for those fed 6 lb. and 10 lb. for those full-fed during the grazing period. Alfalfa-bromegrass forage was included at levels so that the air-dry feed was about 15 lb. initially. Corn grain was increased by 1 lb. per head daily to a full feed with the forage dry matter being decreased by a similar amount to the constant level fed during the experiments.

All steers within a treatment group were marketed at the same time. An average weight of 1150 lb. was selected, but there was some variation from this weight.

Results

Pasture Phase

Results for the pasture phase of the experiments averaged for the 4 years are presented in table 1. Daily feed of corn did not quite equal the treatment levels for the 3- and 6-lb. groups. Rains and resulting soft lanes prevented feeding on some days during the experiments. The average intake for the full-fed group was 13.9 lb.

Table 1. Grain Feeding on Pasture--Pasture Phase
(Average 1969, 1970, 1971 and 1972)

	Level of corn, lb./head daily			
	0	3	6	Full fed
Number	64	65	70	79
Avg. pasture days	127	127	127	127
Avg. init. shrunk wt., lb.	568	570	572	564
Avg. final shrunk wt., lb.	747	792	814	867
Avg. gain/head, lb.	179	222	242	303
Avg. daily gain, lb.	1.41	1.75	1.91	2.39
Avg. daily feed, lb.				
Rolled corn grain	--	2.81	5.56	13.87
Feed/100 lb. gain				
Pasture days	71	57	52	42
Rolled corn grain, lb.	--	161	291	580
Feed/head, lb.				
Rolled corn grain	--	357	706	1761

Rate of gain increased for each higher level of grain. However, the increase per pound of corn decreased with increasing levels of grain, amounting to 0.121, 0.090 and 0.071 lb. daily for the 3-lb., 6-lb., and full-fed levels over the no-grain control. These values show a low response to the various levels of grain supplementation. Forage consumption would be reduced with increasing levels of grain consumed, but it was not measured in these experiments. Stocking rate was the same for the 3-lb. level of grain as for the no-grain control, but it was increased 1.5 and 2.0 times for the 6-lb. and full-fed levels. Forage growth indicated that the no-grain group exerted the greatest grazing pressure.

Feed requirements per 100 lb. of gain as pasture days and corn grain may be used to calculate costs at this stage of the experiment by use of appropriate charges for corn grain and pasture. These costs along with the cost of the cattle at beginning of the pasture season could be used to arrive at the investment in the cattle at this stage of growing and finishing. Also of importance is the effect the various levels of production up to this stage will have on gain and feed requirements during drylot finishing. These data were obtained during a drylot finishing phase with high-concentrate diets.

Drylot Finishing

Results of the finishing phase with the high-concentrate diets are shown in table 2.

An important consideration when cattle are backgrounded for equal time but for various rates of gain is that the periods for finishing will vary. Therefore, there may be some important differences in climatic environment and the cattle will be sold on different markets. These may have major effects on performance of the cattle and on economic returns.

Initial weight at the beginning of the high-concentrate finishing phase increased with increasing levels of the previous grain feeding. Final weights were not as uniform as desired, but these are not believed to seriously affect average daily gains over the finishing period.

Previous level of grain feeding did not appear to have any important effect on the rate of gain during this phase of the experiment. An important factor to consider here is that there apparently was enough increase in energy content of diets between the pasture and finishing phases to support a substantial increase in weight gain even for the cattle full-fed corn during the pasture phase. This may explain a lack of compensatory growth that has been reported on several occasions by various researchers. Another factor favoring the cattle previously fed the higher levels of grain is that they were brought to a full feed of the high-concentrate diets at a more rapid rate.

Feed consumption and feed efficiency were quite similar except steers full-fed corn on pasture consumed slightly less feed and were slightly more efficient. However, they were marketed at a lighter weight and were fed under more favorable weather conditions that the other groups.

When marketed at similar weights, there were only slight differences in the carcass characteristics measured.

Table 2. Grain Feeding on Pasture--Drylot Phase
(Average 1969, 1970, 1971 and 1972)

	Level of corn, lb./head daily			
	0	3	6	Full fed
Number	79	79	77	79
Days fed	131	112	101	79
Avg. init. wt., lb.	747	791	813	867
Avg. final wt., lb.	1167	1144	1145	1124
Avg. daily gain, lb.	3.21	3.15	3.29	3.25
Avg. daily feed, lb.				
Alfalfa-brome forage[a]	3.28	3.35	2.94	2.28
Corn grain[b]	19.61	19.40	20.05	19.13
Suppl.	1.96	1.96	1.95	1.97
Total	24.85	24.71	24.94	23.38
Feed fed/head, lb.				
Alfalfa-brome forage	430	375	297	180
Corn grain	2569	2173	2025	1511
Suppl.	257	220	197	156
Total	3256	2768	2519	1847
Feed/100 lb. gain, lb.				
Alfalfa-brome forage	102	106	89	70
Corn grain	611	616	609	589
Suppl.	61	62	59	61
Total	774	784	757	720
Carcass wt., lb.	708	700	703	687
Dressing percent	60.7	61.2	61.4	61.1
Conformation[c]	20.9	21.3	21.2	21.6
Marbling[d]	5.9	5.5	5.5	5.5
Final grade[c]	19.7	19.2	19.2	19.2
% kidney fat	3.1	3.1	3.1	3.0
Color[e]	4.7	4.9	4.9	5.3
Firmness[f]	5.6	5.7	5.7	5.5
Maturity[g]	22.5	22.5	22.6	22.8
Rib-eye area, sq. in.	11.45	11.44	11.40	11.65
Fat thickness, in.	0.54	0.51	0.54	0.56

[a]Fed as hay in the first two experiments and as haylage in the last two experiments.

[b]Fed as whole grain in three experiments and as rolled grain in one experiment.

[c]Prime = 23, Choice = 20, Good = 17.

[d]Modest amount = 6, small amount = 5.

[e]Light cherry red = 5, cherry red = 4.

[f]Firm = 6, moderately firm = 5.

[g]A maturity = 23, B maturity = 22.

Combined Backgrounding and Finishing Phases

Steers fed no grain when on pasture made the lowest rate of gain (2.26 lb.) daily during both phases of the experiment (table 3). They were fed for a total of 258 days. If all cattle had been fed to the same final weight of 1150 lb., the number of days of drylot finishing on basis of daily rates of gain obtained (table 2) would have been 126, 114, 102 and 87, respectively, for the 0, 3-lb., 6-lb. and full-fed levels of grain.

Table 3. Combined Pasture and Drylot Phase
(Average 1969, 1970, 1971 and 1972)

	Level of corn, lb./head daily			
	0	3	6	Full fed
Days fed				
Pasture	127	127	127	127
Drylot	131	112	101	79
Total	258	239	228	206
Avg. init. wt., lb.	568	570	572	564
Gain/head, lb.				
Pasture	179	222	242	303
Drylot	420	353	332	257
Total	599	575	574	560
Avg. daily gain, lb.	2.32	2.41	2.52	2.72
Feed fed/head, lb.				
Corn grain	2569	2530	2731	3272
Alfalfa-brome forage	430	375	297	180
Suppl.	257	220	197	156
Total	3256	3125	3225	3608
Days/100 lb. total gain				
Pasture	21.2	22.1	22.1	22.7
Drylot	21.9	19.5	17.6	14.1
Total	43.1	41.6	39.7	36.8
Feed/100 lb. of total gain				
Corn grain	429	440	476	584
Alfalfa-brome forage	72	65	52	32
Suppl.	43	38	34	28
Total	544	543	562	644

Since there appeared to be no important differences in carcass characteristics measured between the treatments, differences in cost of producing slaughter cattle under the various systems would be primarily those costs resulting from the differences in amount of various feeds, number of days in drylot and difference in pasture cost because of variable stocking rates with the various levels of grain feeding. Assuming a total gain of 600 lb. for each group, differences in feed requirements in comparison to the control would be as shown in table 4. Calculations are on basis of no changes in performance during the pasture phase and from the daily rate of gains and feed efficiencies shown in table 2 for the remainder of the 600 lb. of total gain.

Table 4. Feed Requirements in Comparison to No-Grain Control For Various Levels of Grain Feeding on Pasture For 600 lb. Total Gain

Item	Grain level on pasture (127 days)		
	3 lb.	6 lb.	Full-fed (14 lb.)
Corn, lb.	+133[a]	+314	+938
Alfalfa-bromegrass, lb.[b]	-28	-110	-221
Protein suppl., lb.	-23	-46	-76
Drylot days	-11	-22	-40

[a](+) values represent a higher requirement and (-) values a lower requirement in comparison to the no-corn control pasture treatment during the pasture phase.
[b]Fed as hay in two experiments and as haylage in two experiments.

Differences in costs of producing finished cattle by the various systems in comparison to the pasture no-grain control group can be estimated by making appropriate charges for the feeds, drylot days and pasture days. The values shown (table 4) indicate that the 3-lb. level of grain might be justified on basis of savings in forage, protein supplement and days in drylot in comparison to the increase in amount of corn at typical prices for these items. More importance probably would have to be given to the fewer days in drylot and the possible heavier stocking rate during the pasture season to justify the system with 6 lb. of grain during the pasture season. In view of the higher requirement for corn in relation to reductions for forage, protein supplement and days in drylot, the full-fed or pasture system would not appear as economical as the systems with lesser amounts of grain.

Summary

During 4 years, steers which had been wintered for rates of gain in the order of 0.75 to 1.25 lb. daily were fed various levels of corn grain during grazing periods of about 4 months. The pasture was an alfalfa-grass mixture (bromegrass and intermediate wheatgrass). Rates of grain feeding were 0, 3 lb., 6 lb. and a full feed (or about 14 lb.) daily. The pasture furnished ample forage for the number of steers used.

Rates of gain increased with increasing rates of grain amounting to 1.41, 1.75, 1.91 and 2.39 lb. per head daily for the four treatments. However, the response in weight gain per unit of increasing grain intake was quite low. There was an increase in daily rate of gain for each pound of corn consumed of 0.121, 0.090 and 0.071 lb., respectively, for the 3 lb., 6 lb. and full-fed treatments in comparison to the no-grain control group. Increasing levels of grain would reduce consumption of pasture forages which was not measured in these experiments. The decrease in forage consumption would mean more animals could be stocked per acre and result in a lower pasture charge per animal.

Feeds fed and pasture days shown in table 1 could be used to calculate costs of gain at the end of the pasture phase of the experiment. These costs with the initial value of the cattle could be used to arrive at the investment in the cattle at this stage of growing and finishing.

Rate of gain during the pasture backgrounding phase appeared to have little effect on the rate of gain when fed high-concentrate finishing diets. Therefore, heavier cattle off pasture required fewer days of drylot finishing. Thus, they were fed under more favorable weather conditions. They also were raised to a full feed of the high-concentrate diets at faster rates. The diets during the finishing phase apparently contained a level of energy capable of supporting a high rate of gain even for the cattle full-fed grain during the pasture phase of the experiment.

There were no large differences in feed efficiency between treatment groups during the finishing phase of the experiment but was slightly lower for steers full-fed corn on pasture.

Carcass characteristics measured showed only small differences between treatment groups when fed to similar final weights.

Differences in feed requirements and days required to produce 600 lb. of gain are presented (table 4). Cost of producing finished cattle under the system of no grain on pasture or the 3-lb. level prior to drylot finishing would not appear to differ greatly. Justification for the 6-lb. level of grain would depend largely on the value placed on the reduction in days in drylot and the possible higher stocking rate on pasture. Gains made from the full-fed group were more costly in terms of feed. However, they required less days in drylot and thus would be marketed at an earlier date. This system would have the most merit where maximum number of cattle are desired on a given acreage with a minimum period of drylot finishing with high-concentrate diets. Additional value might be given to this system where some of the finishing period would be desired on pasture rather than a continuous drylot period.

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A.S. Series 73-31

Adaptation of Feedlot Cattle to Urea and Antibacterial Compounds

J. D. Burkhardt, L. B. Embry and L. B. Dye

A period of adaptation to urea during which feedlot performance is suppressed is frequently experienced when this product is added to rations of cattle not previously, or recently, fed it. This effect appears more evident with levels of urea used when it forms a major part of total protein in the ration.

Urea and antibiotics in combination are common additions to protein supplements or mixed rations. At usual levels for continuous feeding of antibiotics and safe levels of urea for the dietary conditions, the combination appears satisfactory and to offer the beneficial effects from these compounds after a suitable period of urea adaptation. However, much less is known about the effects of high levels of antibacterial compounds and urea together during early stages in the feedlot with unadapted cattle. More research is needed to answer questions concerning levels of these compounds during early stages in the feedlot, especially with calves shipped at weaning or a few weeks thereafter. Other information needed includes the relative effects of adaptation to urea and antibacterials singularly and together after various times of arrival of the cattle at the feedlot.

Effects of adding urea to furnish the major source of supplemental protein to a corn silage ration for calves at various times following arrival at the feedlot were investigated in this experiment. Urea additions were made to rations of calves fed with and without antibacterial compounds.

Procedures

One hundred twenty steer calves were purchased in late January for the experiment. The average weight of the calves was about 510 lb. The calves had been given treatments usually associated with "preconditioned" calves but reported to have not received any antibiotics or urea in their feed.

They were allotted into 8 pens of 15 each on basis of weight taken after arrival. The experimental design was as follows:

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Design of the Experiment

Protein supplement treatment	Control group	Antibiotic group[a]
Soybean meal	15 steer	calves per pen
Urea on day 1		
Urea on day 14[b]		
Urea on day 28[b]		

[a]Fed as Aureo S-700 to furnish 350 mg. each of chlortetracycline and sulfamethazine per head daily for the first 28 days of the experiment and then chlortetracycline at 70 mg. per head daily.
[b]Supplement prior to these days was soybean meal with or without Aureo S-700 according to the experimental design.

Rations during the experiment consisted of 2 lb. of protein supplement (about 37% protein) and a full feed of corn silage. Animals were fed twice daily. They were implanted with 24 mg. of diethylstilbestrol at the beginning of the experiment.

The protein supplements were soybean meal or corn-urea based supplements. The soybean meal supplement contained 84.5% soybean meal with added minerals and vitamins. The corn-urea supplement contained about 70% corn, 11% urea and also minerals and vitamins. Calcium sulfate was added to the corn-urea supplement in an amount to supply 1 part sulfur to 10 parts nitrogen that came from urea.

Four protein supplements were provided for the first 28 days of the experiment. Two of these were soybean meal supplements, one with and one without chlortetracycline-sulfamethazine. The other two were corn-urea supplements, also with and without the antibacterials.

Results

Results of the experiment are shown in table 1. Overall comparisons between control and antibacterial groups show essentially no differences from supplementing the cattle with 350 mg. each of chlortetracycline and sulfamethazine for 28 days followed by 70 mg. of chlortetracycline for the remainder of the 120-day experiment. The initial high level of the antibacterials did not appear to result in any consistent improvement in early feedlot performance for the various protein supplement groups. Calves fed the soybean meal supplement did gain at a faster rate with the antibacterials. However, this effect was not consistent during the first month of the experiment when other groups received the same rations for 14 or 28 days.

Results do not show any benefit from adding urea after 14 or 28 days in comparison to starting the calves on the urea supplement at the beginning of the experiment. In fact, those supplemented with urea at the later dates gained at slightly lower rates than calves fed urea from the beginning of the experiment. The latter group gained at about the same rate as calves supplemented with soybean meal.

Type of supplement as to antibacterials or protein source did not appear to affect feed consumption. Therefore, calves making slightly faster rates of gain also had small advantages on feed efficiency.

Calves used in the experiment had not been fed urea or an antibiotic prior to the experiment. However, they had been weaned and fed growing-type rations for several weeks. This may have been important in the response to the antibacterials and in adaptation to urea.

Summary

A high level of chlortetracycline and sulfamethazine (350 mg. each daily) followed by 70 mg. daily of the antibiotic did not affect feedlot performance of calves in this experiment where corn silage was full fed with a protein supplement for 120 days. Results from the antibacterials did not appear to be affected by protein source (soybean meal or urea) in the supplements.

Adding urea after 14 or 28 days in the feedlot offered no benefits in comparison to feeding urea from the beginning of the experiment. Weight gains were at a slightly lower rate when urea was added at the later dates.

Age, weight and previous treatments for the calves may have had an important influence on the results obtained. Such calves are more resistant to effects of stress from shipping and adaptation to a new location and rations than would be calves weaned and immediately subjected to these stresses.

Under conditions of this experiment, it would appear unnecessary to avoid urea in the protein supplement for a period of 2 to 4 weeks after arrival of the cattle. Adaptation to urea may be accomplished with less evident depression in feedlot performance at the same time as adaptation to the new location and ration changes than at a later date.

Table 1. Results from Urea and Antibacterial Compounds Fed to Growing Feedlot Cattle

(Jan. 27 to May 26--120 days)

	Control					Antibiotic[a]				
	SBOM	Urea on day 1	Urea on day 14[b]	Urea on day 28[b]	Avg.	SBOM	Urea on day 1	Urea on day 14[b]	Urea on day 28[b]	Avg.
No. of steers	15	15	15	15	60	15	15	15	15	60
Init. shrunk wt. (lb.)	508.7	507.3	511.3	510.0	509.3	509.7	511.0	511.3	512.0	511.0
Final shrunk wt. (lb.)	777.0	783.3	780.3	762.0	775.6	801.7	787.7	778.0	771.7	784.8
Avg. daily gain (lb.)	2.24	2.30	2.24	2.10	2.22	2.43	2.31	2.22	2.16	2.28
Avg. daily feed										
Corn silage	37.00	37.77	37.80	37.77	37.58	37.93	37.61	37.91	37.77	37.80
Supplement	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Feed/100 lb. gain (lb.)										
Corn silage	1655	1642	1686	1798	1695	1559	1631	1706	1745	1660
Supplement	88	86	88	94	89	81	85	88	91	86

[a]Fed as Aureo S-700 (aureomycin and sulfamethazine each at 350 mg. per head daily) for the first 28 days of the experiment and then aureomycin at 70 mg. per head daily.

[b]Supplement prior to these days was the soybean meal with or without Aureo S-700 according to the experimental design.

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A.S. Series 73-32

Weaning Age and Management Systems For Fall Born Beef Calves

William McCone

Seventeen registered Angus, Hereford and Shorthorn cows calved in September, 1972. The cows calved on pasture and remained on pasture until early November. From November 10 to December 29, the cows were bred for 1973 fall calves. On December 29, 1972, one-half of the calves were weaned and started on a self-fed ration. The remaining one-half of the calves were allowed to continue nursing the cows, but the calves also had access to a creep feeder containing the same ration used for the weaned calves. At the start of the experiment the calves were randomly divided by sex, breed and age. At this time, December 29, 1972, the average age of all calves was 115 days and they averaged 250 lb. in weight.

The experiment was conducted over a 90-day winter feeding period which was initiated on December 29, 1972, and was completed on March 29, 1973. The early weaned calves made an average per head daily gain of 2.49 lb. over the 90-day period and the nursing calves gained 2.35 lb. daily. The early weaned calves averaged 470 lb. per head at 205 days of age and the nursing calves averaged 465 lb.

The cows were fed according to the recommended amounts required for lactating or dry cows. One of the objectives of this trial was to obtain data which may indicate the more desirable management practice for fall born beef calves. That is, should the added required feed be furnished a lactating beef cow or should the calf be weaned early and the added required feed given the weaned calf. Using typical feed costs for the year's work reported, the feed cost differences for calf gains on the two management systems were small. The early weaned group of calves produced gains at the rate of 20 cents feed cost per pound of gain. The calves nursing cows made gains at a cost of 19 cents per pound.

The diet used and self-fed to all calves of both groups was as follows:

	Pounds
Cracked shelled corn	700
Rolled oats	450
Wheat bran	200
32% protein pellets	250
Chopped brome-alfalfa hay	400
Total mixture	2,000

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Table 1. Weaning Age and Management Systems for Fall Born Beef Calves (1972-73)

	Calves nursing cows	Calves weaned
Calf data		
Lot number	1	2
No. calves (3 bulls + 6 heifers in lot 1) (3 bulls + 5 heifers in lot 2)	9	8
Age in days at start	114	116
Days on trial (Dec. 29 to March 29)	90	90
Age in days at finish	204	206
Avg. initial weight, lb.	252	248
Avg. final weight, lb.	463	472
Avg. total gain, lb.	211	224
Avg. daily gain, lb.	2.35	2.49
Avg. daily feed, lb.	7.31	13.19
Creep feed per cwt. gain, lb.	311.58	529.25
Creep feed cost per cwt. calf gain, $	7.48	12.70
Creep feed cost per calf, $	15.78	28.45
	Cows nursing calves	Dry cows
Cow data		
Number of cows	9	8
Avg. age of cows (years)	6.9	7.5
Avg. initial weight, lb.	1081	1111
Avg. final weight, lb.	1111	1065
Weight gain or loss per head, lb.	+30	-46
Avg. daily feed, lb.		
Brome-alfalfa hay	16.7	18.7
Corn silage	25.4	none
Feed cost per cow for 90 days, $	24.14	16.88

Feed prices: Brome-alfalfa hay, $20.00 per ton; corn silage, $8.00 per ton; creep feed, $2.40 per cwt.

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A.S. Series 73-33

Storage Methods and Protein Supplements for High-Moisture Ear Corn

W. S. Swan and L. B. Embry

A high rate of gain can be obtained with growing and finishing cattle fed ear corn adequately supplemented with protein, minerals and vitamins. The cob portion of the ear furnishes more roughage than has been reported to result in optimum gains with minimum problems frequently associated with high-concentrate diets. Other roughages are not indicated with ear corn where high rates of gain are desired.

Ear corn contains less protein than recommended in most diets for growing and finishing cattle. The low protein cob portion may not be an economical source of roughage in comparison to those considerably higher in protein unless there can be an effective and relatively cheap source of supplemental protein. Urea can be an effective source of protein at less cost than most plant sources under proper conditions of use. However, there are limitations in amount for the most effective results which vary with dietary conditions.

There are several advantages for harvesting corn at about 30% grain moisture. This high-moisture grain has been reported to have some advantages over dry grain for growing and finishing cattle. The advantages for the high moisture content over the dry form appears to be greater for ear corn than for shelled corn. Storage conditions for high-moisture grains must be adequate to prevent spoilage. Conditions vary with moisture content and length of time in storage.

The experiment reported here was conducted to study sources and levels of protein supplementation with high-moisture ground ear corn for growing and finishing cattle. Comparisons were also made between an upright concrete stave and an oxygen-limiting (Harvestore) silo as methods for storing the corn.

Procedures

One hundred sixty-eight steers were used in the experiment. They were allotted into 28 pens of 6 each for 14 replicated treatments. Those in 14 pens were fed high-moisture ground ear corn from a concrete stave silo (18 ft. x 50 ft.). The others were fed the ear corn from an oxygen-limiting silo (17 ft. x 50 ft.). Treatments within each silo group were no supplemental protein control, soybean meal to provide supplements with about 27, 32 and 37% protein, and urea at levels to provide the same levels of protein in supplements as with soybean meal.

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Diets consisted of ground ear corn and 3 lb. of supplement. Ingredient compositions of the supplements were as shown in table 1.

The ear corn was harvested from the same field for the two silos. The oxygen-limiting silo was filled first and the average moisture was 33.13%. The concrete stave was filled immediately thereafter, and the average moisture content was 30.17%. Average protein content of samples at harvest was 9.0% on a moisture-free basis (approximately 8% air-dry).

The cattle were full-fed ground ear corn with 3 lb. of the supplements top-dressed on the corn. Feeding was once daily with the high-moisture ear corn fed in amounts to be nearly consumed by the next feeding.

All pens of cattle were fed the ground ear corn without supplement for a period of 4 weeks. They were allotted into concrete stave or oxygen-limiting silo groups. After this preliminary period, they were reallotted on basis of weight within silo groups for the various levels and sources of supplemental protein.

The ear corn stored in the oxygen-limiting silo was fed up after 113 days following the preliminary period. The cattle were weighed without shrink at this time and the data summarized to this point.

Results

Oxygen-Limiting Silo

Results of the experiment with the oxygen-limiting silo are presented in table 2.

Samples of the corn were taken once each week during the course of the experiment. The average moisture content determined by a forced-draft oven was 31.54%. This was the approximate moisture (33.13%) as stored determined by the same method.

The control diet without supplemental protein was approximately 8.0% protein on an air-dry basis. Those with the first level of supplemental protein were approximately 10.5%. Subsequent increases in supplement added about 0.7 percentage units of protein to the air-dry diets.

Rates of gain shown were high during the 113 days of the experiment. The weights were without shrink for both initial and final ones. Rates of gain would be expected to be reduced as the cattle were fed to heavier weights and a higher finish than those at termination of this phase of the experiment.

Rate of gain was at a high rate (3.04 lb. daily) for the cattle fed ground ear corn without supplemental protein. However, there was a substantial increase when fed supplemental protein from either soybean meal or urea. There appeared to be no advantage from levels more than furnished by 3 lb. of the supplement with about 27% protein (approximately 10.5% in the air-dry diet).

Rates of gain remained relatively constant with each increase in amount of protein with soybean meal. When urea was used, the highest rate of gain was obtained with the lowest addition of supplemental protein. In this instance, rate of gain was higher than for soybean meal (0.24 lb. daily). Higher levels of protein from urea resulted in lower rates of gain.

Feed intake was improved by supplementing ground ear corn with additional protein. However, there appeared to be little effect of level or source of supplemental protein.

The lower feed intake by the steers fed no supplemental protein resulted in only slightly higher feed requirements in comparison to those fed soybean meal. Steers fed diets with urea and about 10.5% protein and making the fastest rate of gain had the lowest feed requirements. Higher levels of urea which resulted in lower weight gain also resulted in higher feed requirements.

Concrete Stave Silo

Results obtained with the ear corn stored in the concrete stave silo are presented in table 3. Average moisture content of samples taken once each week during the experiment was 21.88%. This represents a decrease of 8.29 percentage units from the moisture content when stored. The feeding rate averaged approximately 4 inches daily. The material as removed was noticeably drier than that from the oxygen-limiting silo. It appeared to be little different from dry ground ear corn, while that from the oxygen-limiting silo had a moist appearance and a slight odor of fermented feed.

Rate of gain for steers fed the ear corn from the concrete stave silo without additional protein supplementation was at a slightly higher rate (0.11 lb. daily) than for those fed the comparable diet from the oxygen-limiting silo. During the 4-week preliminary period when all the cattle were fed ear corn without protein supplementation, those fed from the concrete stave silo also gained at a faster rate (0.31 lb. daily). Gains were at a low rate during the preliminary period which may have had a bearing on the rather high rates of gain obtained during the 113-day experiment.

When the ear corn was supplemented with soybean meal, there was a substantial improvement in rate of gain in two of the three treatments. Except for one treatment being slightly lower, weight gain was quite similar for ear corn from the two silos. Feed intake by steers fed from the oxygen-limiting silo was slightly lower with some lower feed requirements on an air-dry basis as determined by a forced-draft oven. Some research has indicated that this method may have biased feed data in favor of the more moist feed from the oxygen-limiting silo.

Steers fed the ear corn supplemented with urea gained at a lower rate than those fed comparable diets with soybean meal. Rates of gain decreased with increasing levels of urea as encountered with the oxygen-limiting silo.

Feed consumption on an air-dry basis was higher for steers fed the diets supplemented with soybean meal. However, there were only small differences in feed efficiency but in favor of the soybean meal supplement.

Summary and Comments

Steers were fed ground ear corn stored at about 30 to 33% moisture in a concrete stave or an oxygen-limiting silo. Moisture content as fed determined by a forced-draft oven was about that as stored for the oxygen-limiting silo but was 8.29 percentage units less for the concrete stave silo. Feeding rate averaged about 4 inches daily.

Results indicated a need for protein supplementation with the rates of gain obtained in the 113-day experiment. However, there appeared to be no advantage for more than the lowest level used giving diets with about 10.5% protein on an air-dry basis.

Increasing levels of protein with soybean meal resulted in rather consistent rates of gain with only small differences between the two silos.

Increasing levels of protein from urea resulted in decreasing rates of gain with ear corn from either silo. Levels of urea in the supplements provided about 1.0, 1.3 and 1.6% urea in the air-dry diets. Amounts of urea with the two higher levels of protein are in excess of commonly recommended maximum levels (1% of total air-dry diet). The two higher levels also exceed the amount of urea supplementation that can be utilized efficiently with these ear corn diets calculated from the urea fermentation potential (UFP) as proposed by Iowa researchers.

Steers fed ear corn without supplemental protein gained at a slightly higher rate when fed from the concrete stave silo. Similar performance was obtained from steers fed from each silo when soybean meal was the supplemental protein. With the urea supplement, steers fed from the oxygen-limiting silo showed an advantage in weight gain and in feed efficiency over those fed from the concrete stave silo in all comparisons. The highest rate of gain with the lowest feed requirements resulted with ear corn from the oxygen-limiting silo and the urea supplement to give a diet with about 10.5% protein.

The results indicate that urea had its greatest value when fed with ear corn from the oxygen-limiting silo where the feed had more moisture and characteristics of an ensiled grain. Urea may have contributed to a more favorable rumen environment under these conditions as well as being an efficient source of protein in comparison to soybean meal when fed at proper levels.

Table 1. Ingredient Composition of Supplements

Ingredient	Control	Soybean Meal Supplement			Urea Supplement		
		Approximate protein level in total diet (% air-dry)					
		10.5	11.2	11.9	10.5	11.2	11.9
	%	%	%	%	%	%	%
Corn	88.55	35.65	22.10	8.30	77.75	76.55	74.25
Soybean meal (44%)	--	55.00	68.55	82.35	--	--	--
Urea (45% N)	--	--	--	--	7.70	9.00	11.00
TM salt	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	6.70	6.00	6.00	6.00	6.00	5.50	5.40
Dicalcium phosphate	1.40	--	--	--	1.40	1.40	1.40
Calcium sulfate[a]	--	--	--	--	2.00	2.40	2.80
Potassium chloride	--	--	--	--	1.80	1.80	1.80
Aureomycin-10[b]	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin A premix[c]	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Vitamin E premix[d]	0.03	0.03	0.03	0.03	0.03	0.03	0.03

[a]To furnish 1 part sulfur to 10 parts nitrogen from urea.
[b]75 mg. daily of chlortetracycline.
[c]10,000 I.U. vitamin A per pound of supplement.
[d]30 I.U. vitamin E per pound of supplement.

Table 2. Levels and Sources of Protein With High-Moisture Ear Corn Stored in Oxygen-Limiting Silo (April 16 to Aug. 7, 1973--113 days)

	Approximate protein level, %						
	8.0	10.5	11.2	11.9	10.5	11.2	11.9
Supplemental protein	None	Soybean			Urea		
No. animals	12	12	12	12	12	12	12
Avg. init. filled wt., lb.	570	566	567	565	567	566	569
Avg. final filled wt., lb.	913	944	954	946	973	956	936
Avg. daily gain, lb.	3.04	3.35	3.43	3.37	3.59	3.45	3.25
Avg. daily ration, lb.							
Ground ear corn							
As fed	21.82	24.18	24.06	23.86	24.38	24.56	24.17
Air dry	16.60	18.40	18.30	18.15	18.54	18.68	18.39
Suppl.	2.79	2.79	2.79	2.79	2.79	2.79	2.79
Total air dry	19.39	21.19	21.09	20.94	21.33	21.47	21.18
Feed/100 lb. gain, lb.							
Ground ear corn							
As fed	721	722	702	709	680	713	745
Air dry	549	549	534	539	517	542	566
Suppl.	92	83	82	83	78	81	86
Total air dry	641	632	616	622	595	623	652

Table 3. Levels and Sources of Protein With High-Moisture Ear Corn Stored in Concrete Stave Silo (April 16 to Aug. 7, 1973--113 days)

	Approximate protein level, %						
	8.0	10.5	11.2	11.9	10.5	11.2	11.9
Supplemental protein	None	Soybean			Urea		
No. animals	12	12	12	12	12	12	12
Avg. init. filled wt., lb.	589	586	591	583	576	580	581
Avg. final filled wt., lb.	945	966	951	969	938	932	924
Avg. daily gain, lb.	3.15	3.36	3.19	3.42	3.20	3.12	3.04
Avg. daily ration, lb.							
Ground ear corn							
As fed	21.08	23.13	21.54	22.38	20.82	21.32	20.19
Air dry	18.30	20.08	18.70	19.43	18.07	18.51	17.53
Suppl.	2.79	2.80	2.79	2.79	2.79	2.79	2.79
Total air dry	21.09	22.88	21.49	22.22	20.86	21.30	20.32
Feed/100 lb. gain, lb.							
Ground ear corn							
As fed	670	699	676	655	652	685	667
Air dry	582	598	587	568	566	595	578
Suppl.	89	85	88	82	87	90	92
Total air dry	671	683	675	650	653	685	670

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A.S. Series 73-34

Growing and Finishing Bulls, Heifers and Steers

P. J. Thiex and L. B. Embry

Growth rate of an animal depends upon energy consumed in excess of that for maintenance, and the requirements increase as the animal grows and fattens. Male and female cattle differ in rates of growth and fattening, but changes may be brought about by castration. There still is some concern as to the effects of market weight and energy content of rations on weight gain, feed efficiency and carcass characteristics of feedlot bulls, heifers and steers.

This experiment was conducted to study these factors. Bulls (calves and yearlings), heifers and steers were fed to one of two final weight groups. Rations with about 50% or 90% concentrates were used for each weight and sex group. This report is concerned with the feedlot performance data. Results of the study on carcass data are presented in another report (A.S. Series 73-37).

Procedures

The cattle for the experiment were from the experimental cow herd at the Pasture Research Center, Norbeck. Hereford cows were bred artificially to one Hereford bull over a period of about 6 weeks. Cleanup bulls were then used which were mostly half-sibs and progeny of the cow herd from the previous year.

The yearling bulls were used for cleanup bulls during the immediate past breeding season and were the larger calves from those of the previous year. Each ran in a pasture with 8 to 10 cows after the period of artificial insemination. They were fed no grain during the period of summer grazing.

The bull calves were from a group of 126, and 34 of the larger ones were selected for use as cleanup bulls the following breeding season. The remaining ones were shipped to Brookings for the feedlot experiment. During a preliminary period of about 3 months, they were fed a ration of alfalfa-bromegrass haylage or hay, protein supplement and a limited feed of grain. Upon initiation of the feedlot experiment, 84 were selected from the 92 head. They were allotted into 12 pens of 7 each. After the initial weighing and allotment, those in four of the pens were castrated for the steer group in the experiment.

The 56 heifers were a random assortment from 128 head from which no previous selection had been made. They were trucked to Brookings at about the same time as the bull calves and were fed in the same manner as the bulls during the preliminary period.

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Experimental treatments were two final market weights for each of the sex groups. Weight group 1 was to be about 1350, 1100, 950 and 1050 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Good. Weight group 2 was to be about 1500, 1250, 1100 and 1200 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Choice.

Dietary treatments within each weight group were 50% or 90% concentrate rations on an air-dry basis. The rations consisted of alfalfa-bromegrass haylage and a concentrate-supplement mixture. Ingredient composition of each ration is shown in table 1.

Table 1. Ingredient Composition of Rations (Air-Dry)

Ingredient	50% concentrate diet	90% concentrate diet
	%	%
Alfalfa-brome haylage	50.0	10.0
Rolled corn grain	49.0	87.0
Soybean meal (44%)	---	6.0
Limestone	---	1.0
Dicalcium phosphate	0.5	---
TM salt	0.5	0.5
Potassium chloride	---	0.5
Vitamin A (1500 I.U./lb. of ration)	5 g	5 g
Vitamin E (8 I.U./lb. of ration)	4 g	4 g
Aureomycin-10 (5 mg./lb. of ration)	22.7 g	22.7 g

The steers were implanted with 36 mg. of diethylstilbestrol (DES) at the beginning of the experiment and again after about 4 months for those in weight group 2. Heifers were fed 0.4 mg. daily of melengestrol acetate (MGA). Bulls did not receive any hormone additive or implant treatment.

Feeding was once daily in amounts that would be nearly consumed by the next feeding after the cattle were on full feed. They were raised to a full feed over a period of about 2 weeks. The 90% concentrate ration was calculated to contain 13% protein, 0.60% calcium and 0.35% phosphorus on an air-dry basis. Supplements were added to the 50% concentrate ration to furnish at least these amounts of nutrients. Alfalfa-brome haylage (average of about 58% dry matter) and concentrates were fed separately but in ratios to give the 50 or 90% levels of concentrates on an air-dry basis. Hay was fed on a few days when trouble was encountered from freezing of haylage in the silo. Total amount was small and the quantities were converted to a haylage equivalent for daily forage consumed shown in the tables.

The cattle were marketed as the group (sex and concentrate level) reached the approximate desired weight. Carcass data were obtained and sides were brought to the meat laboratory for studies of carcass quality and composition (see A.S. Series 73-37). Some losses occurred during the experiment. Data presented are for the cattle completing the experiment.

Results

Sex groups were not considered to be directly comparable in the experiment. Differences existed as to selection from the source groups, and there was a lack of uniformity in a terminal point for the experimental periods between groups. Therefore, results are presented and discussed within sex groups as to the effects of market weight and concentrate level of the rations. However, comments as to similarity or difference in response by sex groups to the treatments are made where deemed appropriate. Percentage difference in weight gain and feed efficiency and haylage replacement values of the concentrates as affected by market weight and concentrate level of ration are presented in table 6.

Yearling Bulls

Results of the feedlot performance from the yearling bulls are presented in table 2. Those in weight group 1 and fed the 90% concentrate ration were marketed at 1335 lb. and they were fed for 104 days (3.56 lb. daily). There was a pronounced reduction in weight gain for those fed the 50% concentrate diet (21.3%). This group was fed for 145 days but they had a higher final weight. On basis of their daily gain, 132 days would have been needed for the same amount of gain as for the 90% concentrate group.

Table 2. Market Weight and Concentrate Level of Ration for Finishing Yearling Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	7	7	7	7
Days fed	145	104	217	168
Avg. init. shrunk wt., lb.	964	965	965	968
Avg. final shrunk wt., lb.	1371	1335	1542	1530
Avg. daily gain, lb.	2.80	3.56	2.66	3.35
Avg. daily ration, lb.				
Concentrates	17.68	25.27	17.27	26.19
Haylage	22.76	4.05	24.04	4.04
Total	40.44	29.32	41.31	30.23
Feed/100 lb. gain, lb.				
Concentrates	631	709	649	782
Haylage	813	114	904	120
Total	1444	823	1553	902

Total feed intake and feed requirements were higher for the bulls fed the 50% concentrate rations but with less concentrates. On basis of feed efficiency, 100 lb. of the extra corn consumed by the yearling bulls fed the ration with 90% concentrates reduced the amount of haylage by 896 lb. in comparison to the 50% concentrate ration.

Yearling bulls in weight group 2 fed the 90% concentrate ration were marketed at 1530 lb. and were fed for 168 days. In this comparison, those fed the 50% concentrate ration gained 0.69 lb. less (20.6%) daily. Feed intake and total feed requirements were also greater for the 90% concentrate group. In this instance, each 100 lb. of corn consumed in excess of the 50% concentrate group resulted in a reduction of 589 lb. of haylage.

The reduction in going from weight group 1 to weight group 2 was similar for the 50% concentrate (5.0%) and the 90% concentrate (5.9%) groups. Also, the increase in total feed requirements at the higher final weight was similar for the 50% (7.5%) and 90% (9.6%) concentrate groups.

These data indicate a substantial advantage in weight gain for the higher level of concentrates and a good replacement value of concentrates for haylage with each weight group. However, differences between concentrate levels on basis of weight gain and feed efficiency between weight groups were small. Number of animals were small and more data are needed to properly evaluate the effects of concentrate levels at various market weights for feedlot yearling bulls.

Bull Calves

Results of the experiment with bull calves are presented in table 3. Those in weight group 1 fed the 90% concentrate ration were marketed at 1100 lb. after 227 days, and they had an average daily gain of 2.94 lb. When fed the 50% concentrate ration, there was a reduction in rate of gain of 0.35 lb. (11.9%). Feed intake and feed requirements were higher for the lower energy ration. On basis of feed efficiency, 100 lb. of the extra corn in the higher energy rations resulted in a reduction of 616 lb. of haylage.

Table 3. Market Weight and Concentrate Level of Ration for Growing and Finishing Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	13
Days fed	259	227	357	311
Avg. init. shrunk wt., lb.	434	432	433	433
Avg. final shrunk wt., lb.	1107	1100	1242	1281
Avg. daily gain, lb.	2.59	2.94	2.26	2.72
Avg. daily ration, lb.				
Concentrates	12.60	16.99	13.28	18.01
Haylage	17.48	2.86	19.11	3.36
Total	30.08	19.85	32.39	21.37
Feed/100 lb. gain, lb.				
Concentrates	485	579	586	662
Haylage	676	97	847	124
Total	1161	676	1433	786

When fed the longer period of time for weight group 2, daily gain was 2.72 lb. Weight gain was reduced by 0.46 lb. daily (16.9%) for the 50% concentrate ration in comparison to 90% concentrates. On basis of feed efficiency, 100 lb. of the greater amount of concentrates consumed by the 90% concentrate groups resulted in 951 lb. less haylage.

Weight gains were reduced more from weight group 1 to weight group 2 by the 50% concentrate ration (12.7%) than by the 90% concentrate (7.5%). Respective increases in feed requirements were 23.4 and 16.3% for the 50% and 90% concentrate rations.

As with the yearling bulls, these data show a decided advantage for the 90% concentrate ration on basis of weight gain and concentrate replacement value for haylage. The advantage for the higher level of concentrates became more pronounced as the bull calves were fed to the heavier weight. However, the effect may have been partly from weather. Bull calves fed the 50% concentrate ration to the heavier weights were fed for a longer time and a greater part of the period was during more severe weather conditions.

Heifers

Results of the experiment with heifer calves are presented in table 4. Heifers in weight group 1 fed the 90% concentrate ration were marketed at 970 lb. and had made an average daily gain of 2.48 lb. For the group offered the ration with 50% concentrates, there was a 14.1% reduction in rate of gain. On basis of feed efficiency, 100 lb. of the greater amount of corn consumed by the 90% concentrate group resulted in a reduction of 376 lb. of haylage.

Table 4. Market Weight and Concentrate Level of Ration for Heifers

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	14
Days fed	238	210	301	273
Avg. init. shrunk wt., lb.	444	449	443	442
Avg. final shrunk wt., lb.	952	970	1109	1102
Avg. daily gain, lb.	2.13	2.48	2.21	2.41
Avg. daily ration, lb.				
Concentrates	11.56	17.93	12.34	16.48
Haylage	16.91	2.92	17.73	2.86
Total	28.47	20.85	30.07	19.34
Feed/100 lb. gain, lb.				
Concentrates	543	723	557	685
Haylage	794	118	804	119
Total	1337	841	1361	802

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The yearling bulls were used for cleanup bulls during the immediate past breeding season and were the larger calves from those of the previous year. Each ran in a pasture with 8 to 10 cows after the period of artificial insemination. They were fed no grain during the period of summer grazing.

The bull calves were from a group of 126, and 34 of the larger ones were selected for use as cleanup bulls the following breeding season. The remaining ones were shipped to Brookings for the feedlot experiment. During a preliminary period of about 3 months, they were fed a ration of alfalfa-bromegrass haylage or hay, protein supplement and a limited feed of grain. Upon initiation of the feedlot experiment, 84 were selected from the 92 head. They were allotted into 12 pens of 7 each. After the initial weighing and allotment, those in four of the pens were castrated for the steer group in the experiment.

The 56 heifers were a random assortment from 128 head from which no previous selection had been made. They were trucked to Brookings at about the same time as the bull calves and were fed in the same manner as the bulls during the preliminary period.

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Experimental treatments were two final market weights for each of the sex groups. Weight group 1 was to be about 1350, 1100, 950 and 1050 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Good. Weight group 2 was to be about 1500, 1250, 1100 and 1200 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Choice.

Dietary treatments within each weight group were 50% or 90% concentrate rations on an air-dry basis. The rations consisted of alfalfa-bromegrass haylage and a concentrate-supplement mixture. Ingredient composition of each ration is shown in table 1.

Table 1. Ingredient Composition of Rations (Air-Dry)

Ingredient	50% concentrate diet	90% concentrate diet
	%	%
Alfalfa-brome haylage	50.0	10.0
Rolled corn grain	49.0	87.0
Soybean meal (44%)	---	6.0
Limestone	---	1.0
Dicalcium phosphate	0.5	---
TM salt	0.5	0.5
Potassium chloride	---	0.5
Vitamin A (1500 I.U./lb. of ration)	5 g	5 g
Vitamin E (8 I.U./lb. of ration)	4 g	4 g
Aureomycin-10 (5 mg./lb. of ration)	22.7 g	22.7 g

The steers were implanted with 36 mg. of diethylstilbestrol (DES) at the beginning of the experiment and again after about 4 months for those in weight group 2. Heifers were fed 0.4 mg. daily of melengestrol acetate (MGA). Bulls did not receive any hormone additive or implant treatment.

Feeding was once daily in amounts that would be nearly consumed by the next feeding after the cattle were on full feed. They were raised to a full feed over a period of about 2 weeks. The 90% concentrate ration was calculated to contain 13% protein, 0.60% calcium and 0.35% phosphorus on an air-dry basis. Supplements were added to the 50% concentrate ration to furnish at least these amounts of nutrients. Alfalfa-brome haylage (average of about 58% dry matter) and concentrates were fed separately but in ratios to give the 50 or 90% levels of concentrates on an air-dry basis. Hay was fed on a few days when trouble was encountered from freezing of haylage in the silo. Total amount was small and the quantities were converted to a haylage equivalent for daily forage consumed shown in the tables.

The cattle were marketed as the group (sex and concentrate level) reached the approximate desired weight. Carcass data were obtained and sides were brought to the meat laboratory for studies of carcass quality and composition (see A.S. Series 73-37). Some losses occurred during the experiment. Data presented are for the cattle completing the experiment.

Results

Sex groups were not considered to be directly comparable in the experiment. Differences existed as to selection from the source groups, and there was a lack of uniformity in a terminal point for the experimental periods between groups. Therefore, results are presented and discussed within sex groups as to the effects of market weight and concentrate level of the rations. However, comments as to similarity or difference in response by sex groups to the treatments are made where deemed appropriate. Percentage difference in weight gain and feed efficiency and haylage replacement values of the concentrates as affected by market weight and concentrate level of ration are presented in table 6.

Yearling Bulls

Results of the feedlot performance from the yearling bulls are presented in table 2. Those in weight group 1 and fed the 90% concentrate ration were marketed at 1335 lb. and they were fed for 104 days (3.56 lb. daily). There was a pronounced reduction in weight gain for those fed the 50% concentrate diet (21.3%). This group was fed for 145 days but they had a higher final weight. On basis of their daily gain, 132 days would have been needed for the same amount of gain as for the 90% concentrate group.

Table 2. Market Weight and Concentrate Level of Ration for Finishing Yearling Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	7	7	7	7
Days fed	145	104	217	168
Avg. init. shrunk wt., lb.	964	965	965	968
Avg. final shrunk wt., lb.	1371	1335	1542	1530
Avg. daily gain, lb.	2.80	3.56	2.66	3.35
Avg. daily ration, lb.				
Concentrates	17.68	25.27	17.27	26.19
Haylage	22.76	4.05	24.04	4.04
Total	40.44	29.32	41.31	30.23
Feed/100 lb. gain, lb.				
Concentrates	631	709	649	782
Haylage	813	114	904	120
Total	1444	823	1553	902

Total feed intake and feed requirements were higher for the bulls fed the 50% concentrate rations but with less concentrates. On basis of feed efficiency, 100 lb. of the extra corn consumed by the yearling bulls fed the ration with 90% concentrates reduced the amount of haylage by 896 lb. in comparison to the 50% concentrate ration.

Yearling bulls in weight group 2 fed the 90% concentrate ration were marketed at 1530 lb. and were fed for 168 days. In this comparison, those fed the 50% concentrate ration gained 0.69 lb. less (20.6%) daily. Feed intake and total feed requirements were also greater for the 90% concentrate group. In this instance, each 100 lb. of corn consumed in excess of the 50% concentrate group resulted in a reduction of 589 lb. of haylage.

The reduction in going from weight group 1 to weight group 2 was similar for the 50% concentrate (5.0%) and the 90% concentrate (5.9%) groups. Also, the increase in total feed requirements at the higher final weight was similar for the 50% (7.5%) and 90% (9.6%) concentrate groups.

These data indicate a substantial advantage in weight gain for the higher level of concentrates and a good replacement value of concentrates for haylage with each weight group. However, differences between concentrate levels on basis of weight gain and feed efficiency between weight groups were small. Number of animals were small and more data are needed to properly evaluate the effects of concentrate levels at various market weights for feedlot yearling bulls.

Bull Calves

Results of the experiment with bull calves are presented in table 3. Those in weight group 1 fed the 90% concentrate ration were marketed at 1100 lb. after 227 days, and they had an average daily gain of 2.94 lb. When fed the 50% concentrate ration, there was a reduction in rate of gain of 0.35 lb. (11.9%). Feed intake and feed requirements were higher for the lower energy ration. On basis of feed efficiency, 100 lb. of the extra corn in the higher energy rations resulted in a reduction of 616 lb. of haylage.

Table 3. Market Weight and Concentrate Level of Ration for Growing and Finishing Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	13
Days fed	259	227	357	311
Avg. init. shrunk wt., lb.	434	432	433	433
Avg. final shrunk wt., lb.	1107	1100	1242	1281
Avg. daily gain, lb.	2.59	2.94	2.26	2.72
Avg. daily ration, lb.				
Concentrates	12.60	16.99	13.28	18.01
Haylage	17.48	2.86	19.11	3.36
Total	30.08	19.85	32.39	21.37
Feed/100 lb. gain, lb.				
Concentrates	485	579	586	662
Haylage	676	97	847	124
Total	1161	676	1433	786

When fed the longer period of time for weight group 2, daily gain was 2.72 lb. Weight gain was reduced by 0.46 lb. daily (16.9%) for the 50% concentrate ration in comparison to 90% concentrates. On basis of feed efficiency, 100 lb. of the greater amount of concentrates consumed by the 90% concentrate groups resulted in 951 lb. less haylage.

Weight gains were reduced more from weight group 1 to weight group 2 by the 50% concentrate ration (12.7%) than by the 90% concentrate (7.5%). Respective increases in feed requirements were 23.4 and 16.3% for the 50% and 90% concentrate rations.

As with the yearling bulls, these data show a decided advantage for the 90% concentrate ration on basis of weight gain and concentrate replacement value for haylage. The advantage for the higher level of concentrates became more pronounced as the bull calves were fed to the heavier weight. However, the effect may have been partly from weather. Bull calves fed the 50% concentrate ration to the heavier weights were fed for a longer time and a greater part of the period was during more severe weather conditions.

Heifers

Results of the experiment with heifer calves are presented in table 4. Heifers in weight group 1 fed the 90% concentrate ration were marketed at 970 lb. and had made an average daily gain of 2.48 lb. For the group offered the ration with 50% concentrates, there was a 14.1% reduction in rate of gain. On basis of feed efficiency, 100 lb. of the greater amount of corn consumed by the 90% concentrate group resulted in a reduction of 376 lb. of haylage.

Table 4. Market Weight and Concentrate Level of Ration for Heifers

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	14
Days fed	238	210	301	273
Avg. init. shrunk wt., lb.	444	449	443	442
Avg. final shrunk wt., lb.	952	970	1109	1102
Avg. daily gain, lb.	2.13	2.48	2.21	2.41
Avg. daily ration, lb.				
Concentrates	11.56	17.93	12.34	16.48
Haylage	16.91	2.92	17.73	2.86
Total	28.47	20.85	30.07	19.34
Feed/100 lb. gain, lb.				
Concentrates	543	723	557	685
Haylage	794	118	804	119
Total	1337	841	1361	802

In weight group 2, the reduction in weight gain for the 50% concentrate ration in comparison to the 90% concentrate was 8.3%. In this instance, the replacement value for 100 lb. of the greater amount of concentrates from the 90% concentrate ration was 544 lb. of haylage.

These data show a greater response to the higher concentrate ration by heifers when marketed at the lighter weight. There were only small changes in weight gain and feed efficiency by feeding to the heavier weights. These results differ somewhat from those obtained with bull calves. There were substantial reductions in weight gain and increases in feed requirements for bull calves when fed to the heavier weights, being more pronounced with the lower level of concentrates.

Steers

Results of the experiment with steer calves are presented in table 5. In weight group 1, steers fed the 90% concentrate ration gained only 6.1% more than those fed the 50% level of concentrates. This was the lowest response obtained from the higher level of concentrates and 100 lb. concentrates reduced haylage by 488 lb.

Table 5. Market Weight and Concentrate Level of Ration for Steers

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	6	6	7	7
Days fed	245	217	350	280
Avg. init. shrunk wt., lb.	452	430	438	435
Avg. final shrunk wt., lb.	1094	1035	1159	1204
Avg. daily gain, lb.	2.62	2.79	2.06	2.75
Avg. daily ration, lb.				
Concentrates	12.79	16.89	13.45	18.28
Haylage	17.79	2.86	19.37	3.10
Total	30.58	19.75	32.82	21.38
Feed/100 lb. gain, lb.				
Concentrates	488	606	653	666
Haylage	679	102	940	112
Total	1167	708	1593	778

Rate of gain was about the same for weight group 2 as for weight group 1 when fed the higher concentrate ration. However, there was a marked reduction for steers in weight group 2 when fed to the heavier weight. This is not believed to be a true effect of treatment. This pen of steers showed a somewhat lower performance than those in weight group 1 during the period of time when weather conditions and rations were the same for the two groups.

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These data show essentially no difference in weight gain for weight group 1 over weight group 2 when fed the 90% concentrate ration. However, there was an improvement in feed efficiency (9.9%) for those marketed at the lighter weight. Numbers were small and other studies should be conducted to obtain more reliable data.

Summary

This experiment with feedlot bulls (yearlings and calves), heifers and steers showed an advantage in weight gains for a ration with about 90% concentrates over one with about 50% concentrates when market weights in the above order of sex groups were about 1350, 1100, 950 and 1050 lb. and at the heavier weights of about 1530, 1250, 1100 and 1200 lb.

Yearling bulls showed the most advantage for the higher level of concentrates with only small differences between weight groups. These results would indicate a need for high energy rations for large cattle capable of making rapid gains to rather heavy weights without excessive fattening. Rate of gain decreased and feed requirements increased when fed to the heavier weights. However, these changes were similar for the two levels of concentrates.

Bull calves also showed a pronounced advantage for the higher level of concentrates. The advantage was some greater when fed to the heavier weights. While there was a decrease in rate of gain and an increase in feed requirements when fed to the heavier weights, the changes were greater with the lower level of concentrates. These results also indicate a need for high energy rations for cattle capable of making high rates of gain. It would further appear that such rations become more important as the cattle approach a high degree of finish. However, a weather factor in the experiment cannot be discounted. Those in weight group 2 fed the 50% concentrate ration were fed the longest time and a greater amount of the total time was under more severe weather conditions.

Heifer calves showed even more advantage for the higher level of concentrates than did bull calves when marketed at the lighter weight. Interesting results with the heifers were the small changes in weight gains and feed requirements when fed to the heavier weights. They appeared to differ from bulls and steers in changes in weight gain and feed efficiency with increasing weight and finish.

Steers in weight group 1 fed the 90% concentrate ration showed the least response to the higher level of concentrates. Performance by the pen fed 50% concentrates in weight group 2 was not believed to be typical for the ration and comparisons with other treatments could give some distorted values. There was only a small change in weight gain for the 90% concentrate group when fed to the heavier weights. They did consume more feed and higher feed requirements than when marketed at the lighter weights.

Table 6. Performance of Feedlot Bulls, Heifers and Steers as Affected by Concentrate Level of Rations and Market Weight

	Bulls Yearlings	Bulls Calves	Heifers Calves	Steers Calves
	Advantage for 90% Over 50% Concentrates			
Average daily gain, %				
Wt. group 1	21.3	11.9	14.1	6.1
Wt. group 2	20.6	16.9	8.3	---
	Concentrate Replacement Value as Haylage, Lb.			
Wt. group 1	896	616	376	488
Wt. group 2	589	951	544	---
	Advantage of Weight Group 1 Over Weight Group 2			
Average daily gain, %				
50% conc.	5.0	12.7	3.6	---
90% conc.	5.9	7.5	-2.9	-1.4
Feed efficiency, %				
50% conc.	-7.5	-23.4	-1.8	---
90% conc.	-9.6	-16.3	-4.6	-9.9

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A.S. Series 73-35

Growth Stimulating Products for Feedlot Heifers Fed High-Concentrate Diets of High-Moisture Corn with Hay or Haylage

J. D. Burkhardt and L. B. Embry

This experiment was one in a series to determine the response by feedlot heifers to various growth promoting products. Products tested were diethylstilbestrol (DES), zeranol and melengestrol acetate (MGA) under conditions of high-concentrate diets with high-moisture grain and hay or haylage.

Procedure

Fifty-six Hereford heifers were used in this experiment. They were allotted into 8 pens with 7 animals per pen. The experimental diets were composed of 1 lb. of a 40% protein supplement, 2 lb. roughage dry matter and a full feed of rolled, reconstituted, high-moisture corn (24.5% moisture). All animals received 20,000 I.U. of vitamin A and 70 mg. bacitracin per head daily. Four pens were fed dry, chopped, alfalfa-brome hay (13% moisture) and the other four pens received haylage (52.8% moisture). The haylage was from the same source as the hay but was reconstituted and stored in an oxygen-limiting silo (Harvestore).

Growth promoting experimental treatments were control, 36 mg. zeranol implants, 10 mg. DES per head per day or 0.4 mg. MGA per head per day. Each of these treatments was administered to cattle fed hay or haylage.

The cattle were fed for 127 days and the experiment terminated. At time of slaughter the livers were examined for abscesses and carcass measurements were taken after an 18-hour chill.

Results

Growth Promoting Products

Results of the experiment with the growth promoting products averaged for hay and haylage diets are presented in table 1.

Weight gains were high for the heifers during this 127-day experiment. Heifers fed 10 mg. DES or 0.4 mg. MGA daily gained at essentially the same rate. The improvement over controls was 6.4%. Heifers implanted with 36 mg. zeranol gained at a lower rate than those fed DES or MGA (3.4% more than controls).

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Feed consumption was about the same for all treatment groups including the control. There were slight improvements in feed efficiency from the growth promoting compounds. The percentage improvements amounted to 5.7, 4.7 and 3.5, respectively, for DES, MGA and zeranol over control heifers.

Differences in carcass characteristics measured were small. Heifers fed DES had a lower dressing percent, less marbling, less fat thickness, a lower carcass grade but a larger rib eye in comparison to the controls. Those fed MGA were quite similar to controls but with less fat covering. Heifers implanted with zeranol appeared to differ from controls mainly in a larger rib eye and less fat covering.

Hay vs. Haylage

Results of comparisons between hay and haylage averaged for the growth promoting products are presented in table 2. Rate of gain was slightly higher for the heifers fed haylage (2.3%). Feed intake (90% dry matter) was about the same for hay and haylage with about the same difference in feed efficiency (2.1%) as for rate of gain in favor of haylage.

There appeared to be no important differences in carcass characteristics of heifers fed hay or haylage. Incidences of abscessed livers were 5 for haylage-fed group (17.9%) and 8 for hay-fed group (28.6%).

Summary

Feedlot heifers were fed alfalfa-bromegrass hay or reconstituted haylage with reconstituted high-moisture corn in conjunction with diethylstilbestrol (DES), melengestrol acetate (MGA) or zeranol from weights of about 590 to 980 lb. DES at 10 mg. daily or MGA at 0.4 mg. daily resulted in about the same improvement (6.4%) in weight gain over controls. Response to zeranol implants (36 mg.) was at a lower rate (3.4%). There were small improvements in feed efficiency, 5.7, 4.7 and 3.5%, respectively, for DES, MGA and zeranol.

The DES treatment appeared to result in a slightly lower dressing percent, less marbling, less fat thickness but a larger rib eye. Zeranol appeared to have similar but less pronounced effects as DES on carcass characteristics. Carcasses from heifers fed MGA were similar to controls.

Differences in rate of gain and feed efficiency between hay and haylage were quite small, 2.3% more gain with 2.1% less feed in favor of haylage. However, the forages made up only about 10% of the ration dry matter. Converted to a ton of forage dry matter, the small differences became rather substantial. The economic importance would depend upon the consistency in performance of cattle under the treatments.

Table 1. Growth Promoting Products for Feedlot Heifers
(June 15 to Oct. 20, 1972--127 days)

	Control	Zeranol 36 mg. implant	DES 10 mg. daily	MGA 0.4 mg. daily
Number	14	14	14	14
Init. wt., lb.	591	590	589	591
Final wt., lb.	967	979	989	990
Avg. daily gain, lb.	2.96	3.06	3.15	3.14
Avg. daily feed, lb. (90% dry matter)				
Rolled high-moisture corn	17.27	17.23	17.36	17.48
Hay or haylage	2.04	2.04	2.04	2.04
Protein suppl.	0.99	0.99	0.99	0.99
Total	20.30	20.26	20.39	20.51
Feed/100 lb. gain, lb. (90% dry matter)				
Rolled high-moisture corn	583	563	551	557
Hay or haylage	69	67	65	65
Protein suppl.	33	32	31	32
Total	685	662	647	654
Carcass wt., lb.	604	611	612	616
Dressing percent	62.4	62.3	61.9	62.2
Conformation[a]	21.4	21.0	21.1	21.4
Marbling[b]	5.5	5.7	5.0	5.5
Carcass grade[a]	18.9	19.0	18.6	19.0
Maturity[c]	23.0	23.0	23.0	23.0
Color[d]	4.6	4.7	4.6	4.9
Firmness[e]	6.2	6.1	6.0	5.9
% kidney fat	2.8	3.0	2.8	3.0
Loin eye area, sq. in.	9.66	10.28	10.16	9.81
Fat depth, in.	0.68	0.53	0.58	0.59
Abscessed livers	3	2	5	3

[a]Good = 17; Choice = 20. Graded to one-third grade.
[b]Slight = 4; Small = 5; Modest = 6.
[c]A+ maturity = 22; A maturity = 23.
[d]Cherry red = 4; Light cherry red = 5.
[e]Moderately firm = 5; Firm = 6.

Table 2. Hay or Haylage with Rolled High-Moisture Corn
(June 15 to Oct. 20, 1972--127 days)

	Hay	Haylage
Number	28	28
Init. wt., lb.	591	589
Final wt., lb.	978	985
Avg. daily gain, lb.	3.04	3.11
Avg. daily feed, lb. (90% dry matter)		
Rolled high-moisture corn	17.36	17.32
Hay or haylage	2.02	2.07
Protein suppl.	0.99	0.99
Total	20.37	20.38
Feed/100 lb. gain, lb. (90% dry matter)		
Rolled high-moisture corn	571	557
Hay or haylage	66	67
Protein suppl.	33	32
Total	670	656
Carcass wt., lb.	607	614
Dressing percent	62.1	62.3
Conformation[a]	21.3	21.2
Marbling[b]	5.6	5.3
Carcass grade[a]	18.9	18.9
Maturity[c]	23.0	23.0
Color[d]	4.5	4.9
Firmness[e]	6.0	6.1
% kidney fat	2.9	2.9
Loin eye area, sq. in.	9.92	10.04
Fat depth, in.	0.56	0.63
Abscessed livers	8	5

[a]Good = 17; Choice = 20. Graded to one-third grade.
[b]Slight = 4; Small = 5; Modest = 6.
[c]A+ maturity = 22; A maturity = 23.
[d]Cherry red = 4; Light cherry red = 5.
[e]Moderately firm = 5; Firm = 6.

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A.S. Series 73-36

Investigation of Western Yellow Pine (*Pinus ponderosa*) Abortion

C. Cogswell and L. D. Kamstra

For a number of years, ranchers in western South Dakota have been of the opinion that pregnant cows will abort after the consumption of sufficient quantities of yellow pine (*Pinus ponderosa*) needles. Problem areas exist where the yellow pine is the predominant pine species. Incidence of pine needle abortion is particularly high in late winter and early spring after cows in the last trimester of pregnancy graze on the needles. Some ranchers, however, have experienced the problem throughout the year when cows in earlier stages of pregnancy have aborted. Retained placentas are frequently associated with the abortions. If true abortions did not occur, animals frequently gave birth to live but weak premature calves.

An investigation concerned with pine needle abortion is currently being conducted to determine the abortive factor(s). Results of preliminary research testing different fractions obtained from pine needles are presented in this report.

Procedures

Samples of yellow pine needles were collected at a site near Sturgis, South Dakota, and stored in plastic bags at 20 C. Needles collected in September, October and January were used for the trial studies. Fractions were prepared as follows: (1) Water-soluble fraction. The needles were cut into inch long segments and macerated in a blender with distilled water. The liquid portion was decanted into a funnel and the residue extracted twice with additional water. The filtrate and washings were concentrated in a flash evaporator and designated as the aqueous fraction. (2) Acetone-soluble fraction. The solids, a green mass from the water extraction, were transferred into the blender and extracted with acetone following the procedure used for the water extraction. The filtrate and washings were concentrate in a flash evaporator and designated as the acetone fraction.

The water-soluble and acetone-soluble fractions are designated aqueous and acetone fractions, respectively. The amount of pine needle fraction added to the basal feed, Purina Laboratory Chow, was calculated according to the amount of each fraction extracted from a known weight of fresh needles. For consumption purposes, the amount of concentrated extract obtained from 25 grams of fresh needles was added to each 100 grams of the basal feed. Control rats were fed only the basal feed throughout the experiment.

Twenty-eight virgin female rats of the Sprague-Dawley strain were randomly mated with two females per male. The vaginal smear technique was used to determine estrus. Feeding of the pine needle fractions began three to four days after mating.

Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Discussion

Results given in table 1 indicate that the aqueous fraction had a greater detrimental effect upon litter size than the acetone fraction. The number of surviving embryos from aqueous-treated rats was approximately one-half that of the control litters. A somewhat lesser effect upon reproduction was obtained after feeding the acetone fraction, although resorption of embryos appeared to occur as measured by reduction in litter size.

A high incidence of gastrointestinal inflammation did occur with the feeding of both pine needle fractions. Upon autopsy, severe hemorrhage of the entire intestinal tract was observed in the pregnant rats. The pregnant rats appeared to suffer the toxic effects of the pine needle extracts as much as the embryos they were carrying.

Table 1. Effect of Various Pine Needle Fractions on Pregnancy in Rats

Test ration	No. of pregnant rats	No. of rats giving birth	Avg. litter size	Total no. of stillborn
Control	4	4	11.2	3
Aqueous fraction July collection	4	3	8.7	5
Acetone fraction July collection	4	4	7.8	3
Aqueous fraction October collection	4	3	7.3	5
Acetone fraction October collection	4	4	6.8	1
Aqueous fraction January collection	4	2	5.5	5
Acetone fraction January collection	4	2	7.0	4

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A.S. Series 73-37

Carcass Characteristics of Bulls, Heifers and Steers as Influenced by Ration and Market Weight

Peter B. Smith, W. J. Costello, Peter J. Thiex and L. B. Embry

High feed grain prices, a growing worldwide demand for animal protein, and increasing demand for lean, high quality beef make it imperative that beef volume and production efficiency increase. Because of high feed costs it is important to know how concentrate level in the ration and market weight influence production efficiency and carcass composition of different sex groups. The purpose of this study was to evaluate the effects of market weight and ration concentrate level on the quantitative and qualitative carcass traits of yearling bulls, bull calves, heifers and steers.

Procedures

The carcasses used in this study were those obtained from a feedlot performance trial (A.S. Series 73-34). The following table shows the experimental design:

	Heifers				Steers				Bull calves				Yearling bulls			
Weight group	1		2		1		2		1		2		1		2	
Concentrate level, %	50	90	50	90	50	90	50	90	50	90	50	90	50	90	50	90
Number of carcasses	14	14	14	14	6	6	7	7	14	14	13	13	5	7	7	7

The experiment was designed so that weight group 1 cattle would be fed until the heifers reached approximately 950 lb.; steers, 1050 lb.; bull calves, 1100 lb. and the yearling bulls, 1350 lb. Weight group 2 heifers were fed up to 1100 lb.; steers, 1200 lb.; bull calves, 1250 lb. and yearling bulls, 1500 lb. The primary objectives were to study differences in the weight groups and effects of the concentrate level used in arriving at the final weights.

The cattle were slaughtered at a commercial packing company and the following data were obtained after a 72-hour chill: carcass weight, quality grade, conformation, maturity, marbling, firmness score, color score, fat thickness at the 12th rib, rib eye area, percent kidney, pelvic and heart fat, and yield grade. The right sides, or the ribs and rounds from the right sides, were transported to the SDSU meat laboratory for physical separation into semi-boneless retail cuts, fat and

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Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

bone. Steaks were taken from the rib for proximate analysis, taste panel studies and tenderness determination on the Warner-Bratzler shear machine.

Results

Heifers

Results for the heifer carcasses are shown in table 1. Within weight group 1, the heifers fed the 90% concentrate ration were slaughtered 28 days earlier, possessed a higher dressing percentage, a higher conformation score and a higher percentage of kidney, pelvic and heart fat. This group had lower Warner-Bratzler shear values. However, the taste panel judged steaks from the 50% concentrate group more tender. Chemical analysis indicated higher protein and lower water levels in carcasses from heifers fed the 90% concentrate ration. Concentrate level, however, appeared to have no effect on carcass maturity, color, firmness and rib eye area.

In weight group 2 heifers, there was a greater difference in dressing percent between concentrate levels than was evident in group 1, 1.9% vs. 3.2%, respectively. The 90% concentrate group had higher quality grades and higher percentages of ether extract and water. All other differences between animals fed the 50 and 90% concentrate rations were small. Compared with weight group 1, weight group 2 heifers were fed 63 days longer and had greater carcass weights, dressing percent and carcass grades but less desirable yield grades. Chemical analysis of the 10th rib section detected a lower percent of protein, higher percent of fat and lower percent of water in weight group 2 heifers. Weight group 1 heifers had lower Warner-Bratzler shear values, indicating more tenderness. The taste panel, however, could not detect any differences between weight groups for tenderness, juiciness or flavor.

Steers

Table 2 shows results from the steer carcasses. Within weight group 1, although possessing lighter slaughter and carcass weights, the 90% concentrate group had higher dressing percents, larger rib eye areas, more outside fat cover and higher but less desirable yield grades. Physical separation of the carcasses, however, revealed that the 90% concentrate group had a higher percentage of edible portion, less trimmable fat and a lower percentage of bone. Moreover, steers fed the 90% level of concentrates were more tender.

Within weight group 2, the 90% concentrate level resulted in steers that averaged 45 lb. heavier with 70 less days on feed. As contrasted with weight group 1, the 50% concentrate level resulted in slightly higher dressing percents, higher percentages of edible portion and bone and lower percentages of trimmable fat. Moreover, the 50% concentrate level resulted in less marbling, lower quality grades, less desirable yield grades and smaller rib eye areas.

Weight group 1 steers had a higher level of protein and less fat but more water in the 10th rib steak as determined by chemical analysis than the heavy weight steers. In addition, weight group 1 steers averaged 4.9% more edible portion and 6.2% less trimmable fat.

Bull Calves

Results for the bull calves are presented in table 3. Within weight group 1, although the bulls on the 50% concentrate level weighed 7 lb. more after being fed 68 days longer, those fed the higher level of concentrates had higher dressing percentages and heavier, higher grading carcasses containing larger rib eyes. Moreover, the lean color score was much higher for the 90% concentrate ration, although this advantage was considerably less in weight group 1. The 50% concentrate level in both weight groups produced carcasses with less fat thickness, a lower chemical determination of intramuscular fat, a higher percentage of edible portion and less fat trim. The Warner-Bratzler shear and taste panel rated the steaks from bulls fed the higher level of concentrates more tender in both weight groups. Weight group 1, however, appeared to be the most tender.

The 90% concentrate level in weight group 2 produced heavier, higher grading carcasses. Moreover, the lean in the 90% concentrate group was much firmer and brighter colored, moderately firm vs. soft and cherry red vs. dark red, respectively. The 50% concentrate group, however, possessed less fat thickness, more desirable yield grades, a higher percentage of edible portion and bone and less fat trim.

Weight group 1 bulls had less marbling and fat but much firmer, brighter colored lean and a higher percentage of edible portion.

Yearling Bulls

Data from the yearling bulls are presented in table 4. The yearling bulls in weight group 1 fed the 50% concentrate ration were fed 41 days longer and weighed 36 lb. more at slaughter. The bulls on the 50% level of concentrates had more external finish, larger rib eyes and less protein and fat in the 10th rib sample as determined by chemical analysis. It appeared that energy level in the ration had no appreciable effect on conformation, maturity, firmness, color score, percent kidney fat and Warner-Bratzler shear value in weight group 1.

In weight group 2, the bulls on the 50% concentrate ration had lower dressing percents and carcass weights, more youthful maturity scores, and smaller rib eye areas. Level of concentrate did not appear to affect conformation, color, firmness, fat thickness, kidney fat or taste panel evaluation.

Comparing weight groups, group 1 had a lower dressing percent and the difference was largest at the 90% concentrate level. Bulls in weight group 1 fed the lower level of concentrates had more youthful carcasses, less fat thickness and more favorable taste panel evaluation. The group 1 bulls appeared more tender by the shear test with the 90% weight group 1 bulls the most tender.

Summary

Carcass characteristics from yearling bulls, bull calves, heifers and steers fed either a 50 or 90% concentrate ration to two slaughter weight groups were studied. In all sex groups, the final slaughter weight affected carcass composition more than concentrate level.

The cattle in weight group 2 had higher dressing percents, higher quality grades, more marbling, larger rib eye areas, more outside fat cover, lower percentages of protein and water, higher percentages of fat as determined by chemical analysis and yielded lower percentages of edible portion. The Warner-Bratzler shear test indicated that the cattle in weight group 1 were more tender than weight group 2 regardless of sex group.

Although comparisons between sex groups may not be valid because of non-random assortment of the males, it appears that the bulls had heavier carcasses, were trimmer, had more desirable yield grades and a higher percentage of edible portion. The heifers had higher quality grades, smaller rib eye areas, and more outside fat cover than the steers and bulls, respectively. Tenderness as determined by both the Warner-Bratzler shear and taste panel was more desirable in the steers and heifers than in the bulls.

Table 1. Carcass Characteristics of Heifers

	Weight group 1			Weight group 2		
	50%	90%	Avg.	50%	90%	Avg.
Number of animals	14	14		14	14	
Live weight, lb.	952	970	961	1109	1102	1105
Dressing percent	62.4	64.3	63.4	62.9	66.1	65.5
Carcass weight, lb.	594	633	613	699	729	714
Days on feed	238	210	224	301	273	287
Quality grade[a]	18.6	19.0	18.8	19.6	21.1	20.6
Conformation[a]	21.0	22.5	21.7	21.3	22.6	22.0
Maturity[b]	22.9	23.0	23.0	23.0	23.1	23.0
Marbling[c]	5.1	5.3	5.2	6.1	7.0	6.5
Firmness score[d]	5.8	5.8	5.8	6.0	5.8	5.9
Color score[e]	4.5	4.9	4.7	5.1	5.1	5.1
Yield grade	4.0	4.5	4.2	5.0	5.1	5.1
Fat thickness, in.	0.69	0.81	0.75	1.04	0.98	1.01
Rib eye area, sq. in.	9.6	9.9	9.7	10.6	10.4	10.5
% kidney fat	3.5	3.9	3.7	3.2	3.9	3.6
Shear force	16.3	15.8	15.9	18.0	16.7	17.3
Panel tenderness[f]	2.7	3.9	3.3	3.2	3.0	3.1
Juiciness[g]	3.5	3.6	3.6	3.3	3.7	3.5
Flavor[h]	3.0	2.8	2.9	2.8	3.1	2.9
Proximate analysis, %						
Protein	21.64	23.06	22.35	21.74	21.57	21.66
Fat	6.12	6.74	6.43	7.11	8.86	7.99
Water	71.43	70.09	70.76	70.36	68.74	69.55

[a]Good- = 16; Good+ = 18; Choice- = 19; Prime- = 22.
[b]A- = 24; A = 23; A+ = 22; B = 20; C- = 18.
[c]Devoid = 1; Small = 5; Moderately abundant = 9.
[d]Extremely soft = 1; Slightly soft = 4; Very firm = 7.
[e]Very dark red = 1; Cherry red = 4; Light cherry red = 5; Dark pink = 7.
[f]Extremely tender = 1; Slightly tender = 4; Extremely tough = 8.
[g]Extremely desirable = 1; Extremely undesirable = 8.
[h]Extremely juicy = 1; Slightly juicy = 4; Extremely dry = 8.

Table 2. Carcass Characteristics of Steers

	Weight group 1			Weight group 2		
	50%	90%	Avg.	50%	90%	Avg.
Number of animals	6	6		7	7	
Live weight, lb.	1094	1035	1046	1159	1204	1182
Dressing percent	61.2	63.4	62.3	65.0	64.5	64.8
Carcass weight, lb.	669	657	663	753	778	765
Days on feed	245	217	231	350	280	315
Quality grade[a]	18.7	18.2	18.4	18.7	20.3	19.5
Conformation[a]	21.5	21.5	21.5	22.1	21.3	21.2
Maturity[b]	23.0	23.0	23.0	23.0	23.0	23.0
Marbling[c]	4.7	4.8	4.8	5.1	6.4	5.8
Firmness score[d]	6.0	5.7	5.8	6.0	5.9	5.9
Color score[e]	4.8	5.2	5.0	4.7	5.3	5.0
Yield grade	3.8	3.9	3.8	5.0	4.4	4.7
Fat thickness, in.	0.61	0.69	0.65	0.89	0.85	0.87
Rib eye area, sq. in.	10.1	10.8	10.5	10.5	11.3	10.9
% kidney fat	2.2	3.1	2.6	3.8	3.1	3.5
Shear force	15.6	13.4	14.5	17.8	17.8	17.8
Panel tenderness[f]	3.1	2.2	2.7	3.2	3.2	3.2
Juiciness[g]	3.7	3.9	3.8	3.4	3.8	3.6
Flavor[h]	2.9	2.8	2.8	2.9	3.1	3.0
Proximate analysis, %						
Protein	22.06	23.52	22.79	21.61	21.26	21.43
Fat	4.64	4.4	4.25	5.69	7.02	6.36
Water	72.24	72.39	72.31	71.63	70.7	71.16
Physical separation, %						
Edible portion	56.90	58.69	57.81	53.02	52.07	52.86
Trimmable fat	29.35	27.89	28.61	33.91	34.77	34.34
Bone	13.75	13.42	13.58	13.07	12.53	12.8

[a]Good- = 16; Good+ = 18; Choice- = 10; Prime- = 22.
[b]A- = 24; A = 23; A+ = 22; B = 20; C- = 18.
[c]Devoid = 1; Small = 5; Moderately abundant = 9.
[d]Extremely soft = 1; Slightly soft = 4; Very firm = 7.
[e]Very dark red = 1; Cherry red = 4; Light cherry red = 5; Dark pink = 7.
[f]Extremely tender = 1; Slightly tender = 4; Extremely tough = 8.
[g]Extremely desirable = 1; Extremely undesirable = 8.
[h]Extremely juicy = 1; Slightly juicy = 4; Extremely dry = 8.

Table 3. Carcass Characteristics of Bull Calves

	Weight group 1			Weight group 2		
	50%	90%	Avg.	50%	90%	Avg.
Number of animals	14	14		13	13	
Live weight, lb.	1107	1100	1103	1242	1281	1262
Dressing percent	61.0	63.4	62.2	62.3	63.4	62.9
Carcass weight, lb.	676	698	687	781	813	797
Days on feed	295	227	243	357	311	334
Quality grade[a]	17.5	18.3	17.9	18.4	20.1	19.3
Conformation[a]	21.9	22.0	21.9	22.6	22.5	22.6
Maturity[b]	23.0	23.0	23.0	21.9	23.2	22.5
Marbling[c]	4.8	4.9	4.7	5.9	6.3	6.1
Firmness score[d]	6.0	6.0	6.0	3.4	5.7	4.5
Color score[e]	2.7	4.3	3.6	1.8	4.4	3.1
Yield grade	3.2	3.6	3.4	4.0	4.6	4.3
Fat thickness, in.	0.47	0.62	0.55	0.64	0.88	0.76
Rib eye area, sq. in.	11.3	11.5	11.4	11.7	11.9	11.8
% kidney fat	2.6	3.3	2.9	3.2	3.1	3.2
Shear force	18.7	14.4	16.5	19.3	18.8	19.0
Panel tenderness[f]	3.8	3.3	3.6	4.3	3.9	4.0
Juiciness[g]	3.9	3.8	3.9	3.6	3.9	3.6
Flavor[h]	2.9	3.0	3.0	3.4	3.1	3.3
Proximate analysis, %						
Protein	21.82	23.08	22.45	21.89	19.04	20.46
Fat	2.95	5.19	4.07	4.42	6.27	5.35
Water	74.27	71.79	73.03	73.08	71.35	72.2
Physical separation, %						
Edible portion	62.11	60.19	61.30	62.29	57.52	59.9
Trimmable fat	23.24	27.23	25.23	23.42	30.80	26.17
Bone	14.35	12.58	13.47	14.29	12.4	13.4

[a] Good- = 16; Good+ = 18; Choice- = 19; Prime- = 22.
[b] A- = 24; A = 23; A+ = 22; B = 20; C- = 18.
[c] Devoid = 1; Small = 5; Moderately abundant = 9.
[d] Extremely soft = 1; Slightly soft = 4; Very firm = 7.
[e] Very dark red = 1; Cherry red = 4; Light cherry red = 5; Dark pink = 7.
[f] Extremely tender = 1; Slightly tender = 4; Extremely tough = 8.
[g] Extremely desirable = 1; Extremely undesirable = 8.
[h] Extremely juicy = 1; Slightly juicy = 4; Extremely dry = 8.

Table 4. Carcass Characteristics of Yearling Bulls

	Weight group 1			Weight group 2		
	50%	90%	Avg.	50%	90%	Avg.
Number of animals	5	7		7	7	
Live weight, lb.	1371	1335	1353	1542	1530	1536
Dressing percent	62.8	62.2	62.5	63.0	64.6	64.1
Carcass weight, lb.	862	831	846	980	989	984
Days on feed	145	104	124	217	168	192
Quality grade[a]						
Conformation[a]	21.0	21.0	21.0	21.0	21.0	21.0
Maturity[b]	22.0	22.0	22.0	18.9	22.1	20.4
Marbling[c]	3.2	4.0	3.6	3.1	3.7	3.4
Firmness score[d]	4.6	4.6	4.6	4.6	4.7	4.6
Color score[e]	3.8	4.0	3.9	3.7	3.6	3.6
Yield grade	2.8	2.6	2.7	3.9	3.7	3.8
Fat thickness, in.	0.52	0.44	0.48	0.7	0.71	0.70
Rib eye area, sq. in.	14.5	14.3	14.4	13.7	14.8	14.2
% kidney fat	1.9	2.0	1.9	1.9	2.0	1.9
Shear force	17.4	17.1	17.3	17.8	18.5	18.1
Panel tenderness[f]	4.5	4.7	4.6	5.2	5.1	5.2
Juiciness[g]	3.4	4.0	3.7	3.9	4.0	4.0
Flavor[h]	3.1	3.3	3.2	3.0	3.3	3.2
Proximate analysis, %						
Protein	22.87	24.06	23.59	23.08	23.26	23.17
Fat	1.84	2.9	2.37	2.77	3.15	2.96
Water	74.41	73.42	73.91	73.85	72.99	73.42

[a]Good- = 16; Good+ = 18; Choice- = 19; Prime- = 22.
[b]A- = 24; A = 23; A+ = 22; B = 20; C- = 18.
[c]Devoid = 1; Small = 5; Moderately abundant = 9.
[d]Extremely soft = 1; Slightly soft = 4; Very firm = 7.
[e]Very dark red = 1; Cherry red = 4; Light cherry red = 5; Dark pink = 7.
[f]Extremely tender = 1; Slightly tender = 4; Extremely tough = 8.
[g]Extremely desirable = 1; Extremely undesirable = 8.
[h]Extremely juicy = 1; Slightly juicy = 4; Extremely dry = 8.

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"Bullock" Beef

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World population is still booming. And the demand for meat will grow even more as diets improve around the world. Thus, it may be largely up to the American beef producer to supply not only more meat to satisfy the growing U.S. demand but larger quantities for the export trade. In addition, the calorie conscious American public is seeking trim, lean beef. Responding to this demand the American farmer and rancher has set as his chief goal the production of the most pounds of lean edible portion in the shortest amount of time with the least amount of feed.

Feeding bulls fits the bill. Most research indicates bulls gain faster and more efficiently than steers and heifers. Bull carcasses as compared to steers are trimmer and yield more pounds of lean edible portion. Thus, bull carcasses have a more desirable U.S.D.A. yield or cutability grade. One of the quickest ways to increase pounds of edible portion is to increase the cutability of the carcass, and bulls do have increased carcass cutability. With DES completely banned for feedlot use, the idea of feeding young bulls for beef is being given some thought.

Research indicates young bulls (under 24 months of age) don't deserve the same fate as old herd bulls who have traditionally found their way into processed meats or provided the lean portion for ground beef. Research at the University of Nebraska has shown that meat from young bulls is often comparable to steer beef in quality, tenderness, and flavor. However, within any one age group there is more variability in tenderness in bull meat than in steer beef.

Based on a considerable amount of research information comparing young bull beef to steer beef, the U.S.D.A. has adopted new quality grade standards for young bull beef. Beginning July 1, 1973, beef from young bulls is being graded by the same standards now used to assign the "prime", "choice" and "good" quality grades to steer and heifer beef. The meat from these young bulls will be designated "bullock beef." Prior to July 1 a young bull may have been called a "stag." Under the new system young bulls will be graded prime, choice, or good bullock beef depending upon their marbling, maturity and conformation. Quality grades for older bulls will be discontinued.

Because bulls put more of their energy into muscle growth, they deposit less internal and subcutaneous fat and less fat as intramuscular fat or marbling. Thus, bulls have less desirable carcass quality grades than steers of the same age. The failure of bulls to grade choice is the biggest problem with feeding

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Presented at the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

them. When fed the same ration as steers, bull carcass grades will be about two-thirds of a grade lower than steer grades.

The new U.S.D.A. standard for bullock beef will not change the quality grading of steer or heifer beef that is now generally available in retail stores. Since very few young bulls are now being produced for use as fresh beef, consumers should not expect bullock beef to be immediately available in volume at retail meat counters.

The success of bullock beef production for use as fresh beef may depend upon several factors. (1) How economically bullock beef can be produced as compared with steer beef. (2) How much the packer is willing to pay for the lean, muscular bullock beef that will have a more desirable yield grade but a less desirable quality grade than steers. (3) Consumer acceptance of bullock beef as compared to the beef they now eat.

Effects of Confinement Feeding Systems on Beef Cattle Production

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Introduction

Several factors have stimulated interest in housing systems for feedlot cattle. Some of these factors are (1) the desire to eliminate problems associated with the use of bedding, (2) the desire to decrease the labor required for feeding, bedding and manure handling, (3) the need to develop effective pollution control measures and (4) the desire to know the effects that housing systems may have on the performance and carcass characteristics of feedlot cattle. The objectives of the trials reported herein were (1) to study the influence of housing systems on the performance of finishing steer calves and (2) to study the effect of animal density on feedlot performance. The housing systems studied are described below:

Conventional open shed. Cattle in this facility are fed from an outside fence-line bunk. The entire outside lot is paved with concrete. There is no concrete in the building, but the area under roof is bedded and a manure pack is allowed to develop. When used at 30, 20 and 17 sq. ft. of shed (bedded area) per head, space availabilities in the outside lot are 50, 33 and 28 sq. ft. per head. Thus at these densities, the total areas available are 80, 53 and 45 sq. ft. per head. Runoff from the lot is collected in a detention pond. Investment costs per head for this facility are approximately \$105, \$70 and \$60 when used at 30, 20 and 17 sq. ft. of shed area per head.

Manure scrape unit. Cattle in this system are confined under roof in an open pole shed. The feed bunk is located along the open south side, under the roof overhang. The entire floor is concrete. It slopes away from the feed bunk at 1 in. per ft. for 6 ft. 8 in. in a flat 10 ft. center alley. The floor then slopes upward at 1/4 in. per ft. for 23 ft. to the north wall. The area to the north of the alley is bedded and a manure pack is allowed to develop. The center alley is scraped every 1 to 2 weeks, and all manure is handled as solid waste. When the cattle are housed at 30, 20 and 17 sq. ft. of bedded area per head, areas available in the center alley and feeding area are 24, 16 and 14 sq. ft. per head. Thus, total areas available are 54, 36 and 31 sq. ft. per head when the cattle are housed at 30, 20 and 17 sq. ft. of bedded area per head. Investment costs per head of capacity are approximately \$120, \$80 and \$68 when used at 30, 20 and 17 sq. ft. of bedded area per head.

Cold slat unit. The open, slatted floor confinement shed is 40 ft. deep and has a 16 ft. wide feeding alley that runs the full length of the building next to the back (north) wall. A cable fence along the open south side confines the cattle to the slatted floor area which runs the length of the building and extends inward to the feed bunk for about 23 feet. The slats are 5½ in. wide with 1½ in. between slats. The liquid manure pit is 8 ft. deep. The cattle are

Presented at the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

fed from a feed bunk which is located along the inner edge of the slatted floor area. Investment costs per head of capacity are approximately $173, $115 and $97 when used at 25, 17 and 14 sq. ft. of slatted area per head.

Warm slat unit. The enclosed, insulated, slatted floor confinement building has a 48 ft. wide slatted floor area, which is divided into two equal sized lots by a mechanical feeding system and feed bunk down the center of the floor area. The slatted floor consists of slats that are 5½ in. wide at the top, with 1½ in. between slats. The manure pit under the slatted floor is 8 ft. deep and extends 4 ft. outside the walls along both sides of the building. Exhaust fans which remove air from the pit are located outside the building. The building is insulated with 4 in. of fiberglass in the walls and 6 in. in the ceiling. There are 7 ft. 3 in. by 5 ft. 6 in. swing-up insulated panels in the outside walls which are opened in the summer to allow air movement in addition to that provided by exhaust fans in the walls.

Fresh air is admitted into the building through an insulated plenum chamber in the attic. This triangular chamber is 8 ft. wide and 7 ft. high. Fresh air is drawn into the housing area when air is expelled by the exhaust fans in the walls and manure pit. Outside air enters the chamber through louvers located at each end of the chamber. A heating unit is located at one end of the chamber. When the heating unit is in operation, all incoming air is drawn through it. Investment costs per head of capacity are approximately $255, $170 and $143 when used at 25, 17 and 14 sq. ft. of slatted area per head.

Open lot. The open lot unit has a dirt mound that is 5 ft. 6 in. high and 32 ft. wide at the top. The mound is located near the middle of the lot. A windbreak fence runs along the center of the top of the mound. The mound and fence are at right angles to prevailing winds (it lays NE to SW). The cattle have access to the mound and either side of the windbreak fence. The fence is 10 ft. high and constructed using 6 in. posts spaced 7 ft. 6 in., center to center. Four 2 by 6 in. purlins are used to support 1 by 10 in. vertical boards. The boards are spaced to provide a fence that is about 15% open. The cattle are fed from a fence-line bunk. There is an 8 ft. wide concrete strip next to the feed bunk and a 12 ft. wide asphalt strip between the concrete and the base of the mound. The cattle have no shelter other than that provided by the fence. Investment cost per head of capacity is approximately $25 when used at 250 sq. ft. of lot area per head.

Procedure

Hereford steer calves were obtained from the same herd in each of 3 years. With the exception of the open lot, each system was divided to provide two areas of equal size. Densities studied in these areas and other information concerning the three trials are shown below:

	Year		
	1970	1971	1972
Number of calves	324	340	340
Initial weight, lb.	435	431	424.5
Length of feeding period, days	256	234	241
Bunk space/head, inches	10.7	9.0	9.0
Densities, sq. ft./head			
Slatted floor facilities	25,17	25,14	25,14
Bedding facilities	30,20	30,17	30,17
Open lot	250	250	250

The square footages shown for the bedded units (conventional and manure scrape) represent the bedded area only. Bunk space was equalized at 10.7 or 9.0 inches per head by blocking off part of the feed bunk where necessary.

A ration composed of corn silage, high moisture shelled corn and supplement was fed to all lots in amounts that resulted in some feed being available at all times. The feeding program was as follows:

Up to about 700 lb.: High moisture shelled corn and corn silage full-fed at a ratio of 40 parts corn to 60 parts corn silage (wet basis) plus 1 lb. of supplement per head daily. All cattle were changed to the higher energy ration at the same time.

700 lb. to market: High moisture shelled corn and corn silage full-fed at a ratio of 80 parts corn to 20 parts corn silage (wet basis) plus 1 lb. of supplement per head daily.

The compositions of the supplements used in the 3 years are shown in table 1. When the cattle weighed 750 lb., they were provided with 20 mg. of stilbestrol daily. This was accomplished by substituting 10 lb. of stilbestrol premix (2 grams per lb.) for 10 lb. ground shelled corn in the formulation shown in table 1. The high moisture shelled corn fed in 1970, 1971 and 1972 had dry matter contents of 75.8, 71.3 and 73.7%, respectively. The corn silage had dry matter contents of 40.0, 42.9 and 42.6%, respectively.

Results

Feedlot performance data are presented in table 3 and carcass characteristics of the steers from the various housing systems in table 4.

1. Differences appear to exist among systems and among densities within systems relative to animals not completing the trials (died or removed, table 3). Close consideration fails to reveal any cause for these circumstances.

2. Average daily gains were highest for cattle housed at 25 or 17 sq. ft. per head in the warm slat unit (2.56 and 2.52 lb., respectively), followed closely by the cattle housed at 17 sq. ft. in the manure scrape unit (2.49 lb.). Cattle

housed at 14 sq. ft. per head in the warm slat unit averaged 2.36 lb. per day gain. A decrease in average daily gain was observed for cattle in the cold slat unit as density increased from 25 to 17 to 14 sq. ft. per head (2.43, 2.36 and 2.30 lb.).

Cattle housed at 20 or 17 sq. ft. of bedded area per head in the manure scrape unit gained faster (2.44 and 2.49 lb., respectively) than cattle housed at 30 sq. ft. per head (2.36 lb. per day). Average daily gains were 2.36, 2.26 and 2.30 lb. for cattle housed at 30, 20 and 17 sq. ft. of bedded area per head in the conventional facility. Cattle in the open lot had the slowest average daily gains (2.21 lb.).

3. Daily feed intakes tended to be greatest for cattle housed in the manure scrape, cold slat and warm slat units.

4. Amounts of feed per 100 lb. of gain (table 3) appeared to be influenced more by density in the slatted facilities (cold slat and warm slat) than in the bedded facilities (manure scrape and conventional). Amounts of feed (dry matter) required for 100 lb. of gain averaged 577 lb. for cattle housed in the warm slat unit, 581 lb. for cattle in the manure scrape unit, 603 lb. for cattle in the cold slat unit, 605 lb. for cattle in the conventional unit and 635 lb. for cattle in the open lot.

5. Carcass data presented in table 4 indicated that cattle housed in the manure scrape, cold slat and warm slat units were fatter than cattle housed in the conventional unit or open lot.

6. Economic calculations are presented in table 5 for feeders that keep their lots filled to capacity. The calculations are based on the densities used in these trials. Costs and returns were projected for units of equal size (to contain 200 head each at the lowest density studied). Housing costs are representative of a producer's cost to construct facilities for housing 200 head of cattle at the lower densities. Thus, high density units were assigned the same total housing cost as for low density units. An annual charge equal to 12% of the initial cost of each building was used to cover depreciation, repair, taxes and insurance. The number of days of feeding in each system to obtain 575 lb. of gain divided into 365 days per year gives the turnover rate per year. Lot capacity multiplied by the turnover rate indicates the number of cattle that could be fed per lot at 100% efficiency (each lot with the stated number of cattle all days of the year). While it is recognized that 100% efficiency would be difficult to attain, a producer should set his goal as close to 100% as possible to maximize returns. This is particularly true for those units having a high fixed cost per head.

Operational charges on a per head basis are shown in tables 5 and 6. These include bedding charges for conventional, manure scrape and open lot systems and heat and additional electricity for operating the warm confinement unit. Differences in labor charges per head are related to bedding and the periodic scraping of the facility (conventional, manure scrape and open lot).

In all instances, returns to labor and management favored the highest densities studied. Thus, even though performance was depressed in some units at the higher densities, returns continued to increase with each increase in density. Of course, there will be a density at which performance is decreased to such an extent that returns are reduced.

Projected returns to labor and management at the highest densities studied were:

Feedlot filled to capacity at all times		One lot per year	
Unit	$	Unit	$
Manure scrape	20,825	Manure scrape	11,755
Cold slat	17,308	Conventional	10,442
Conventional	16,902	Cold slat	10,210
Warm slat	15,863	Open lot	10,032
Open lot	14,869	Warm slat	8,168

Projected returns to management at the highest densities studied were:

Feedlot filled to capacity at all times		One lot per year	
Unit	$	Unit	$
Manure scrape	13,459	Manure scrape	7,000
Cold slat	12,306	Cold slat	6,783
Warm slat	11,583	Conventional	6,206
Conventional	10,722	Open lot	5,796
Open lot	10,127	Warm slat	5,312

When evaluating these data, a feedlot operator should consider if he is dependent on hired labor or if the feedlot is operated largely with family labor. If a majority of the labor is hired, the rankings under return to management apply. If a majority of the labor is supplied by the family, rankings under return to labor and management apply. Also, differences in returns among systems of $1000 or less should not be considered economically significant, since small variations in bedding costs, depreciation rates or other items may cause returns to vary by this amount.

Summary and Conclusions

Monetary charges have been identified herein that are related to the housing systems studied. These charges must be considered in evaluating the systems, but, because many of the charges vary from farm to farm and from year to year, producers are urged to apply their own cost estimates. The costs and returns used in these studies do not necessarily reflect current prices but are based on the economic conditions that existed at the time the studies were conducted. These costs and returns provide valid comparisons of the various housing systems; they are not intended to show the profitability of cattle feeding.

Three trials were conducted with Hereford calves fed in five housing systems. The systems studied were (1) conventional open shed with an outside concrete lot, (2) manure pack confinement with scrape alley, (3) cold slat confinement, (4) warm slat confinement and (5) open lot with a dirt mound and windbreak fence. With the exception of the open lot, all systems were divided to provide two animal densities. All cattle were started on trial in November and fed a ration composed of high moisture shelled corn, corn silage and supplement.

More animals died or were removed for poor health in the manure scrape facility than any other system. Close observation failed to reveal any reason foı this circumstance. Average daily gains were reduced in the cold slat and warm slat systems as density was increased. In the cold slat system average daily gains were 2.43, 2.36 and 2.30 lb. for cattle housed at 25, 17 and 14 sq. ft., respectively. In the warm slat system average daily gains were 2.56, 2.52 and 2.36 lb. for cattle housed at 25, 17 and 14 sq. ft., respectively. Small differences in average daily gains were observed as density increased in the conventional facility (2.36, 2.26 and 2.30 lb. per day for cattle housed at 30, 20 and 17 sq. ft. of bedded area per head, respectively). Average daily gains increased as density increased in the manure scrape unit (2.36, 2.44 and 2.49 lb. per day for cattle housed at 30, 20 and 17 sq. ft. of bedded area per head, respectively).

Feed efficiency data reflected the rates of gain of cattle in the various systems--slow gaining cattle required more feed per 100 lb. of gain than cattle which gained at a more rapid rate. Feed costs per 100 lb. gain were $12.88, $12.98, $13.45, $13.55 and $14.17 for cattle housed in the warm slat, manure scrape, cold slat, conventional and open lot, respectively. The ranking of the systems with regard to feed cost per 100 lb. gain was consistent during the 3 years that this study was conducted. Carcass data suggested that those animals housed in the manure scrape, cold slat and warm slat units were fatter than those in the conventional and open lot systems.

Economic calculations showed that, when the lots were used at 100% of capacity, returns favored the high density conditions in all instances. Under the high density conditions (14 sq. ft. of slatted area per head in cold and warm slat units and 17 sq. ft. of bedded area per head in conventional and manure scrape units) returns per year to labor and management favored cattle housed in the manure scrape unit followed by those in the cold slat, conventional, warm slat and open lot units. With medium density conditions (17 sq. ft. slatted area per head in the warm slat and cold slat units and 20 sq. ft. bedded area per head in the conventional and manure scrape units) returns per year to labor and management favored cattle housed in the manure scrape unit followed in order by the cold slat, warm slat and conventional units (open lot considered only as high density unit). With the low density conditions (25 sq. ft. slatted area per head in warm slat and cold slat units and 30 sq. ft. bedded area per head in conventional and manure scrape units) returns per year to labor and management favored cattle housed in the cold slat unit followed in order by conventional, manure scrape and warm slat units.

When only one lot is fed per year economic calculations showed that returns to labor and management at high density were highest for the manure scrape unit followed in order by conventional, cold slat, open lot and warm slat units. At medium density, returns to labor and management again favored the manure scrape unit followed in order by cold slat, conventional and warm slat units. At low density and one lot per year they ranked conventional, manure scrape, cold slat and warm slat.

Based on these data, it appears that there is little justification for incurring the expense of a high-cost unit such as the warm slat facility, especially for the one-lot-per-year feeder. If a higher depreciation rate than the one used herein was used, the warm slat unit may not have an advantage over any of the units, in spite of the advantage in cattle performance that it has permitted.

Table 1. Supplement Composition

Ingredient	1970	1971 and 1972
	%	%
Ground shelled corn	42.05	40.6
Urea	25.00	24.7
Ground limestone	19.00	13.5
Dicalcium phosphate	2.50	9.5
Vitamin A premix (13,600,000 IU/lb.)	0.18	0.22
Stilbestrol premix (2 g/lb.)[a]	0.50	0.50
Elemental sulfur	0.45	0.45
Trace mineralized salt	10.00	10.0
Vitamin D premix (750,000 IU/lb.)	0.32	0.40
Antibiotic premix (50 g/lb.)[b]	---	0.14

[a]To provide 10 mg. of stilbestrol per pound of supplement.

[b]To provide 70 mg. of chlortetracycline per pound of supplement.

Table 2. Analyses of Feeds

Feed	Dry matter, %			Crude protein, % of dry matter		
	1970	1971	1972	1970	1971	1972
Corn silage	40.0	42.9	42.6	7.7	7.4	7.0
High moisture corn grain	75.8	71.3	73.7	10.5	10.7	10.2
Supplement	96.2	92.1	92.7	70.2	73.5	80.4

Table 3. Least Squares Means Showing the Effects of Housing System and Density on Feedlot Performance

Item	Type of housing / Density, sq. ft./head	Conventional			Manure scrape			Cold slat			Warm slat			Open lot
		30	20	17	30	20	17	25	17	14	25	17	14	250
No. of steers		86	44	90	61	30	62	71	34	71	108	51	127	136
Initial weight, lb.		433	436	428	433	434	428	433	435	436	433	422	434	431
Final weight, lb.[a,b]		1006	985	988	1007	1030	1033	1024	1009	994	1035	1034	1009	969
Avg. daily gain, lb.		2.36	2.26	2.30	2.36	2.44	2.49	2.43	2.36	2.30	2.56	2.52	2.36	2.21
% of conventional		100	96	97	100	103	106	103	100	97	108	107	100	94
Avg. daily feed, lb. of dry matter														
Corn grain		9.59	9.49	9.58	9.46	9.59	9.77	9.76	9.68	9.64	9.96	9.93	9.51	9.48
Corn silage		3.44	3.40	3.45	3.46	3.54	3.54	3.64	3.57	3.62	3.61	3.58	3.48	3.57
Supplement		0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Total		13.96	13.82	13.96	13.85	14.06	14.24	14.33	14.18	14.19	14.50	14.44	13.92	13.98
Feed/100 lb of gain, lb. of dry matter														
Corn grain		408	426	415	404	388	399	400	416	418	393	390	404	431
Corn silage		145	151	149	147	143	144	148	153	156	142	141	147	161
Supplement		40	42	40	41	38	38	39	40	40	37	36	40	43
Total		593	619	604	592	569	581	587	609	614	572	567	591	635
% of conventional		100	104	102	100	96	98	99	103	104	96	96	100	107
Number of animals not completing the trials														
Died		1	0	0	4	2	3	0	1	2	1	2	3	2
Removed		3	1	0	2	1	1	1	1	0	0	0	1	5
Total		4	1	0	6	3	4	1	2	2	1	2	4	7
% died and removed		4.4	2.2	0	9.0	9.1	6.1	1.4	5.6	2.7	0.9	3.9	3.1	4.9
Bedding/head/day, lb.		2.09	2.05	2.02	2.37	2.28	2.19	-	-	-	-	-	-	2.81[c] 0.08

[a] Fed for an average of 243 days.

[b] Adjusted to a dressing percentage of 63.4 so as to remove differences in final weights due to fill and dirt on the hide.

[c] Pounds of corn cobs per steer per day. All other values are pounds of baled straw per steer per day.

Table 4. Least Squares Means Showing the Effects of Housing System and Density on Carcass Characteristics

Item	Type of housing	Conventional			Manure scrape			Cold slat			Warm slat			Open lot
	Density, sq.ft./head	30	20	17	30	20	17	25	17	14	25	17	14	250
No. of carcasses		86	44	90	61	30	62	71	34	71	108	51	127	136
Marbling score[a,b]		5.08	4.94	4.98	5.08	5.01	5.01	4.95	5.01	4.81	4.77	4.54	4.78	5.14
Conformation score[c]		13.77	13.68	13.86	13.64	13.64	13.94	13.97	13.87	14.04	13.86	14.01	14.03	13.85
KHP, %[d]		2.94	2.91	2.92	2.98	2.98	2.92	2.96	3.30	3.00	3.06	3.16	3.00	2.86
Rib eye area, sq. in.		11.32	11.78	11.62	11.36	11.44	11.44	11.46	11.63	11.70	11.39	11.46	11.68	11.32
Fat depth, in.		0.62	0.58	0.59	0.67	0.70	0.70	0.66	0.68	0.70	0.74	0.76	0.64	0.59
Quality grade[c]		11.67	11.56	11.48	11.77	11.64	11.69	11.46	11.55	11.35	11.21	10.86	11.26	11.87
Yield grade[e]		3.44	3.19	3.27	3.56	3.61	3.59	3.51	3.56	3.52	3.75	3.80	3.38	3.34
Carcass Value/100 lb., $		52.17	52.06	51.98	52.27	52.14	52.19	51.96	52.05	51.85	51.71	51.36	51.76	52.37

[a] All carcass data adjusted to a carcass weight of 638.4 pounds.

[b] Marbling score: traces, 3: slight, 4: small, 5: modest, 6.

[c] Conformation score and quality grade: high Good, 11; low Choice, 12; average Choice, 13; high Choice, 14.

[d] Kidney, heart and pelvic fat expressed as a percentage of carcass weight.

[e] Yield grades range from 1 to 5. Low values indicate a high percentage of retail cuts.

Table 5. Economic Calculations for Feeders that Keep Their Lots Filled to Capacity

Type of housing	Conventional			Manure scrape			Cold slot			Warm slot			Open lot
Space allowed, sq ft/head	30	20	17	30	20	17	25	17	14	25	17	14	250
Cost of housing unit, $	21,000[a]	21,000[a]	21,000[a]	24,000[a]	24,000[a]	24,000[a]	34,500[b]	34,500[b]	34,500[b]	51,000[b]	51,000[b]	51,000[b]	8,825[c]
Machinery and equipment costs, $[d]	9,600	11,200	11,200	9,600	11,200	11,200	9,600	11,200	11,200	9,600	11,200	11,200	11,200
Housing cost/head, $	105	70	60	120	80	68	173	115	97	255	170	143	25
Avg daily gain, lb	2.36	2.26	2.30	2.36	2.44	2.49	2.43	2.36	2.30	2.56	2.52	2.36	2.21
Feed/100 lb gain, lb	593	619	604	592	569	581	587	609	614	572	567	591	635
Carcass grade	11.7	11.6	11.5	11.8	11.6	11.7	11.5	11.6	11.4	11.2	10.9	11.3	11.9
Animal costs and returns, $/head													
Carcass value	333.05	332.35	331.84	333.69	332.86	333.18	331.71	332.29	331.01	330.12	327.88	330.44	334.33
Purchase of feeders (432 lb x 42.05/100 lb)[e]	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66
Gross margin	151.39	150.69	150.18	152.03	151.20	151.52	150.05	150.63	149.35	148.46	146.22	148.78	152.67
Manure credit	3.78	3.78	3.78	3.41	3.41	3.41	5.01	5.01	5.01	5.01	5.01	5.01	1.70
Gross return	155.17	154.47	153.96	155.44	154.61	154.93	155.06	155.64	154.36	153.47	151.23	153.79	154.37
Expenses, $/head													
Housing charge[f]	8.40	5.83	4.89	9.60	6.19	5.16	13.44	9.20	7.95	18.89	12.75	11.44	2.14
Equipment[g]	5.76	4.67	3.91	5.76	4.33	3.61	5.61	4.48	3.87	5.33	4.20	3.77	4.08
Feed for 575 lb gain[h]	76.36	79.75	77.62	76.19	73.02	74.63	75.32	78.14	78.60	73.43	72.74	75.96	81.48
Pretrial feed and bedding	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Bedding[i]	3.83	3.55	4.00	4.33	3.81	4.20	-	-	-	-	-	-	5.47
Interest on animal[j]	10.08	10.45	10.30	10.08	9.78	9.59	9.82	10.08	10.30	9.37	9.52	10.08	10.68
Materials handling	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Veterinary and medicines	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Insurance and utilities	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.09	4.13	3.47	1.00
Death loss	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Trucking to market	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total	124.85	124.67	121.14	126.38	117.55	117.61	124.61	122.32	121.14	131.53	122.76	124.14	124.27
Return to labor and management, $/head	30.32	29.80	32.82	29.06	37.06	37.32	30.45	33.32	33.22	21.94	28.47	29.65	30.10
Labor charge, $/head	12.00	12.00	12.00	13.20	13.20	13.20	9.60	9.60	9.60	8.00	8.00	8.00	9.60
Return/head, $	18.32	17.80	20.82	15.86	23.86	24.12	20.85	23.72	23.62	13.94	20.47	21.65	20.50
No. of head (lot capacity)	200	300	353	200	300	353	200	300	357	200	300	357	353
No. days feeding for 575 lb gain[k]	244	254	250	244	236	231	237	244	250	225	228	244	260
Rate of turnover[l]	1.50	1.44	1.46	1.50	1.55	1.58	1.54	1.50	1.46	1.62	1.60	1.50	1.40
No. head fed/year	300	432	515	300	465	558	308	450	521	324	480	535	494
Return/lot, $	5496	7690	10722	4758	11095	13459	6422	10674	12306	4517	9826	11583	10127
Return to labor and management, $/lot[m]	9096	12874	16902	8718	17233	20825	9379	14994	17308	7109	13666	15863	14869

Footnotes on page 58.

Table 6. Economic Calculations for Feeders that Feed One Lot Per Year

Type of housing	Conventional			Manure scrape			Cold slot			Warm slot			Open lot
Space allowed, sq ft/head	30	20	17	30	20	17	25	17	14	25	17	14	250
Cost of housing unit, $	21,000 [a]	21,000 [a]	21,000 [a]	24,000 [a]	24,000 [a]	24,000 [a]	34,500 [b]	34,500 [b]	34,500 [b]	51,000 [b]	51,000 [b]	51,000 [b]	8,825 [c]
Machinery and equipment cost, $ [d]	8,000	9,600	9,600	8,000	9,600	9,600	8,000	9,600	9,600	8,000	9,600	9,600	9,600
Housing cost/head, $	105	70	60	120	80	68	173	115	97	255	170	143	25
Avg daily gain, lb	2.36	2.26	2.30	2.36	2.44	2.49	2.43	2.36	2.30	2.56	2.52	2.36	2.21
Feed/100 lb gain, lb	593	619	604	592	569	581	587	609	614	572	567	591	635
Carcass grade	11.7	11.6	11.5	11.8	11.6	11.7	11.5	11.6	11.4	11.2	10.9	11.3	11.9
Animal costs and returns, $/head													
Carcass value	333.05	332.35	331.84	333.69	332.86	333.18	331.71	332.29	331.01	330.12	327.88	330.44	334.33
Purchase of feeders (432.0 lb x 42.05/100 lb) [e]	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66	181.66
Gross margin	151.39	150.69	150.18	152.03	151.20	151.52	150.05	150.63	149.35	148.46	146.22	148.78	152.67
Manure credit	3.78	3.78	3.78	3.41	3.41	3.41	5.01	5.01	5.01	5.01	5.01	5.01	1.70
Gross return	155.17	154.47	153.96	155.44	154.61	154.93	155.06	155.64	154.36	153.47	151.23	153.79	154.37
Expenses, $/head													
Housing charge [f]	12.60	8.40	7.14	14.40	9.60	8.16	20.70	13.80	11.60	30.60	20.40	17.14	3.00
Equipment [g]	7.20	5.76	4.90	7.20	5.76	4.90	7.20	5.76	4.84	7.20	5.76	4.84	4.90
Feed for 575 lb gain [h]	76.36	79.75	77.62	76.19	73.02	74.63	75.32	78.14	78.60	73.43	72.74	75.96	81.48
Pretrial feed and bedding	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Bedding [i]	3.83	3.55	4.00	4.33	3.81	4.20	-	-	-	-	-	-	5.47
Interest on animal [j]	10.08	10.45	10.30	10.08	9.78	9.59	9.82	10.08	10.30	9.37	9.52	10.08	10.68
Materials handling	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Veterinary and medicines	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Insurance and utilities	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.09	4.13	3.47	1.00
Death loss	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Trucking to market	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total	130.49	128.33	124.38	132.62	122.39	121.90	133.46	128.20	125.76	145.11	131.97	130.91	125.95
Return to labor and management, $/head	24.68	26.14	29.58	22.82	32.22	33.03	21.60	27.44	28.60	8.36	19.26	22.88	28.42
Labor charge, $/head	12.00	12.00	12.00	13.20	13.20	13.20	9.60	9.60	9.60	8.00	8.00	8.00	12.00
Return/head, $	12.68	14.14	17.58	9.62	19.02	19.83	12.00	17.84	19.00	0.36	11.26	14.88	16.42
No. of head (lot capacity)	200	300	353	200	300	353	200	300	357	200	300	357	353
No. days feeding for 575 lb gain [k]	244	254	250	244	236	231	237	244	250	225	228	244	260
Return/lot, $	2536	4242	6206	1924	5706	7000	2400	5352	6783	72	3378	5312	5796
Return to labor and management, $/lot [l]	4936	7842	10442	4564	9666	11755	4320	8232	10210	1672	5778	8168	10032

Footnotes on page 58.

<u>Footnotes to tables 5 and 6</u>

[a] Cost of a building to hold 200 head at 30 sq. ft./head or 300 head at 20 sq. ft./head or 353 head at 17 sq. ft./head.

[b] Cost of a building to hold 200 head at 25 sq. ft./head or 300 head at 17 sq. ft./head or 357 head at 14 sq. ft./head.

[c] Cost to build an open lot to hold 353 head at 250 sq. ft./head.

[d] Machinery and equipment investment calculated at $8,000 for 200 head, $9,600 for 300 head, or $11,200 for 500 head.

[e] Ranch pay weight plus trucking ($176.76 + $4.90).

[f] 12% of initial cost of housing unit (depreciation, repair, taxes and insurance) divided by number of head marketed.

[g] 18% of machinery and equipment investment divided by number of head marketed.

[h] Feed prices: Corn grain, $2.36/100 lb. dry matter; corn silage, $1.43/100 lb. of dry matter; supplement, $3.95/100 lb. of dry matter (cost of ingredients plus $7/ton for mixing).

[i] Straw and corn cobs charged at $15/ton.

[j] Interest calculated at 7½% of initial cost for total days (26-day pretrial + an average 243-day feedlot period).

[k] Days of feeding to produce 575 lb. gain.

[l] (table 5) Number of groups that could be fed in 365 days.

[l] (table 6) Return to labor and management/head times the potential number of cattle marketed/year.

[m] (table 5) Return to labor and management/head times the potential number of cattle marketed/year.

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Meeting the Protein Needs of Growing and Finishing Cattle

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The cost of nearly all feed commodities has sharply risen since one year ago. Those feed ingredients normally used as natural protein sources, however, have risen in cost much more dramatically than the roughages or the cereal grains used for animal feed. This substantial rise in cost of high protein feeds plus possible shortages of feed grade urea will force many cattle feeders to alter feeding and management practices used in the past. For example, recommendations in previous years frequently called for the use of soybean meal or soybean meal based supplements as the source of protein in growing rations. These recommendations were based on experimental work that had shown that urea or other nonprotein nitrogen sources were not utilized as well in high roughage rations (such as those commonly used in growing programs) as was natural protein. The current price differential between all natural protein supplements and those containing non-protein nitrogen is considerably greater than it has been in the past. Therefore, economics dictate the use of supplements containing substantial quantities of nonprotein nitrogen in growing as well as finishing rations.

With the high cost of protein and the possibility of a shortage of feed grade urea no one can afford to over feed protein. An inexpensive protein analysis of feedstuffs can sometimes prevent over feeding. Frequently, feedstuffs protein content varies from book values (book values are simply an average of many samples). Whether the actual protein analysis of a feedstuff is higher or lower than book value, it is important that the feeder has this information available if he is to formulate an efficient ration.

Often times when feed grains and forages are grown on ground which has been fertilized with high levels of nitrogen, they contain levels of protein higher than book values. If the feeder is made aware of such higher protein values by having feedstuffs analyzed, he may reduce protein supplementation needs considerably.

In the case of feeders who feed complete mixed rations formulated on a percentage basis, moisture analysis should also be made. Underestimating moisture content of percentage rations will result in feeding a higher percentage of protein supplement than was desired. Both protein and moisture analyses are relatively inexpensive. There are several independent laboratories, as well as South Dakota State University Experiment Station Biochemistry Laboratory, which are equipped to make such analyses.

A summary of the presentation given at Cattle Feeders Day, November 2, 1973.

After a producer has determined what his protein needs are, supplements should be purchased to fit his particular program. Most supplements are not only formulated to contain a specified level of protein but also other feed additives. Frequently, feeders will feed levels of these supplements to assure adequate levels of antibiotics, vitamins and minerals. This often times results in over feeding of protein. Most manufacturers have a number of supplement formulas. Therefore, careful shopping following feed analysis and ration formulation will usually result in the finding of a supplement that will meet protein needs and contain proper levels of other feed additives as well.

Frequently, feeders will change forages or grains during a feeding period. Protein supplementation should be reconsidered when such changes are made. For example, if alfalfa haylage is used to replace sorghum silage, protein supplement needs may be reduced considerably.

Perhaps the greatest reduction in supplementation costs can be made by proper management of locally grown feedstuffs which are moderately high in protein. South Dakota producers in many instances have access to alfalfa, oats and barley. These feedstuffs can be incorporated into growing rations to provide much of the animal's protein requirement. In growing rations such feedstuffs (alfalfa, oats and barley) would provide natural protein much cheaper than commercial sources. A logical course of action for a farmer-feeder, who finished as well as backgrounded cattle, would be to utilize higher protein, home-grown feeds in the backgrounding stage. Lower protein grain (such as corn) and lower quality roughage could be used in the finishing phase with nonprotein nitrogen supplementation. Cattle fed high concentrate finishing rations have been shown to utilize nonprotein nitrogen nearly as effectively as natural protein. Utilization of nonprotein nitrogen in lower concentrate rations, however, is not as effective.

The difference in nonprotein nitrogen utilization in these two types of rations is due to the difference in the amounts of readily available energy. Microorganisms in the rumen break down nonprotein nitrogen compounds and ammonia is liberated. If energy is readily available when the ammonia is released (and it is in typical finishing rations), bacteria will utilize the ammonia to synthesize bacterial protein which is, in turn, digested in the lower tract of the animal. In the case of growing rations which usually contain substantial quantities of roughage, energy is not released as rapidly and therefore high levels of energy are not available to the microorganisms at the same time ammonia is released from urea. Consequently, the nonprotein nitrogen (urea) is not as efficiently utilized as it is in high-concentrate rations.

Hopefully supplies of urea or nonprotein nitrogen will be adequate. If, however, supplies should become limited or unavailable, it would be advisable to reduce or cut out supplemental protein at the end of the finishing period as opposed to earlier in the growing phase. Growing animals' weight gains are mostly muscle and therefore protein needs are more critical. An animal nearing slaughter weight on the other hand is laying down mostly fat. The larger animal is also consuming more total feed daily and therefore is also consuming more total protein than a smaller animal eating a ration containing the same percent protein. Recent results in Ohio have shown that steers fed finishing rations with no supplemental protein after the first 56 days on feed performed quite satisfactorily. These tests were limited in number and therefore no recommendations can be based on them yet. These tests do, however, lend support to the idea of limiting protein at the end of the finishing period if you must limit it at all.

A summarization of ways feeders might most effectively utilize high protein feedstuffs and reduce supplemental protein costs is as follows:

(1) Have protein analysis run on feedstuffs to determine actual protein supplement needs.

(2) Buy or have supplements formulated to fit specific needs. Don't over feed protein just to insure adequacy of other additives. Buy protein supplement separate from other feeds if necessary.

(3) Get maximum utilization from natural protein in local feedstuffs. Use higher protein forages and grains in growing phase if practical. Lower cost nonprotein nitrogen supplements are better utilized with finishing rations.

(4) If energy sources of ration are changed, determine if supplement needs to be altered as well.

(5) If protein supplements become limited, limit protein supplementation at the end of the finishing period.

As many commercial supplements will contain sizable quantities of urea this year, it should be pointed out the management will become more critical. Over consumption of nonprotein nitrogen (urea) can cause toxicity and sometimes death. If high urea feeds are to be utilized, several precautions should be exercised:

(1) It is recommended that supplements containing nonprotein nitrogen be introduced gradually over a period of 1 to 2 weeks and not until after a period of 4 weeks for calves following weaning.

(2) Supplements should be mixed thoroughly in mixed rations or be fed in a manner so as to avoid over consumption and subsequent toxicity.

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Growth Stimulant Substitutes for Stilbestrol

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In 1954 stilbestrol was first approved as a growth-promoting drug and became an accepted standard. Probably no other drug has had such an effect on the livestock industry as stilbestrol. As many as 85% of fed cattle have been receiving stilbestrol in some form, saving producers $7 to $14 per animal in production costs. Its reasonable cost and convenience overshadowed other materials available. As of January 1, 1973, oral feeding of stilbestrol was no longer allowed and later in the year the implant was banned.

This legislative action left cattle producers looking for available substitutes and fortunately there has been considerable research on other growth promoting drugs which are alternatives to stilbestrol. Here are the common growth promoting drugs that are approved.

RALGRO IMPLANTS

Ralgro (zeranol) is a growth stimulating implant which avoids many of the common objections since it does not contain a hormone. Ralgro is made from an extract of corn mold and can be used for both steers and heifers. Since there is no hormone activity, there are none of the side effects that sometimes occur with other implants. Gain response and efficiency from Ralgro have been about equal to that of stilbestrol. Ralgro implants apparently last for at least 100 days. Implanting once at the beginning of the finishing period should be sufficient.

The level approved for steers and heifers is 36 mg. (three pellets). The withdrawal time is 65 days between implanting and slaughter, which means a feeder can't implant just 65 days before slaughter time.

With growing calves they should be implanted at the beginning of the feeding period (36 mg.) and reimplanted with 36 mg. at the beginning of the finishing period.

For nursing calves the level of implant is also 36 mg.

Implants are placed in the ear the same as stilbestrol. The same implant machine can be used as the pellets are the same size. The cost of the Ralgro pellets will be higher than stilbestrol running at approximately 70 cents per treatment.

A summary of the presentation given at Cattle Feeders Day, November 2, 1973.

SYNOVEX IMPLANTS

Synovex is a hormone implant which comes in two preparations, one type for heifers and the other for steers. Synovex-H for heifers contains the hormones testosterone and estradiol. Synovex-S for steers contains the hormones progesterone and estradiol. The hormone preparations are contained in small pellets which are implanted in the ear. One capsule contains the proper number of pellets for an animal.

Generally, research has shown that response to Synovex in weight gains and feed efficiency is equal to, or perhaps slightly greater than, response to stilbestrol implants.

The implants last about 150 days and cannot be used within 60 days of slaughter. A producer feeding calves would therefore implant at the start of the feeding program and reimplant after 120 days. A producer feeding yearling cattle or cattle that are to be fed 130 to 170 days would implant only once.

Synovex implants cost approximately 80 to 90 cents per animal. As with other implants, it is not recommended for breeding cattle.

MGA FOR HEIFERS

Melengestrol Acetate (MGA) is a growth promoting drug approved as a feed additive for finishing mature heifers. Although MGA is a hormone, it is a progesterone, differing from the estrogenic activity of stilbestrol and other hormone growth stimulants.

For heifers which have reached sexual maturity, MGA depresses heat periods and increases the rate of feedlot gain. Rate of gain is increased as much or more than from stilbestrol. Boosts in feed efficiency generally amount to around 8%. However, little, if any, advantage will be seen in heifers which have not reached maturity. Heifers must be open for the drug to be beneficial. It is not effective for steers.

Since MGA is available only in feed form, its use for grazed heifers is limited. Good results depend on adequate consumption of the material in the feed.

Current regulations call for a level of 0.25 mg. to 0.5 mg. per head per day in the feed. A 48-hour withdrawal is required before slaughter. Since heifers will return to heat after MGA is removed from feed, withdrawal for longer than 72 hours is not recommended. Cost is approximately $1.25 to $1.50 per head for 140-day feeding period.

Producers who do not take advantage of these growth promoting drugs are losing a great advantage in reducing production costs. Be sure to follow the directions on the drug containers as to proper use of the drugs.