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1971 NEBRASKA BEEF CATTLE REPORT

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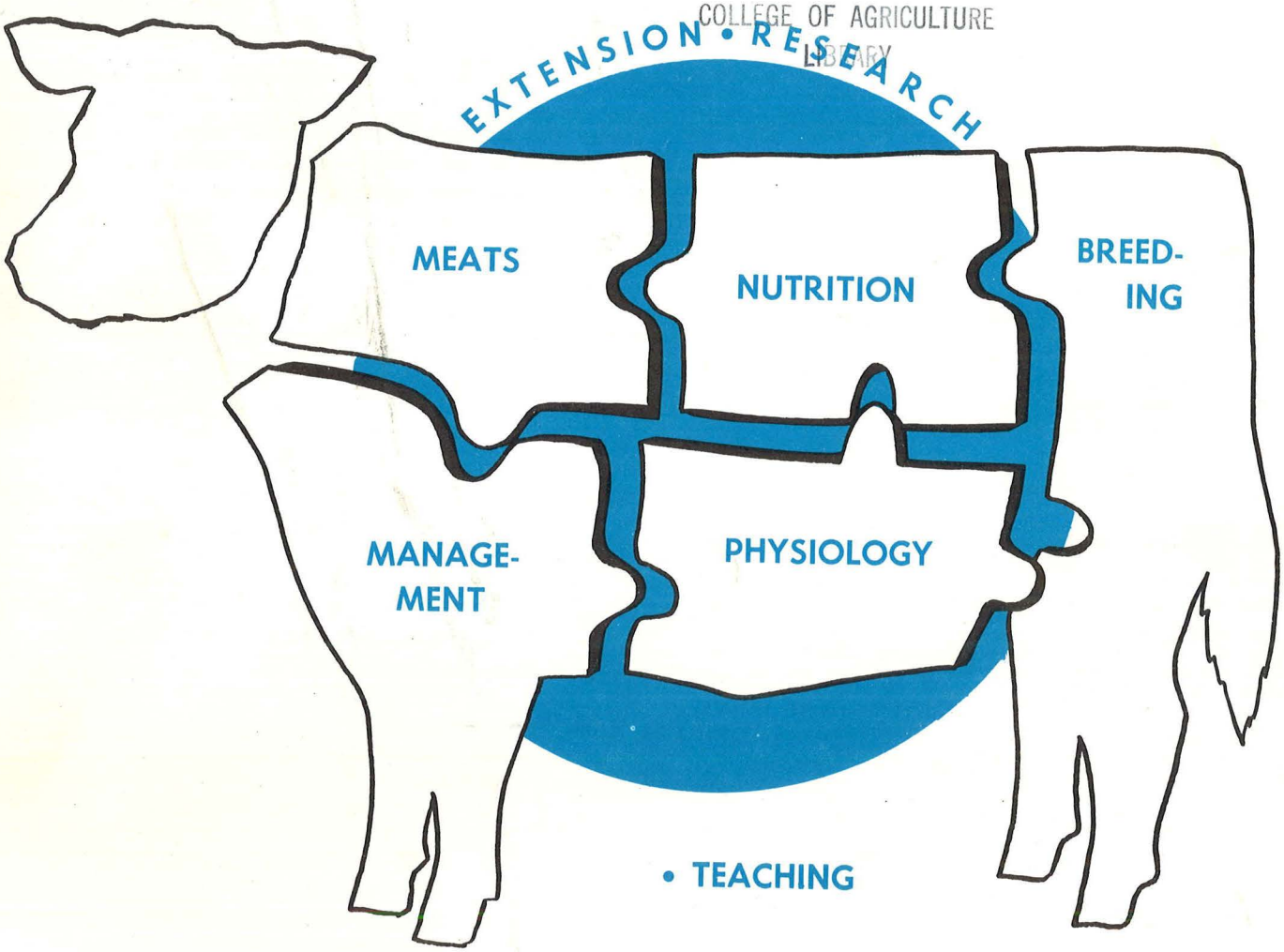

Prepared by the staff in Animal Science and cooperating Departments for use in the Extension and Teaching programs

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ACKNOWLEDGMENTS

All research reported from the Fort Robinson Beef Cattle Research Station is cooperative between the Beef Cattle Research Branch, Animal Husbandry Research Division, ARS, USDA and the Nebraska Agricultural Experiment Station.

Appreciation is expressed to the following firms for their support in the beef cattle research and Extension programs.

1. Allied Chemical Corporation, New York, New York.
2. Hoffman-LaRoche, Inc., Nutley, New Jersey.
3. Calcium Carbonate Company, Quincy, Illinois.
4. Chas. Pfizer and Company, Terre Haute, Indiana.
5. Dow Chemical Company, Midland, Michigan.
6. Gooch Milling and Elevator, Lincoln, Nebraska.
7. Eli Lilly and Company, Indianapolis, Indiana.
8. Merck and Company, Inc., Rahway, New Jersey.
9. Nopco Chemical Company, Harrison, New Jersey.
10. Farmland Industries, Kansas City, Missouri.
11. American Cyanamid, Kansas City, Missouri.
12. Commercial Solvents Corporation, Terre Haute, Indiana.
13. Cargill, Inc., Minneapolis, Minnesota.
14. E. R. Squibb and Sons, New Brunswick, New Jersey.
15. Dierks Forests, Inc., Hot Springs, Arkansas.
16. Corn Products Company, Argo, Illinois.
17. S. B. Penick and Company, San Francisco, California.
18. Swift and Company, Oak Brook, Illinois.
19. G. D. Searle, Chicago, Illinois.
20. Smith Kline & French, Philadelphia, Pennsylvania.
21. American Dehydrators Association, Kansas City, Missouri.
22. John R. Jirdon Industries, Morrill, Nebraska.
23. American Breeders Service, DeForest, Wisconsin.
24. Gothenburg Feed Products Company, Gothenburg, Nebraska
25. Nebraska Dehydrators Association, Lincoln, Nebraska.
26. Ferma-Gro Corporation, Storm Lake, Iowa.
27. Fairmont Foods, Omaha, Nebraska.
28. American Stores, Lincoln, Nebraska.
29. Wilson & Company, Omaha, Nebraska.
30. G. A. Hormel & Company, Fremont, Nebraska.
31. Iowa Beef Processors, Dakota City, Nebraska.
32. Swift and Company, Grand Island, Nebraska.
33. Spencer Foods, Inc., Schuyler, Nebraska.
34. Armour & Company, Omaha, Nebraska.
35. American Beef Co., Omaha, Nebraska.
36. John Roth & Company, Fairbury, Nebraska.
37. Fairbury Meat Company, Fairbury, Nebraska.
38. Minden Beef Company, Minden, Nebraska.
39. Cornland Beef Company, Lexington, Nebraska.
40. Prairie Maid Meat Company, Lincoln, Nebraska.
41. Falls City Meat Company, Falls City, Nebraska.
42. Nebraska Department of Agriculture, Nebraska Wheat Commission, Lincoln, Nebraska.

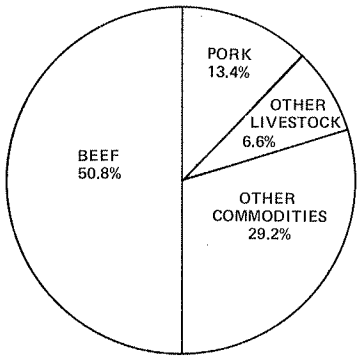

Fig. 1. Cash receipts from Nebraska agriculture, 1967-68-69.

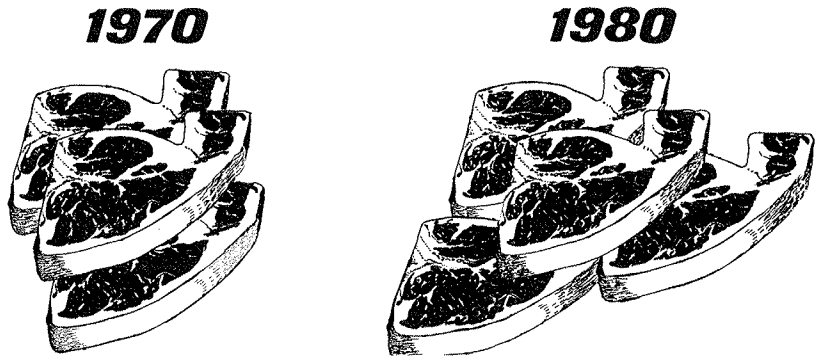

Fig. 2. Beef demand to increase more than 25% between 1970 and 1980.

Nebraska's Great Opportunity Decade

By Frank H. Baker
Chairman, Department of Animal Science

The Seventies will truly be the great opportunity decade of animal agriculture in Nebraska. Shakespeare's line "What's past is prologue" is truly apropos.

And what a prologue the 60's have been.

Nebraska's beef income rose to a point of contributing more than half of agriculture's receipts at the end of the 60's. Cash receipts from beef, pork and dairy have reached an all-time high. Livestock and livestock products yield two-thirds of the income from agriculture as the 70's begin (Fig. 1). Beef production equals the needs for the entire cities of New York and Chicago.

Outlook Is Good

The outlook for effective demand for beef is good; many experts suggest a need for more than 25% increase in available beef by the end of the 70's (Fig. 2).

In the absence of future inflation, the technology available from research laboratories can prevent the increases in production costs and may permit actual reduction in costs. This maintenance of low costs can permit the industry to deal with competition from meats of other countries, meats from other species of animals or with plant proteins in the form of substitutes.

This maintenance of low costs is vital to the health of the industry because these low costs can permit **reasonable profits for the industry. Without reasonable profits the industry will surely wither and die during the 70's.**

Nebraska's great opportunity decade of animal agriculture will grow out of a three-dimensional opportunity for economic growth.

1. Developing operations to process all Nebraska produced meat into retail-ready products. (Fig. 3).

2. Developing animal production and feeding operations to completely convert Nebraska's feed and forage production to animal products.

3. Developing land and water resources as new feed-producing capacity in complexes of farming, livestock feedings, meat fabrication systems (Fig. 4). Fabrication is activity concerned in changing meat carcasses to retail-ready products.

Strengths

Nebraska has three dimensions of strength for its great decade of animal agriculture.

1. **Feed** represents two-thirds or more of the costs of livestock production. Nebraska has the greatest unprogramed feed supply and feed-producing potential in the entire United States (Fig. 5).

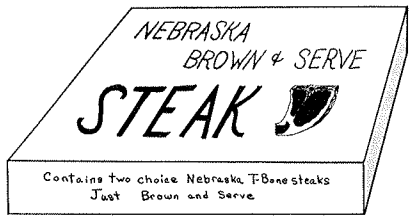

Fig. 3. New food item for 1980.

For example, two of the last four corn crops, 1969 and 1967, have been record crops. The 1969 crop, 433 million bushels, was actually 100 million more than the 1967 crop. The 1970 crop was about the same as the 1967 crop. The 70's is the time to exploit this feed producing capacity. Nebraska had 20.8 million tons of feed grain in storage on January 1, 1970. Two-thirds of this feed grain was stored on farms.

A million tons of feed grain can yield one of the following:

667,000 choice slaughter steers from 700 pound yearlings.

300,000 litters of market weight hogs.

2.33 billion pounds of milk.

Recent calculations indicate about 50% of this feed supply will be fed in Nebraska (Table 1). This means that the wealth that will be generated by livestock use or industrial use of 10 million tons of grain is being lost to the Nebraska economy. According to calculations by a Kansas banker, each million tons of this feed grain converted to table-ready meat has wealth generating capacity equal to 180 small industrial plants each employing 100 people.

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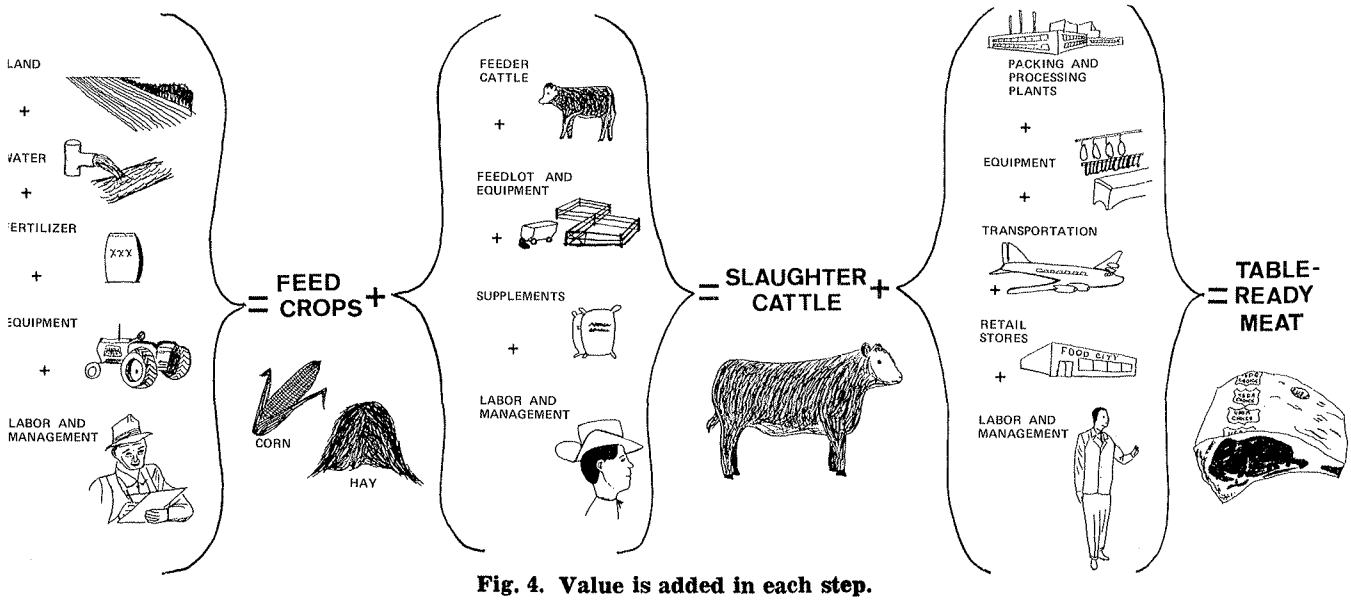


Fig. 4. Value is added in each step.

Great Decade

(continued from page 3)

According to data from a national survey by the U.S. Chamber of Commerce in counties not joining a major metropolitan area, including Platte County, Nebraska, 100 new manufacturing workers in the community meant: 359 more people, 91 school children, $710,000 personal income, $331,000 retail sales, $229,000 bank deposits and 3 new retail firms.

2. **Experience** — Nebraska has been a key livestock producing and feeding state for the past five decades or more. For growth in feedlot capacity see Fig. 6.

3. **Weather** — Although sometimes violent and unpredictable for short periods, weather seldom impairs livestock performance. In many areas of the state it is near ideal for livestock production. Weather may affect performance of livestock producers more than the livestock. Nebraskans need to be good managers to overcome weather. A look at about 90° maximum, days below zero minimum and days over 0.5″ precipitation at five key locations in the state illustrates the desirability of the weather (Fig. 7).

Work Together

All Nebraskans must work together to utilize these strengths of animal agriculture for their full potential for economic growth of Nebraska. It is particularly important that producers, feeders, packers, processors, marketing and service agencies and investors work vigorously toward common goals.

The University of Nebraska must also work vigorously and cooperatively with the entire industry toward achievement of these common goals. The University, properly funded, can make significant contributions of new technology through research, new personnel through undergraduate teaching and can assist in solving industry problems through "Education for Action" projects in Extension.

The opportunity for new feeder cattle production in Nebraska is illustrated by an analysis of the change in our national beef herd during the 60's (Table 2).

The comparative position of feeder cattle producers and feed lot operators has shifted during the 60's. The growth in feed lot capacity has used up the surplus feeder cattle that existed in the country. The cattle feeding industry now uses feeder cattle as

Table 1. Feed grain production and utilization by areas of Nebraska[a]

	Production bu.	Utilization % fed
Northeast	106,070,572	92.6
South	43,811,322	35.0
East	175,704,043	44.9
Southeast	103,951,036	34.3
Southwest	26,257,123	42.3
North	6,674,789	207.0
Northwest	9,972,003	131.0
Central	64,666,175	52.1
State Total	554,836,960	52.0

[a] Preliminary 1969 Statistics, State-Federal Division of Agricultural Statistics.

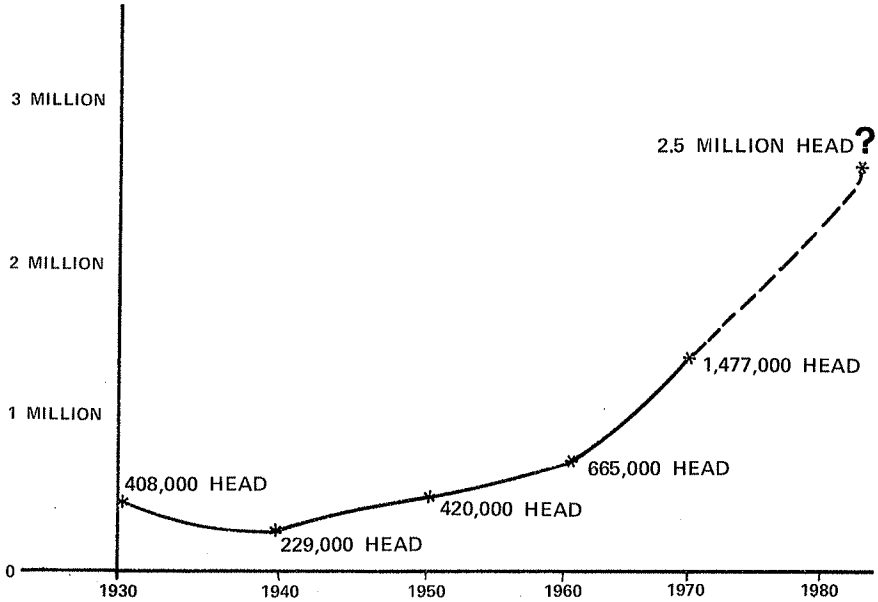


Fig. 5. Nebraska feedlot capacity.

Table 2. Change in national beef herd during 60's.

	1960	1970
National Beef Cowherd (million)	26.3	37.4
Heifer Replacements Needed at 20% Annual Rate (million)	5.2	7.4
Fed Cattle Marketed (million)	12.8	24.8
Calves Needed for Stable Inventory (million)	18.0	32.2
% Calf Crop Needed for Stable Inventory	69.0	86.0

rapidly as they are produced. This shift in the supply of feeder cattle strengthens the bargaining position of the feeder cattle producer. It is quite possible that a shift in "industry economics" will result.

Traditionally, the feeder cattle producer has received 40 to 45% of the gross income of the industry; it seems likely that the producers share will be at the high end of this range during the 70's or possibly above 45%. If such a shift in "industry economics" does occur, the cow-calf enterprise will be more attractive to farm beef producers.

The opportunity for expanded feeder cattle production is further emphasized by examination of current sources of feeder cattle for parts of Nebraska as reported in 1969 by the Economic Research Service (Table 3). The rapid development of feedlots in Texas, Kansas and Oklahoma will reduce the supply of cattle available from those areas. This, of course, will increase competition for feeder cattle from other areas.

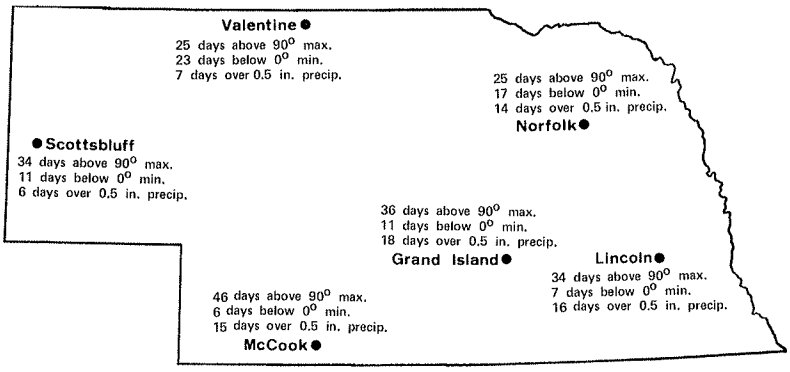


Fig. 6. Weather in Nebraska.

Summary

Nebraska's great opportunity decade exists because Nebraska has:

1. Feed resources for more livestock.
2. Satisfactory environmental conditions for livestock.
3. Supporting service industries of feed processing and manufacturing, marketing, equipment manufacturing, and meat packing and processing for continued growth.
4. A long history of performance and understanding in the livestock business.

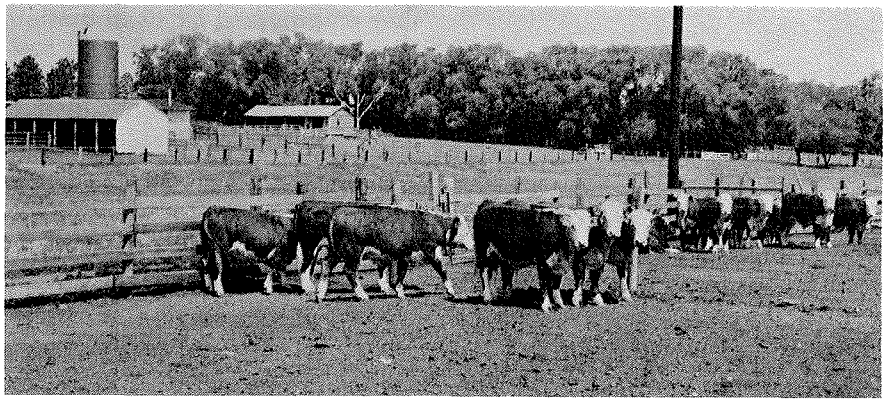
Nebraska needs:

1. Financial institutions filled with enthusiasm for the growth opportunity.
2. Cattle feeders and producers ready to apply sound business management principles, to meet the changes of the decade.
3. Growth in the production of feeder cattle to utilize pasture, forage and crop residues and to provide inputs for the feedlots.

Table 3. Point of origin of feeder cattle used by Midwest feeders[a].

	Western cornbelt (including Northeast Nebraska) (% cattle fed)
Local	20
Western & Mountain States	9
Texas, Kansas & Oklahoma	41
Southeast	3
Montana & Dakotas	25
Miscellaneous	2

[a] ERS Bulletin 1969—1967 Data



Cattle on feed.

Whole Corn Feeding

Walter Woods
Professor, Beef Nutrition
Myron Rumery
Assoc. Prof., Animal Science
Terry Klopfenstein
Assoc. Prof., Beef Nutrition
Donald Clanton
Professor, Animal Science

Cattle fed whole corn or rolled shelled corn in finishing rations had practically the same rate and efficiency of gain for the average of seven comparisons (four trials).

Carcass grade and incidence of liver abscess were similar between the two types of corn. The advantage for feeding cattle whole corn appears to be in the decreased cost of processing and handling.

Performance Checked

Reevaluation of the need to dry roll corn comes from recent industry and University research suggesting that dry rolling of corn may not significantly alter performance of finishing cattle.

The research has been restricted primarily to corn 14 to 20% in moisture. Table 1 summarizes four trials which permitted seven direct comparisons. Rations contained varying levels of roughage and roughage sources but in each direct comparison roughage level and source as well as composition of supplement were identical. The only difference between treatments was the type of corn fed (dry rolled or whole).

In each comparison cattle were allotted to each treatment to equalize them between treatments. Lengths of trials varied from 97 to 165 days in length. Trials 1 and 3 were conducted in the summer and 2 and 4 in the winter.

The average daily gain for cattle fed dry rolled and whole corn was 2.71 lb. and 2.69 lb., respectively. The average daily feed intake was similar for the two kinds of corn. However, in two of the comparisons the cattle fed whole corn went on feed a little faster. The feed required per pound of gain was 7.41 lb. for the cattle fed rolled corn as compared to 7.60 lb. for those fed whole corn. Carcass grades and yields were similar between treatments.

Suggestions

Experiences at the Nebraska Station with whole corn feeding suggest:

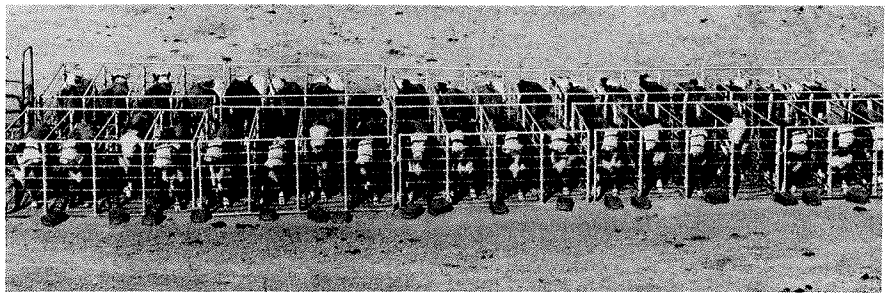
1. Corn ranging from 14 to 19% in moisture has not been improved by dry rolling as measured by rate and efficiency of gain when fed to cattle receiving high concentrate rations.
2. Supplementation of whole corn and rolled corn needs to be the same when fed in equivalent roughage rations.
3. Cattle fed whole corn in all concentrate rations have responded to added roughage in a similar manner to that observed with rolled corn.
4. Yield and grade of cattle fed rolled or whole corn have been similar.
5. The incidence of liver abscess was nearly equal in these studies from the cattle fed the whole and rolled corn. If there is an influence from feeding whole or rolled corn on the incidence of liver abscess, it is not clear from these studies.

Table 1. Average performance of cattle fed dry rolled and whole corn finishing rations.

Trial[a]	No. Days	No. cattle		Average daily gain[b]		Average daily feed		Feed/lb. gain		Carcass grade score[c]	
		Rolled	Whole	Rolled	Whole	Rolled	Whole	Rolled	Whole	Rolled	Whole
				lb.	lb.	lb.	lb.	lb.	lb.		
Trial 1	118	42	42	2.36	2.28	20.1	19.1	8.31	8.16	18.2	18.3
Trial 2	133	199	197	3.02	3.01	23.6	23.2	7.96	7.75	17.0	17.0
Trial 3a	165	34	34	2.55	2.57	19.8	20.1	6.17	6.63	16.9	16.8
Trial 3b	165	34	34	2.63	2.69	21.8	21.8	6.80	7.06	16.9	16.8
Trial 4a	97	15	15	2.35	2.37	21.4	22.3	9.08	9.41	15.6	15.9
Trial 4b	97	24	23	3.06	2.98	22.1	22.3	7.22	7.47	17.5	17.4
Trial 4c	97	24	23	3.00	2.95	19.0	19.9	6.34	6.73	17.4	17.0
Average	124	372	368	2.71	2.69	21.1	21.2	7.41	7.60	17.1	17.0

[a] Trial 1 and 2 were conducted at Lincoln Station, Trial 3 at Scotts Bluff Station and Trial 4 at North Platte Station.
[b] Adjusted daily gain calculated by adjusting final weight to same dressing percent and daily gains calculated on this basis.
[c] Carcass grade score assigned: 17 = low choice, 16 = high good, 15 = average good.

Supplements For Yearling Cattle on Summer Range



Cattle being fed supplements.

D. C. Clanton
Professor, Animal Science
R. L. Hildebrand
Graduate Assistant, Animal Science
L. E. Jones
Technician, Animal Science

Increased costs of summer range and increased amounts of capital in land and cattle make it important to reevaluate use of supplements on native summer range.

During the past three summers (1968, 1969 and 1970) three experiments involving the use of supplements on native summer pasture were conducted at the North Platte Station.

The performance of yearling steers individually fed supplements varying in the amount of energy and level of protein at different periods during the summer was compared. Five steers were used per treatment in the first experiment and six steers per treatment were used in the second and third experiments.

Each year the steers grazed as one group, using the same pasture all three years. They were gathered each morning and individually fed their respective supplements. Steers were weighed between each of the three calendar periods during the summer. The steers were wintered on native range and supplement the previous winter to gain up to one-half pound per head per day.

Table 1. Gains of steers fed supplements containing different amounts and combinations of protein and energy, 1968.

Daily supplement						Average daily gains			
Period I[a]		Period II[a]		Period III[a]		Period[a]			Total
Amount fed	Crude protein	Amount fed	Crude protein	Amount fed	Crude protein	I	II	III	
lb.	%	lb.	%	lb.	%	lb.	lb.	lb.	lb.
0	0	0	0	0	0	1.56	1.53	1.33	1.47
0	0	0	0	1.5	24	1.25	2.06	1.64	1.64
1.0	12	1.0	24	1.0	36	1.85	2.19	1.50	1.85
2.0	12	1.5	24	1.0	48	1.71	1.89	1.56	1.72
2.0	12	1.0	24	1.0	36	2.03	1.58	1.56	1.83

[a] Period I (5/21-6/25); Period II (6/25-7/30); Period III (7/30-9/6).

Table 2. Gains of steers that received different levels of protein and energy supplementation, 1969.

Daily supplements					Average daily gain			
Amount fed	Estimated digestible energy	Crude protein Period[a]			Period[a]			Total
		I	II	III	I	II	III	
lb.	Mcal.	%	%	%	lb.	lb.	lb.	lb.
0	0	0	0	0	1.74	1.50	1.72	1.65
0.5	0.8	24	48	72	1.45	1.76	1.89	1.69
1.0	1.6	12	24	36	1.76	1.85	2.29	1.98
2.0	3.2	10	12	18	2.00	1.74	2.33	2.02
4.0	6.4	10	10	10	2.29	2.00	2.33	2.20

[a] Period I (5/26-7/1); Period II (7/1-8/4); Period III (8/4-9/5).

1968 Experiment

Average daily gains of steers receiving different levels of supplementation during the three calendar periods and the entire summer are shown in Table 1.

The three groups of steers that received supplements during Period I in 1968 gained more than the control group which received no supplement.

There were no significant differences in gains between individual treatments during Period II. The three groups of steers which received supplemental protein, when analyzed as one treatment, did not gain more than the control group. This suggests that the forage contained adequate protein during this period.

There was no significant difference in gains among treatments during Period III. The four groups of steers that received supplemental protein, when analyzed as one treatment, did not gain more than the control group.

Even though the difference between gains of the control steers and the steers that re-

(continued on next page)

Supplements

(continued from page 7)

ceived supplemental protein was not significant, the difference was quite consistent and suggests that 0.36 lb. of crude protein may improve animal performance during the later portion of the grazing season.

Steers that received supplements for the entire season gained more during the entire season than did steers that received no supplement. They also gained more than the group of steers which received supplemental protein during the third period only.

When the total season gains of steers on all treatments in which supplemental protein was fed during Period III were analyzed as a group and compared to the controls, the supplemented steers gained more.

These data indicate that feeding a small amount of high energy supplement, in which the protein content was increased as the season progressed, was beneficial.

1969 Experiment

The average daily gains of steers receiving different levels of supplementation during the three calendar periods and the entire summer are shown in Table 2.

There was no advantage in weight gains from feeding one-half or one pound of high energy-low protein supplement in Period I. The advantage received by feeding two or four pounds of supplement may not be economical. The gains of steers that received one-half pound of the 24% protein supplement and those that received one pound of 12% protein supplement would indicate that there was no protein deficiency early in the season.

The four groups of steers that received supplemental protein during Period II gained more weight than those not receiving a supplement. Energy supplementation did not increase weight gains until the level of four pounds per day was reached. This probably does not represent an economical level of supplementing.

During Period III there was no advantage in feeding more than one pound of a 24% protein supplement per day. Thus, protein was limiting and the supplemental protein gave increased gains, whereas increased energy did not improve gains.

When considering the entire summer there was little advantage in feeding more than one pound of supplement at any time and this advantage was more evident in the later two-thirds of the summer, indicating that protein was more limiting than energy.

1970 Experiment

In the third experiment, there was no advantage to feeding small amounts of energy or protein during Period I. The increased gain in Period II resulting from feeding supplements was a result of the protein and not the energy because there was no difference between the different levels of energy supplementation.

During Period III the steers

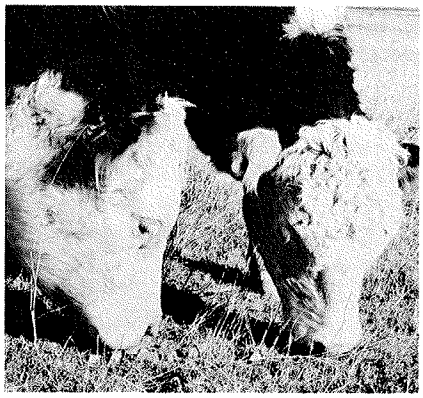
Table 4. Gains of steers fed similar supplements in the three experiments.

Daily supplements					Average daily gain			
Amount fed	Estimated digestible energy	Crude protein Period			Period			Total
		I	II	III	I	II	III	
lb.	Mcal.	%	%	%	lb.	lb.	lb.	lb.
				1968 Experiment				
0	0	0	0	0	1.56	1.53	1.33	1.47
1	1.6	12	24	36	1.85	2.19	1.50	1.85
				1969 Experiment				
0	0	0	0	0	1.74	1.50	1.72	1.65
1	1.6	12	24	36	1.76	1.85	2.29	1.98
2	3.2	10	12	18	2.00	1.74	2.33	2.02
				1970 Experiment				
0	0	0	0	0	2.33	1.59	1.49	1.80
1	1.6	8	24	36	2.29	1.88	1.69	1.95
2	3.2	8	12	18	2.57	1.93	1.69	2.07

Table 3. Gains of steers that received different levels of protein and energy supplementation, 1970.

Daily supplements					Average daily gain			
Amount fed	Estimated digestible energy	Crude protein Period[a]			Period[a]			Total
		I	II	III	I	II	III	
lb.	Mcal.	%	%	%	lb.	lb.	lb.	lb.
0	0	0	0	0	2.33	1.59	1.49	1.80
1	1.6	8	24	36	2.29	1.88	1.69	1.95
2	3.2	8	12	18	2.57	1.93	1.69	2.07
3	4.8	8	8	12	2.43	1.77	2.11	2.10

[a] Period I (6/2-7/7); Period II (7/7-8/11); Period III (8/11-9/15).



Trial cattle.

fed four pounds of supplement gained more than the steers fed one or two pounds. Over the entire summer there was no advantage in feeding more than one pound of supplement and the increased perfomance was a result of additional protein in Period II and III.

Summary

In all three years there was an advantage in supplementing protein during the later part of the grazing season (Table 3). This agrees with results of Burzlaff and Harris (Nebraska Experiment Station Bulletin 505) when they fed a protein supplement to yearling steers during late summer on native range in Western Nebraska.

In 1968 there was an advantage in feeding supplemented energy during the early part of the season (Table 4). This advantage was not apparent in the 1969 and 1970 experiments. At no other time did it appear feasible to supplement energy.

Precipitation during the time of these experiments shows a relationship of steer response to energy supplementation (Figure 1). During the early part of the grazing season in 1968 the steers responded to energy supplementation (this was following the fall of 1967, which had low precipitation). The following two falls, 1968 and 1969, there was abundant precipitation. Energy supplementation was without much benefit the following two grazing seasons. Whether this was a cause and effect relationship can not be determined.

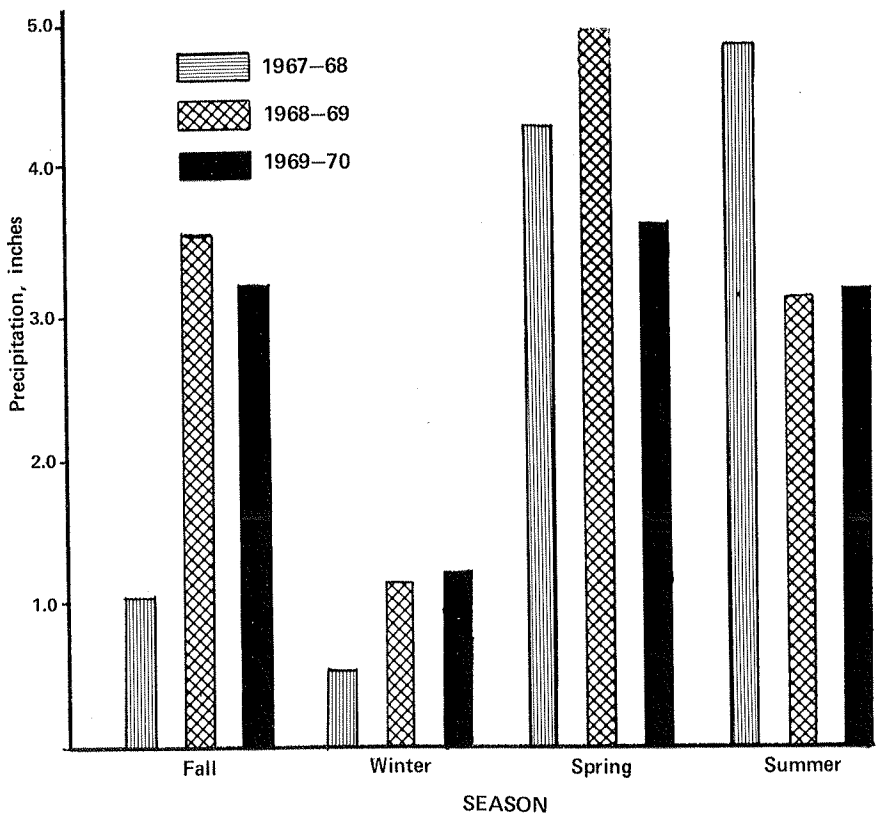


Fig. 1. Precipitation during the conduct of the experiments.

Millet For Finishing Cattle

Terry Klopfenstein
Assoc. Prof., Beef Nutrition

Walter Woods
Professor, Beef Nutrition

Cattle fed rolled millet as 50% or less of the finishing ration gained as well as those fed corn based rations. In addition, cattle fed millet rations were as efficient as those fed the corn ration.

It appears that millet, when properly processed, is equal in value to corn when fed up to 50% of the finishing ration. No digestive problems were apparent in feeding high levels of millet in finishing rations.

Questions Raised

Increases in millet acreages in the Panhandle area of Nebraska have raised questions as to the value of millet when included in finishing rations for cattle. Two trials were conducted to study feed value of millet compared to ground shelled corn in cattle finishing rations.

In Trial 1, steers (14 per group) were fed five different rations. The rations contained 0, 15, 30, 45 or 60% of the grain as millet replacing a like amount of corn. Alfalfa haylage was fed at the level of four pounds per day. Cattle on all rations were fed the same supplement to supply protein, vitamins and minerals. No attempt was made to consider the higher protein content of millet.

In Trial 2, cattle (14 per group) were fed five rations containing 0, 25, 50, 75 or 100%of the grain as millet replacing corn in the ration. Corn silage was used as the roughage and was fed at the

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Feeding Millet

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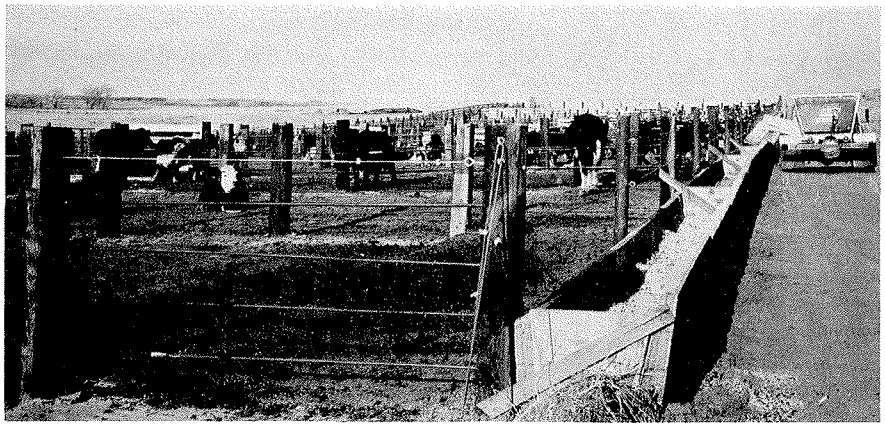
level of 7½% of the dry matter in the ration when grain was full-fed. In this case, different supplements were fed with each ration so that each ration was equal in protein, vitamins and minerals. In this trial the extra protein content of the millet was taken into account and less supplemental protein was fed at higher levels of millet.



Millet for finishing cattle.

Trial Results

Results of Trial 1 are shown in Table 1. This trial lasted for 161 days. Cattle fed rations containing millet gained as rapidly as those on the corn. Cattle fed 15, 30 and 45% millet gained somewhat faster than those on the 60% millet ration.

Cattle fed rations containing millet used the same or slightly less feed per pound of gain indicating that millet was used as efficiently as corn as an energy source. There were no important differences in dressing percentage or grade of the cattle.

Results of Trial 2 are shown in Table 2. Cattle gained as well on the 25 and 50% millet as those on the corn ration. However, those cattle fed 75 and 100% millet did not gain as rapidly as those on corn.

Cattle fed the 25 and 50% millet required less or about the same amount of feed per pound of gain as those on corn. However, those cattle fed 75 and 100% millet required nearly 20% more feed per pound of gain. Again, dressing percentage and grades were not influenced by the level of millet feeding.

The reason for cattle not performing as well on the 75 and 100% millet is not clear at the present time.

The protein content of millet is relatively high compared to corn. In these studies millet contained 13.5% protein on a dry matter basis as compared to 10.5% for corn on a dry matter basis. However, digestibility of millet protein is reported to be somewhat low. If this is the case, cattle fed the 75 and 100% millet may have been slightly protein deficient.

The rolled millet rations are somewhat fine and dusty and dust losses may account for some of the differences in feed conversion. Millet is also reported to have a higher fiber content than corn and this may account for the lower performance of cattle fed 75 and 100% millet rations.

At the present time it can be recommended from these two trials that the value of millet in cattle finishing rations is equal to corn as long as millet does not replace more than 50% of the grain in the ration.

Table 1. Levels of millet in finishing cattle rations.

	Millet as percent of grain				
	0	15	30	45	60
Initial wt., lb.	667	683	665	665	679
Av. daily gain,[a] lb.	2.87	2.95	2.93	3.01	2.87
Daily feed,[b] lb.	21.4	21.5	21.5	21.8	21.5
Feed/gain,[b] lb.	7.46	7.29	7.34	7.24	7.49
Dress %	61.1	62.0	62.4	61.6	62.0
Grade[c]	17.8	17.4	17.8	17.5	17.6

[a] Adjusted to 62% dress.
[b] Dry matter basis, 3.2% supplement, 13.7% alfalfa silage.
[c] 17 = high choice. 16 = average choice, 15 = low choice.

Table 2. Levels of millet in finishing cattle rations.

	Millet as percent of grain				
	0	25	50	75	100
Initial wt., lb.	719	717	717	733	731
Daily gain,[a] lb.	2.52	2.78	2.58	2.29	2.41
Daily feed,[b] lb.	20.0	20.4	20.7	21.4	21.4
Feed/gain,[b] lb.	7.95	7.36	8.06	9.38	9.48
Dress %	61.3	62.6	61.8	61.1	62.3
Grade[c]	15.5	16.1	15.6	15.8	16.0

[a] Adjusted to 62% dress.
[b] Dry matter basis, 11.5% corn silage.
[c] 17 = high choice, 16 = average choice, 15 = low choice.

Profit-Making Feeder Cattle For the 70's

By Paul Q. Guyer
Extension Livestock Specialist
(Beef Cattle)

As many as 25 to 28% of employed Nebraskans (other than in government) depend on beef cattle for their income. Beef cattle provide far more cash farm income for Nebraska than any other single source. Our economy depends heavily on the success of the beef industry.

Production of feeder cattle by ranchers and farm cow herd owners is one of the major sources of our beef income. Another source is the wise purchase of feeder cattle which contribute to greater net profits for both cattle feeders and our beef industry.

Cattlemen in Nebraska calve about 1.5 million potential feeder cattle annually. Another .4 million are used as replacements. Nebraska feeders feed about 3½ million head for slaughter. This means that about 2 million head of feeder cattle must be purchased from other states.

Goals

Goals of the feeder cattle producer and the cattle feeder are basically the same. They both are in the business to make a profit. They both must be interested in producing an end product that ultimately has high consumer desirability. They both are interested in producing cattle that convert feed efficiently into beef. They both seek to promote a sound industry that can and will withstand the competition of other meats and meat substitutes.

One important difference exists that both the feeder and producer should recognize. Feeders must ship in 50 to 70% of the cattle they feed from outside the state. Because of this they have a wide variety of "types" of feeder cattle to choose from.

For a most competitive and profitable Nebraska feeding industry the cattle feeder needs to select feeders that offer the greatest profit potential to his operation. Some of these may deviate substantially from the feeders that Nebraska cattlemen find profitable to produce — in appearance, breed, weight for age, condition and genetic desirability.

The variation may result from the effect of differences in climate and topography on production or, in many instances, from poor management on the part of the cow owner. Regardless of cause of the variation, good business management dictates that cattle feeders purchase feeders that offer high profit potential.

At the same time, cattle feeders should realize that cattle produced in Nebraska should not necessarily be the kind they buy from out-of-state sources. The producer must, in his segment, produce the animal with greatest profit potential from his operation. Thus, each segment of the industry must manage for greatest profit and must support long-range goals that will make our beef industry sound.

Planning Points

What are some important points that both the rancher and feeder should keep in mind as they plan their production or selection program?

First, the American consumer desires quality beef — beef that eats well, beef that has flavor, beef that has juiciness. At present beef of U. S. choice quality grade seems to be desired by most people.

Cattle need the potential for producing at least 80-90% choice grade when they reach desirable slaughter weight and finish.

Marbling has a major influence in determining carcass grade. Selection for marbling appears important in some lines of cattle.

Carcass conformation is one of the criteria used in determining carcass grade. As more detailed carcass studies have become available, conformation appears to be less important than we once thought.

Conformation changes the shape of the animal and the muscle, but does not seem to influence the amount of muscle or the percentage of muscle in the high priced cuts as much as we once believed. Several studies indicate that selection for conformation as practiced a few years ago has resulted in the ability of cattle to finish at younger ages and lighter weights.

Second, excess fat is a luxury that the beef industry cannot afford. Once cattle carry enough finish to give beef the quality the consumer desires, additional fat is a drug on the market. Today, carcasses having more than ½" of fat have to be trimmed.

Some of the fat trimmed may be added to lean from lower grade carcasses for ground beef. But once this need is met then fat may not even pay for the cost of trimming, processing and transportation disregarding the feed cost entirely.

Third, cattle need to be bred and fed to produce carcasses in the top end of USDA yield grade 3 or better. The packing industry is beginning to recognize the merits of yield grade 2's of choice quality in their pricing system. We need to recognize this in sire selection programs. The ability to reach choice grade at correct weights is largely a matter of inheritance. Once the calf is conceived the amount we can modify his final composition and yet be economical is limited.

Fourth, the past few years packers seem to be demanding somewhat heavier carcasses.

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Feeder Cattle

(continued from page 11)

Carcasses with proper lean to fat ratio weighing 700-800 pounds are discounted less and carcasses weighing under 550 pounds seem to be less salable than only a few years ago. Thus, from the standpoint of desirable carcass weight, we need to select against cattle with too early maturity. Steers should reach desirable finish when they weigh from 1000-1250 pounds.

Another important need of a feeder steer is ability to gain rapidly. Rapid gains usually mean efficient gains. The potential is determined basically by inheritance. Because of this, careful attention should be given to gain ability in sire selection.

Other factors also affect gain in the feedlot. Underfed, thin, light-weight cattle compensate for their poor gains when placed on a higher plane of nutrition. These compensatory gains may offset superior genetic potential for gain of cattle that have been on a better feeding regimen.

Health and Fill

Health and fill also affect feedlot gains. Sickness causes a terrific loss in gains. Both the producer and the feeder stand the loss.

Calves need to be immunized for blackleg, malignant edema and perhaps red nose. They need to be managed so that they will be shipped with a moderate fill. They usually adjust better if they know how to eat hay or grain from a bunk and drink water from a trough. These practices will contribute to their gain in the feedlot and make them more valuable as feeders.

On the other hand excess fill will reduce gain in the feedlot. This gut fill must be replaced by gain in muscle or fat tissue which comes slowly and at considerable expense. If a yearling steer has 3% excess fill or 21 pounds of extra water, this would reduce rate of gain by .2 pounds per day in a 100-day feeding period or by .15 pounds per day in a 140-day feeding period.

In addition, the feeder has an opportunity to choose heifers or steers. Heifers usually gain 10 to 15% less rapidly than steers and are less efficient. They also usually sell $.50 to $1.50 per cwt. lower at slaughter than their steer mates. To compensate for this the purchase price must be perhaps as much as $5 per cwt. or more lower than comparable steers depending upon weight and condition.

Summary

Both the feeder and the feeder calf producer need to maximize returns to their individual operation and to the industry. In relating this profit motive to the kind of cattle the feeder feeds and the producer produces, it appears that:

1. Both producers and feeders should be concerned that most of the cattle will grade choice without becoming excessively fat.
2. Cattle should have the potential for high cutability at preferred carcass weights.
3. Feeder cattle should have the genetic potential for rapid gain. Fast gains are usually associated with efficient feed conversion and lower interest and yardage costs per hundredweight gain.
4. Feeders need to purchase cattle that have high profit potential for their operations. Also the producer needs to produce cattle that are the most profitable for him. Thus, at times the kind of cattle selected by each segment of the industry are different yet are justifiably based on their apparent profitability.

How do the cattle you produce or feed meet the needs of the 70's? If you are not sure how they gain or the kind of carcasses they yield, why not arrange to follow them through the feedlot and the cooler—and then use the information to modify your cattle selection for greater profits.

Feeding Drought

By Walter Tolman
Assistant Professor, Animal Science
Walter Woods
Professor, Beef Nutrition

Silage from the drought damaged corn crop of 1968 proved fully equal on a dry matter basis to silage from a normal crop which was carried over from the preceding year. The silage was the basis of a growing ration for calves.

This same crop was somewhat less valuable per pound of dry matter when compared to normal silage from current crop a year later. In this study silage was the basis of the ration for light yearling steers.

The addition of six pounds of corn per steer per day improved animal performance. In the first year of work the response to the added grain was similar for cattle fed each kind of silage. In the second year's study cattle fed drought silage responded more to corn addition than those fed normal silage.

Data indicate drought damaged corn silage has feed value

Breeding I.

E. F. Ellington
Assoc. Prof., Reproduction Physiology
R. B. Osland
Graduate Assistant, Animal Science

Among potential advantages of a procedure(s) for successfully controlling breeding dates is that it would contribute to the feasibility of more conveniently utilizing an artificial insemination program. Hormones, because they regulate reproductive processes, offer potential in developing such procedures.

The general progress as well as the major problems that have arisen in research utilizing hormonal preparations to control breeding dates has been reviewed (1970 Nebraska Beef Cattle Report).

It was indicated that adminis-

Corn Silage

that in many situations may equal or closely approximate that of normal silage.

Drought Damaged Corn

The corn in 1968 was subjected to severe drought stress ahead of tasseling in July. It developed very slowly following occasional showers and a light rain in early September to average about 10 bushels of grain production per acre. The crop never matured normally and was harvested in late September at almost 75% moisture.

The 1967 crop was stored in a plastic covered pile, the 1968 silage in a plastic enclosed "Seal Vac" pile. Both appeared to have stored well with very little visible spoilage or deterioration in quality.

In the first year's study two lots of 12 calves each were fed each kind of silage with and without six pounds of grain. In addition 1.25 pounds of supplement were fed each animal per day. In the second year study the same treatments were applied to two lots of 10 head of light yearling steers on each treatment.

Table 1. Drought damaged corn silage for cattle.

	Average daily gain		Feed/lb. gain dry matter basis	
Year	Drought silage	Normal silage	Drought silage	Normal silage
	lb.	lb.	lb.	lb.
		No added corn		
1968-69[a]	1.52	1.46	10.3	11.2
1969[b]	2.24	2.65	7.8	7.0
Average	1.88	2.06	9.0	9.1
		Plus 6 lb. corn		
1968-69	1.70	1.87	10.1	10.0
1969	3.01	2.80	6.3	6.6
Average	2.36	2.34	8.2	8.3

[a]Calves were fed for 91 days each kind of silage.
[b]Light yearlings were fed each kind of silage per 63 days.

Summary

The summary of data in Table 1 indicates drought damaged corn silage to be about as efficiently utilized as normal corn silage. Some of the variation noted from trial to trial may have been related to a short time of study for Trial 2 or to the fact that the drought silage was one year old.

Performance of the cattle was comparable between silage sources. It appears that effective use can be made of drought damaged corn silage. The large reduction in value appears to be in reduced tonnage per acre and increased harvesting cost per ton instead of reduced feeding value per unit of dry matter. The extensiveness of drought damage will probably modify the relationship to "good" corn silage.

Yearling Heifers

tration of hormones called progestogens for brief periods offers the most promising methods at this time, and that a common problem is the tendency for lower conception rates when breeding at the first post-treatment estrus.

Results of a study were reported in which attempts were made to make the second post-treatment estrus more utilizable. Second estrus is characterized as being associated with satisfactory conception but is more variable among the treated cattle in time of onset.

Treatments tested in the earlier study involved two, successive, synchronization treatments with a natural progestogen (progesterone) followed by injections of two hormones, both of which are called gonadotropins and act directly on the ovary to stimulate activity.

One of these preparations, human chorionic gonadotropin (HCG), was found detrimental in that it resulted in lowered conception rates and was, therefore, not used in the present study.

Present Study Design

A total of 99 Hereford yearling heifers were used in this study. They were allotted to three experimental groups for hormonal treatments before the breeding period.

Group I served as the control and received no hormonal treatment.

Group II received an initial synchronization treatment consisting of a single, subcutaneous injection of 500 mg. of progesterone at a time which will be considered as Day 1 of treatment for simplicity. On Day 22, a time subsequent to the estrus synchronization effect of the first treatment, a second progesterone injection identical to the first was given. A subcutaneous injection of 500 I.U. of a gonadotropin, equine gonadotropin, followed on Day 29.

The treatment for Group III was the same as Group II except that an additional subcutaneous injection of equine gonadotropin in the same amount as before was given on Day 8, a time which preceded the first estrous synchronization response.

Heifers were checked twice daily for estrus with the aid of

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Controlled Breeding

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androgen-treated steers before, during and subsequent to the treated period. Only heifers that stood for mounting by the steers or another heifer were regarded in estrus.

Heifers that exhibited estrus in a 16-day period immediately subsequent to the time of the final gonadotropin injection (end of treatment period) were artificially inseminated with extended semen from one Hereford bull.

The first day of the insemination period was June 9, 1969. Commercial rump heat detectors were utilized during the entire A.I. period to facilitate estrous detection. Cows first detected in estrus at morning check were inseminated during afternoons of the same day. Those that were first in heat at the afternoon checks were inseminated during the mornings of the next days.

Following the artificial insemination (A.I.) period, the heifers were placed with Angus bulls for a time period that would allow a total breeding period (A.I. plus natural) of 60 days.

Results

The heifers in this study, from 2-year-old heifers, averaged 597 lb. in body weight at the time breeding (A.I.) was started. From previous work at this station, it would appear that the heifers were in the range of the minimal weight necessary for satisfactory breeding.

Heat records on the control group, a group not receiving hormonal treatments, up to this time give a measure of reproductive status of the heifers at the time the breeding season started. Of the 33 controls, 15 had shown estrus at least once. However, if the period is extended to the end of the 16-day A.I. period then all 33 of the controls would be included.

The summarized breeding and calving data for the three groups of yearling heifers are given in Table 1. The majority of the heifers did express estrus during the 16-day A.I. breeding period. The point of interest is the grouping or synchronization effect on the occurrence of estrus. Both hormone treatment procedures, especially Treatment III, were relatively effective in this regard. For example, by the seventh day of the A.I. period, 28 of the 33 heifers of Group III had shown estrus whereas estrus had been observed in only 10 of the control group.

Table 1. Summarized breeding and calving data for the yearling heifer study.

Group	No. heifers showing estrus by the end of:					No. heifers calving		
	No. heifers	3rd day AI	5th day AI	7th day AI	Entire AI period	To AI	To cover bulls	Total
I (Control)	33	3	9	10	29	24 (82.8%)[a]	9	33
II (3 injections)	33	5	17	24	32	17 (53.1%)[a]	13	30
III (4 injections)	33	9	21	28	30	12 (40.0%)[a]	15	27

[a] Percent of those artificially inseminated that calved as a result.

The summarized calving data reveal the effectiveness of treatments in terms of resulting fertility. Although conception or pregnancy rate of the control group to A.I. was very good (82.8% of those inseminated), it appeared to be lowered in the two hormone treatment groups (53.1% and 40.0% for Groups II and III, respectively). Most heifers that failed to settle to A.I. were, however, subsequently settled by the cover bulls.

Even though the conception rates appear depressed, they do compare quite well with conception rates as low as 17% that have been reported by others working with estrous synchronization treatments.

Refinement of treatment, no doubt, offers some promise in increasing the realized fertility. For example, in the present study the additional equine gonadotropin injection in Group III appeared to lower fertility. It may be that with yearling heifers alterations in the direction of using lesser amounts of hormonal materials than used here would provide fruitful results. However, there is also the possibility that change in other factors, such as time of injection, may also be important.

Breeding II. Mature Cows

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The preceding paper concerned with controlling breeding dates in yearling heifers introduces the subject of ovarian control. The present paper deals with experimental regulation of ovarian activity in mature cows that are nursing calves. The idea of controlling the estrous cycle by a more gradual and simplified process is again utilized.

Study Design

A total of 88, mature, Hereford cows were used to study the effect of various hormone treatments on breeding and calving

performance. All cows were nursing calves at the time the study was started. The cattle were randomly allotted to four equal-sized groups on the basis of their calving date for subsequent treatments.

Group I received no hormonal treatment and served as the control.

Group II received an initial injection of 750 mg. of progesterone which will be considered as Day I of treatment. An identical injection of progesterone was again given on Day 22, a time which was subsequent to the estrous synchronization effect of the first injection. A subcutaneous injection of 750 I.U. of equine gonadotropin followed on Day 29.

The treatment on Group III was the same as Group II except that the gonadotropin injection consisted of 1500 I.U.

The treatment for Group IV was the same as Group III except that an additional injection of 750 I.U. of equine gonadotropin was given on Day 16.

Estrous detection methods and breeding procedures, including the 16-day artificial insemination period subsequent to the treatment period, were essentially identical to those described in the preceding paper. An exception was that bulls rendered sterile by epididymectomy were utilized for heat checking rather than hormone-treated steers.

Table 1. Summarized breeding and calving data for the mature cow study.

Group	No. cows	No. cows show estrus by the end of:				No. cows calving		
		3rd day AI	6th day AI	9th day AI	Entire AI period	To AI	To cover bulls	Total
I (Control)	22	3	9	11	17	11 (65%)[a]	8	19
II (P, P, low EG)[b]	22	2	11	20	22	5 (23%)[a]	13	18
III (P, P, high EG)[b]	22	2	15	19	20	12[c] (60%)[a]	8	20
IV (P, Low Eg, P, High Eg)[b]	22	2	14	20	20	13 (65%)[a]	6	19

[a] Percent of those artificially inseminated that calved as a result.
[b] P = progesterone; EG = equine gonadotropin.
[c] Four produced multiple births (3 sets twins, 1 set triplets).

Results

Table I summarizes the breeding and calving performance of the cattle by treatment group. Almost all of the cattle in the study, except for the control group, did express estrus during the 16-day A.I. period.

It appears that all three hormone treatments (Groups II, III and IV) did result in synchronized estrus. By the ninth day of the artificial insemination period, 91 to 95% of the hormone treated cattle had exhibited estrus whereas only 50% of the controls had.

A tendency for the high-level, final dose of equine gonadotropin to hasten the occurrence of estrus is indicated in Groups III and IV. At 6 days in the breeding period, more cattle in these two groups had expressed estrus than in Group II which received the lower final dose of equine gonadotropin.

Of the controls that were artificially inseminated during the 16-day period, 65% subsequently calved. It is encouraging to note that similar conception percentages were realized in Groups III and IV. Group II, on the other hand, experienced a low conception of 23%.

The only difference in treatment of Groups II and III is the level of equine gonadotropin used which points to the significance of dose level. Although not studied in the present investigation, it may be that it requires more gonadotropic hormone to get a given response in a cow that is nursing a calf than it would in a dry cow.

Four of the cows of Group III experienced multiple births, all from artificial insemination. One cow produced triplets and the other three produced twins. The higher dose of equine gonadotropin used in this group was found in preliminary studies to have a mild influence in terms of increasing ovulation rate. However, it is not immediately clear why some multiple births were not apparent in Group IV which included the same final gonadotropin injection. The difference may in some way be related to the gonadotropin injection given on Day 16 in Group IV.

On the basis of results of others, there was the suggestion that a gonadotropin injection at this time was beneficial in causing an increased number of ovulations and this would result in the production of twins. Our results question such hypothesis.

The treatment employed in Group III appears promising both in regard to estrous synchronization and resulting fertility, especially if expressed in terms of number of calves resulting. However, of the nine multiple birth calves four died subsequent to calving. This indicates a need for research on this particular point.

Successful production of calf crops exceeding 100% could do a great deal to increase efficiency, and therefore, return on a cow-calf operation. Although there could be problems associated with development of such procedures as is typical with any new development, research investigations in this area seemed justified and needed.

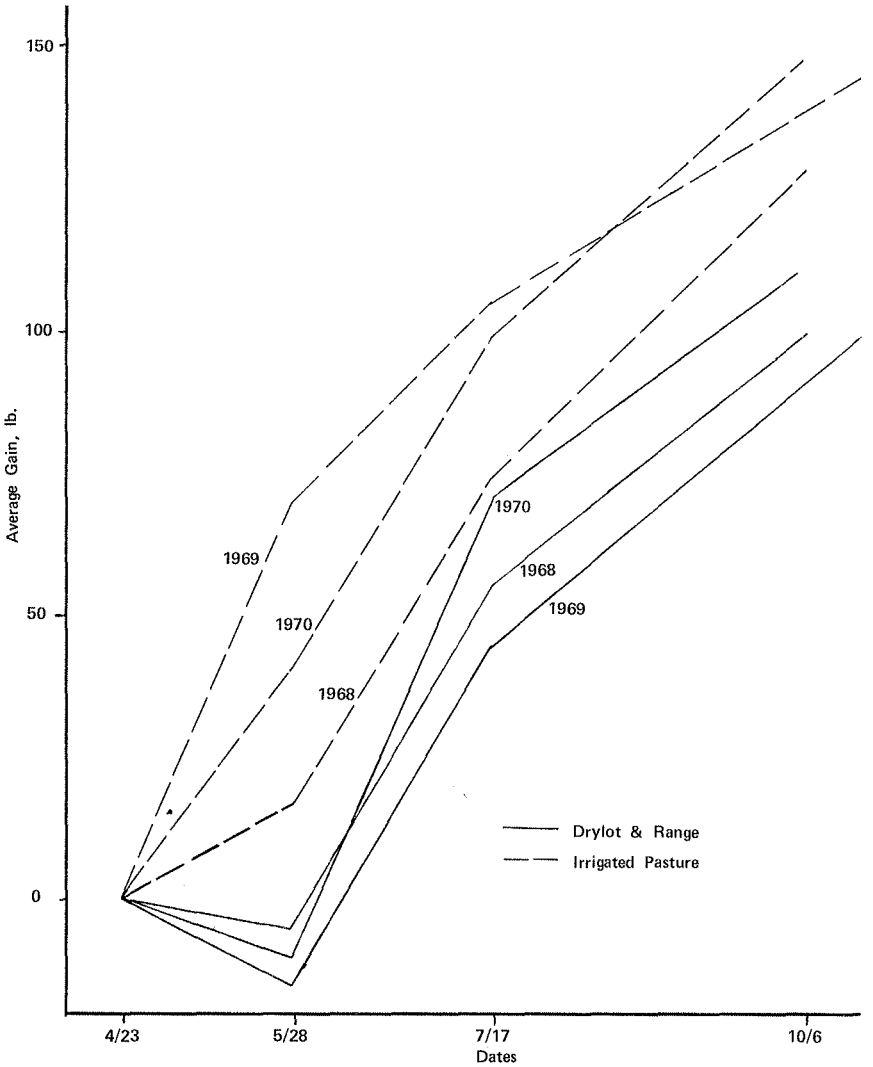

Fig. 1. Average weight gain of cows on irrigated pasture or drylot and range at the North Platte Station.

Young Cows on Irrigated Pastures

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(Range Management)
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Development of center-pivot sprinkler irrigation has greatly reduced labor requirements for irrigation.

This, plus the adaptation of this type of irrigation to sandy soils, which require frequent water application because of their low water holding capacity, has created much interest in irrigation in the Central Great Plains Region.

On sandy soils surface irrigation has been impractical and too difficult. Center-pivot sprinkler irrigation has proven to be a practical means of irrigation and has stimulated interest as a method for producing irrigated pasture.

Uses of Pasture

Two primary uses are being made of irrigated pastures. One is by farmers who evaluate it in terms of the competitiveness it may have with other irrigated crops such as corn, sugarbeets, etc.

The second is by ranchers who use it to complement the forage program in a cow-calf enterprise. In the first case, the pounds of beef per acre produced as efficiently as possible, will be of primary concern. In the second, increased efficiency of the cow herd by improved reproductive performance and higher calf weaning weights will be of greatest interest.

Irrigated pastures can also provide more flexibility in forage production, which can be an asset to good range management.

In many ranching situations green forage is not available during early spring for cows following calving and before the breeding season starts. Irrigated cool season pastures provide green grass for several weeks before the warm season grasses on native range are ready for use.

Pastures Established

Because of the need for more information, irrigated pastures were established in 1967 under a 52-acre center-pivot irrigation system at the University of Nebraska North Platte Station.

The pastures were seeded in the spring of 1967. Presently, all pastures are a mixture of smooth brome, orchardgrass and alfalfa. Initially, some pastures were seeded to other grasses, but have been converted to the above mixture over the last two years.

Irrigation water has been applied at the rate of 17 to 25 inches per growing season, varying by how much natural precipitation was received. A total of 35 to 40 inches of water from both irrigation and rainfall is considered necessary during the growing season to maintain active growth.

Nitrogen fertilizer was applied with water through the irrigation system in several applications throughout the growing season. A total of about 240 pounds of "N" has been applied each of the last two years. Phosphorus is applied each fall with a ground rig at the rate of about 50 pounds of P_2O_5 per acre.

Table 1. Performance of cows and calves on irrigated pasture or drylot and range at the North Platte Station.

	Drylot & range[a]		Irrigated pasture & range[b]	
	Cows	Calves	Cows	Calves
	1968 (2-year old cows)			
Number	78	77	81	80
Av. weight, lb.:				
Initial, 4/20	757	101	765	102
Gain to 5/28	−5	33	17	56
Gain, 4/20 to 10/7	100	227	128	237
Final weight, 10/7	857	328	893	339
Reproductive data:				
Calving to 1st heat, days	71		54	
First heat by 6/5, %[c]	55		89	
Conception rate, %[c]	94		99	
	1969 (3-year old cows)			
Number	32	30	33	31
Av. weight, lb.:				
Initial, 4/23	805	98	785	104
Gain to 5/27	−15	24	70	44
Gain, 4/23 to 10/22	100	249	145	266
Final weight, 10/22	905	347	930	370
Reproductive data:				
Calving to 1st heat, days	62[d]		56	
First heat by 6/5, %[c]	44		76	
Conception rate, %[c]	84		88	
	1970 (4-year old cows)			
Number	80	78	80	80
Av. weight, lb.:				
Initial, 4/24	890	107	871	114
Gain to 5/29	−10	27	41	50
Gain, 4/24 to 10/6	112	238	148	253
Final weight, 10/6	1,002	371	1,019	387
Reproductive data:				
Calving to 1st heat, days	48		57	
First heat by 6/5, %[c]	71		51	
Conception rate, %[c]	94		98	

[a] Remained in drylot receiving grass hay and 2 lb. of 20% protein supplement until May 28 at which time they were placed on native pasture with no supplement.
[b] The cows and calves on irrigated pasture were removed on July 18 and July 17, in 1968 and 1969, respectively, and taken to native grass pasture for the remainder of the season. In 1970, they were on irrigated pasture all summer.
[c] Cows were artificially inseminated for 42 days (2 heat cycles) and clean-up bulls were used for 21 days for a total of a 63-day breeding season in 1968 and 1969. In 1970 clean-up bulls were used for 18 days for a total of a 60-day breeding season.
[d] Does not include six cows that had not shown heat by the end of the 42-day artificial insemination period.

Grazing System

Pastures are used in a rotation system of grazing. Up to one week of use followed by about three weeks of regrowth is practiced with each pasture. In early fall, all cattle are removed from the pasture system three to four weeks before frost to improve plant vigor and to promote winter survival. Following killing frost, the forage is grazed by weaned calves.

Cool season pastures were grazed during the early portion of the season by cow-calf pairs. Following 42 days of artificial insemination, cow-calf pairs were replaced by yearling steers in 1968 and 1969. In 1970, cows and calves remained on the pasture the entire summer. Weaned calves were used in the fall for all three years. This provided information on season-long carrying capacity.

Carrying capacity of the pasture system was 2.3 cow-calf pairs early in the spring and 1.5 cow-calf pairs late in the season. These carrying capacities would be about double if yearlings were used.

Three years data on cows and calves grazing irrigated pasture are discussed in this report. Additional data on seeding mixtures, water application, fertilization, carrying capacity and grazing management are reported in the 1969 North Platte Station progress report entitled "Center-Pivot Self-propelled Irrigated Pasture Study," available from the North Platte Station.

Cattle Performance

Performance of cows on cool season pasture beginning late April was compared to that of cows carried on grass hay and supplement until native range was ready to graze the last week in May (Table 1). Comparisons included return to heat following calving, percent having heat by the start of the breeding season, conception rates and weight changes of the cows and calves. Both groups of cows were wintered on range, grass hay and supplement.

The cows and calves on irrigated pasture gained more weight than their counterparts in drylot between late April and late May (Figures 1 and 2, Table 1). From that time on their

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Young Cows

(continued from page 17)

weight gains paralleled each other. This was after the drylot group had gone to native pasture.

The two groups were summered together in a previously ungrazed native pasture after July 17 in 1968 and 1969. By weaning time, the calves on irrigated pasture had a weight gain advantage of 10 pounds in 1968 and 17 pounds in 1969. In 1970 the cows and calves on irrigated pasture remained on irrigated pasture until September 14 and then non-irrigated cool season pasture until weaning. At weaning time, the calves on irrigated pasture had gained 15 pounds more than those on native range.

In 1968 and 1969 the cows on irrigated pasture had shorter intervals from calving to first heat and a higher percent had cycled by the start of the breeding season (June 5) than those in drylot and on native range. Likewise, the cows on irrigated pasture had higher conception rates.

In 1970 the data on calving to first heat and percent having heat by June 5 may be misleading, because the heat detecting bull in the irrigated pasture became lame in May and was replaced with a dairy steer. It was doubtful if he was doing a good job of heat detection. This conclusion was drawn because 94 percent of the cows on irrigated pasture were bred the first 21 days of the breeding season, although only 51 percent had been detected before June 5. By June 5 the regular heat detection bull had recovered and was put back into use. Eighty-seven percent of the cows on native range were bred the first 21 days.

Problems

Problems in cattle management on irrigated pasture were no greater than what might be expected in any management system. Actually, many phases of management were easier, such as heat detection, artificial insemination, time needed to check cattle, salt and water.

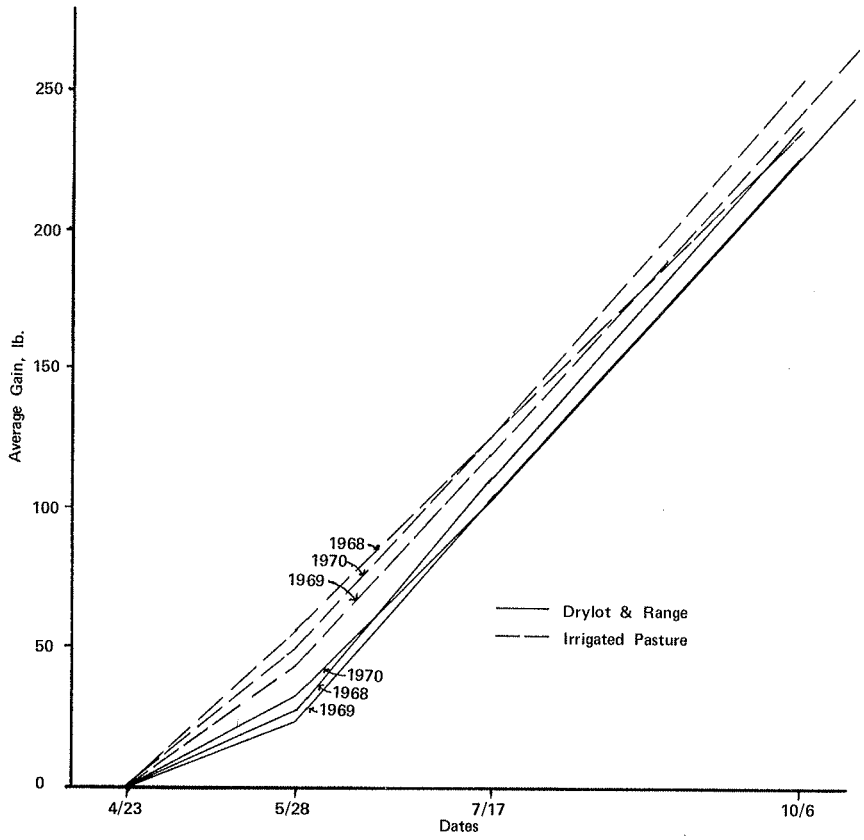
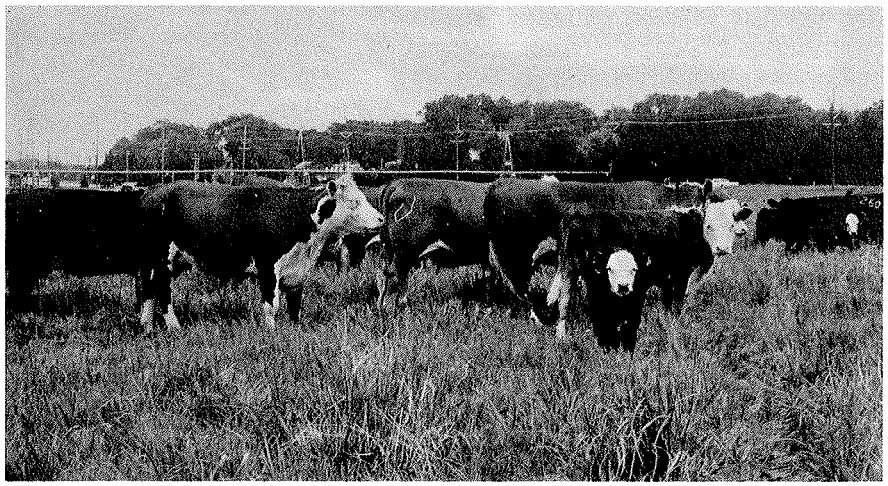


Fig. 2. Average weight gains of calves on irrigated pasture or drylot and range at the North Platte Station.

These data indicate that irrigated pasture can be used successfully and to an advantage in the development of young cows. The primary advantage is getting them on green forage earlier. This has improved reproductive performance and weight gains. It is conceivable to believe, had the genetic potential for milk production in this cow herd been greater, the advantage in weight gains for the calves on the irrigated pasture might have been even greater.

This comparison will be continued for several more years to document long time effects on mature cows.



Young cows developing on irrigated pasture.

Sulfur and Finishing Rations

By Keith Bolsen
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The utilization of nitrogen and sulfur is closely related in ruminants. The relationship is commonly expressed as nitrogen to sulfur ratio (N:S). Finishing rations commonly fed in Nebraska based on supplemental protein from soybean meal have a N:S ratio between 11:1 and 13:1, while those based on supplemental protein from urea have a N:S ratio from 13:1 to 17:1.

Results from several trials suggest that sulfur may not be a critical factor in many finishing rations fed in Nebraska. Supplementing sulfur as ammonium sulfate or methionine did not improve performance of cattle or lambs fed soybean meal.

It appeared that obtaining a too narrow N:S ratio with urea by the addition of ammonium sulfate proved detrimental to performance. The optimum level for urea-containing rations appears not to be as narrow as 12:1. Supplemental sulfur as methionine or ammonium sulfate does not enhance the utilization of urea in a gelatinized corn ration.

Table 2. Composition of rations in Trial 3.

Ingredients	Ration 1	2	3	4	5
Corn, ground	1485.8	1495.2	1607.8	1606.6	1604.4
Corn cobs, ground	260.0	260.0	260.0	260.0	260.0
Soybean meal	146.4	132.8	—	—	—
Urea	—	—	20.2	19.4	17.4
Ammonium sulfate	—	4.2	—	2.0	6.2
Molasses	80.0	80.0	80.0	80.0	80.0
Dicalcium phosphate	1.6	1.6	4.8	4.8	4.8
Limestone	11.2	11.2	10.0	10.0	10.0
Salt	12.0	12.0	12.0	12.0	12.0
Potassium chloride	2.0	2.0	4.2	4.2	4.2
Trace minerals	1.0	1.0	1.0	1.0	1.0
Stilbestrol-2	—	+	+	+	+
Vitamin A	13 gm	13 gm	13 gm	13 gm	13 gm
N:S ratio	12.2:1	9:1	14.5:1	12:1	9:1

[a] Formulated to supply 3,000 IU per animal per day.

Table 1. Composition of rations in Trial 2.

Ingredient	Ration 1	2	3	4	5	6
	lb.	lb.	lb.	lb.	lb.	lb.
Corn, ground	1497.4	1504.6	1631.0	1629.7	1627.5	1617.5
Corn cobs, ground	200.0	200.0	200.0	200.0	200.0	200.0
Soybean meal	165.0	154.0	—	—	—	—
Urea	—	—	22.5	21.4	19.6	11.4
Ammonium sulfate	—	3.8	—	2.3	6.3	24.5
Molasses	100.0	100.0	100.0	100.0	100.0	100.0
Dicalcium phosphate	11.0	11.0	14.4	14.9	14.9	14.9
Limestone	7.5	7.5	6.2	6.2	6.2	6.2
Salt	10.0	10.0	10.0	10.0	10.0	10.0
Potassium chloride	8.5	8.5	14.8	14.9	14.9	14.9
Stilbestrol-2	0.5	0.5	0.5	0.5	0.5	0.5
TM-50	0.15	0.15	0.15	0.15	0.15	0.15
Vitamin A[a]	133 gm	133 gm	133 gm	133 gm	133 gm	133 gm
N:S ratio	12:1	9:1	15:1	12:1	9:1	4.5:1

[a] Formulated to supply 30,000 IU per animal per day.

Performance Trials

Three trials were conducted to determine effect on performance of supplying additional sulfur.

Trial 1. The objective was to determine performance of cattle fed urea and urea supplemented with sulfur in a ration with corn processed to ferment more rapidly. In addition, methionine and ammonium sulfate were compared as sources of supplemental sulfur. Six individually fed steers received each treatment.

The basal ration was 90% concentrate with one-half the grain supplied as ground corn and the remaining one-half supplied as gelatinized corn. Urea furnished all the supplemental protein with ground corn cobs used as the

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Table 3. Performance of steers in Trial 1.[a]

Source of supplemental S N:S ratio Ration number	none 15:1 1	methionine 12.5:1 2	methionine 10:1 3	ammonium sulfate 10:1 4
No. steers	5[b]	6	4[b,c]	5
Initial wt., lb.	868	903	929	908
Av. daily gain, lb.[d]	1.80	1.59	1.67	1.77
Daily feed, lb.[d]	18.7	18.2	19.5	18.4
Feed/100 lb. gain, lb.	10.7	11.9	11.9	10.5

[a]Length of trial was 84 days.
[b]One steer on each treatment removed due to refusal to consume ration.
[c]One steer died from unknown cause.
[d]As fed basis.

Table 4. Performance of steers in Trial 2.[a]

Supplemental ammonium sulfate Source of supplemental N N:S ratio Ration number	– Soybean meal 12:1 1	+ Soybean meal 9:1 2	– Urea 15:1 3	+ Urea 12:1 4	+ Urea 9:1 5	+ Urea 4.5:1 6
No. steers	14	14	14	14	14	14
Initial wt., lb.	701	690	696	694	701	703
Av. daily gain, lb.[b]	3.09	3.02	3.00	2.64	2.68	1.73
Daily feed, lb.[c]	24.7	24.2	24.1	22.4	21.2	16.3
Feed/100 lb. gain, lb.	8.01	8.04	8.05	8.52	7.97	9.56
Dressing percent	61.8	62.7	62.8	61.4	62.5	61.8
Carcass grade scored[d]	17.4	17.0	17.3	17.5	17.1	15.6
Condemned livers[e]	2	2	2	3	0	3

[a]Length of trial was 120 days.
[b]Final live weight adjusted to 62% yield and performance calculated on this basis.
[c]As fed basis.
[d]Carcass score assigned, 17 - low choice, 18 - average choice.
[e]Livers condemned because of abscesses.

Table 5. Performance of lambs in Trial 3.[a]

Supplemental ammonium sulfate Source of supplemental N N:S ratio Ration number	– Soybean meal 12.2:1 1	+ Soybean meal 9:1 2	– Urea 14.5:1 3	+ Urea 12:1 4	+ Urea 9:1 5
No. lambs	9	9	9	9	9
Initial wt., lb.	86	85	85	85	85
Av. daily gain, lb.[b]	.46	.48	.46	.36	.39
Daily feed, lb.[c]	3.47	3.49	3.35	3.20	3.20
Feed/100 lb. gain, lb.	7.68	7.44	7.30	8.65	8.25
Dressing percent	51.8	51.7	52.3	52.9	53.1
Carcass grade score[b]	19.2	19.2	18.7	18.3	18.6

[a]Length of trial was 67 days.
[b]Final live weight adjusted to 51.37% yield and performance calculated on this basis.
[c]As fed basis.
[d]Carcass score assigned, 17 - low choice, 18 - average choice.

Sulfur and Rations

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roughage. The four treatments were basal ration plus the following additions: Ration 1, no supplemental sulfur; Ration 2, 1.0 gm. methionine per pound of ration; Ration 3, 1.3 gm. methionine per pound of ration; and Ration 4, 1.3 gm. ammonium sulfate per pound of ration.

Trial 2. This trial was to determine if source of protein influenced response of cattle to supplemental ammonium sulfate. Two lots of seven steers received each of the six treatments.

Composition of the completely mixed rations is shown in Table 1. All rations were formulated to supply equal amounts of protein, vitamin A, additives and minerals (except sulfur).

In Rations 1 and 2, soybean meal supplied all the supplemental protein with ammonium sulfate added to Ration 2 at the rate of 0.9 gm. per pound. Urea was the primary source of supplemental nitrogen in Rations 3, 4 and 5. Rations 4 and 5 received ammonium sulfate at the rates of 0.5 gm. and 1.4 gm. per pound, respectively. Effect of level of supplemental sulfur on N:S ratio is shown in Table 1.

Trial 3. This trial was to determine if source of protein influenced response of finishing lambs to supplemental ammonium sulfate. Three lots of three ram lambs received each of the five treatments.

The composition of the completely mixed rations is shown in Table 2. Rations were formulated to be equal in all nutrients except sulfur. Rations 2, 4 and 5 received ammonium sulfate at the rates of 0.9, 0.5 and 1.4 gm. per pound, respectively. Effect of level of supplemental sulfur on N:S ration is shown in Table 2.

Results of Trial 1 are shown in Table 3. Performance of all steers fed the four rations was unacceptable from a practical viewpoint. These results are in agreement with previous research at the Nebraska Station

which indicated performance of cattle fed rations based on high levels of gelatinized corn.

Performance of steers fed either methionine or ammonium sulfate was similar to performance of steers fed the basal urea ration. Thus, it appears added sulfur does not increase performance in cattle fed rations containing high levels of rapidly fermentable carbohydrates.

Results of Trial 2 are shown in Table 4. Cattle fed soybean meal, soybean meal plus ammonium sulfate, and urea Rations 1, 2 and 3 were similar in gain and feed required per unit of gain. Daily feed consumption was slightly higher for steers fed soybean meal (Ration 1).

Cattle fed the three urea rations supplemented with ammonium sulfate (Rations 4, 5 and 6) had lower gains and required more feed per unit of gain compared to cattle fed urea with no additional sulfur (Ration 3).

Supplying one-half the supplemental protein with ammonium sulfate (Ration 6) sharply reduced gain and daily feed consumption when compared to the five other rations.

Results of Trial 3 are shown in Table 5. Lamb response to the treatments was similar to steer response observed in Trial 2. Lambs fed soybean meal plus ammonium sulfate and urea did not differ in performance. Lambs fed urea supplemented with ammonium sulfate (Rations 4 and 5) had lower gains, lower daily feed consumptions and required more feed per unit of gain compared to lambs fed only urea (Ration 3).

Summary

In summary the results from this study suggest that feedstuffs used in cattle and sheep finishing rations in Nebraska supply enough sulfur to meet the animal's requirements for this nutrient. Also, care should be taken when sulfur is added not to have the level too high, for performance can be depressed.

Compensatory Gain in Beef Cattle

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L. E. Jones
Technician, Animal Science

Compensatory gain in beef cattle has been well documented. However, the economic importance of this has not been as well documented. Two experiments (1968 and 1969), designed to measure the compensatory gain and cost of gain in the feedlot during the summer following wintering programs which produced different rates of gain, have been completed.

Five groups of steers, each replicated in two lots each year, were fed a conventional finishing ration of silage, corn and supplement. All steers were fed the same ration within each year.

The average daily winter weight gains (lb.) of the five groups were: 2.00, 1.72, 1.54, 0.66 and -0.19 in 1968 and 1.78, 1.38, 1.04, 0.38 and -0.03 in 1969 (Tables 1 and 2).

Wintered in Drylot

The three fastest gaining groups were wintered in drylot on silage and one pound of a supplement formulated to balance the protein, calcium and phosphorus deficiency in the silage. Each group received a different kind of silage, thus the difference in gains was a direct reflection of the available energy in the silage.

The two slowest gaining groups were wintered on native range with different supplements, thus their limited gain was a reflec-

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Table 1. Average feedlot performance of yearling steers which had different rates of gain during the previous winter, 1968.

	Av. daily winter gain, lb.				
	2.00	1.72	1.54	0.66	—0.19
Days on feed	135	155	155	155	178
Av. weights, lb.					
Initial	724	700	665	599	508
Final[a]	1,145	1,148	1,150	1,160	1,163
Daily gain[a]	3.12	2.89	3.13	3.62	3.68
Av. feed consumed, lb./day					
Supplement	2.00	2.00	2.00	2.00	2.00
Corn	14.8	14.8	15.2	17.6	17.4
Corn silage	16.0	15.2	14.7	15.2	13.9
Av. feed/lb. of gain, lb.[a]					
Supplement	0.64	0.69	0.64	0.55	0.54
Corn	4.74	5.12	4.86	4.86	4.73
Corn silage	5.12	5.26	4.70	4.20	3.78
Feed cost of gains, cents/lb.[b]	14.60	15.63	14.63	14.02	13.51
Av. carcass data					
Yield, %[c]	61.05	60.90	61.65	59.57	60.30
Grade[d]	18.10	17.96	17.85	18.07	17.62
Ribeye area, sq. in.	12.02	11.42	12.04	11.76	11.19
Fat thickness, in.	0.87	0.86	0.84	0.84	0.84

[a] Based on gain adjusted to 60% yield.
[b] Supplement, corn and silage were figured at 4, 2 and 0.5 cents/lb., respectively.
[c] % yield based on final full feedlot weight and warm carcass weight.
[d] Carcass grade assigned, 17 = low choice, 18 = average choice.

Table 2. Average feedlot performance of yearling steers which had different rates of gain during the previous winter, 1969.

	Av. daily winter gain, lb.				
	1.78	1.38	1.04	0.38	—0.03
Days on feed	119	119	135	171	171
Av. weights, lb.					
Initial	736	702	646	535	476
Final[a]	1,069	1,038	1,023	1,106	1,084
Daily gain[a]	2.80	2.83	2.79	3.34	3.56
Av. feed consumed, lb./day					
Supplement	2.02	2.06	1.91	1.90	1.92
Corn	15.98	16.92	14.72	14.50	14.60
Corn silage	6.86	8.58	11.50	14.36	13.58
Alfalfa haylage	3.87	4.23	3.40	3.34	3.44
Av. feed/lb. of gain, lb.[a]					
Supplement	0.72	0.73	0.68	0.57	0.54
Corn	5.71	5.98	5.28	4.34	4.10
Corn silage	2.45	3.03	4.12	4.30	3.81
Alfalfa haylage	1.38	1.49	1.25	1.00	0.97
Feed cost of gain, cents/lb.[b]	16.22	17.14	15.96	13.61	12.75
Average carcass data					
Yield, %[c]	60.15	60.02	57.44	60.67	61.02
Grade[d]	17.88	17.69	17.44	18.00	17.86
Ribeye area, sq. in.	11.71	11.69	11.20	11.58	11.54
Fat thickness, in.	0.63	0.59	0.52	0.74	0.74

[a] Based on gain adjusted to 60% yield.
[b] Supplement, corn and silage were figured at 4, 2 and 0.5 cents/lb., respectively.
[c] % yield based on final full feedlot weight and warm carcass weight.
[d] Carcass grade assigned, 17 = low choice, 18 = average choice.

Table 3. Average per head costs and relative initial value of steers using a fixed profit based on that of the steers finished first, 1968.

	Av. daily winter gain, lb.				
	2.00	1.72	1.54	0.66	—0.19
Sale value ($28/cwt. adj. to 60% yield)	320.60	321.44	322.00	324.80	325.64
Feeding costs					
Feed cost	59.86	67.52	66.57	78.09	87.27
Yardage[a]	9.45	10.85	10.85	10.85	12.46
Interest[b]	8.72	9.37	9.39	9.48	10.81
Total	78.03	87.74	86.81	98.42	110.54
Sale value-feeding costs	242.58	233.70	235.91	226.38	215.10
Fixed profit per head[c]	25.38	25.38	25.38	25.38	25.38
Relative cost of steers[c]	217.20	208.32	209.81	201.00	189.72
Relative cost/cwt.[c]	30.00	29.76	31.55	33.56	37.35

[a] Seven cents per head per day.
[b] Eight percent per annum figured on the investment in cattle and feed.
[c] Assuming 30¢ per pound for heaviest steers at the start of the finishing period.

Compensatory Gain

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tion of available energy and protein.

All steers were purchased as calves from the same ranch both years. In 1968, those wintered on native range were, however, the heavy end of the calves before going into the winter. It was assumed that this was a reflection of age and milking ability of the dams and that the inherent feedlot performance was similar. The second year those wintered on native range were a random sort of the entire group of calves.

Marketed by Groups

Steers were marketed by groups when it was felt a high percent of the group would grade choice.

As expected, steers that gained the most during the winter gained the least during the finishing phase. They finished for market sooner (Tables 1 and 2). The average weight gains, feed conversions and feed cost of gains for the two years are shown in Tables 1 and 2.

The relative initial value of the steers was calculated for each year (Tables 3 and 4). A constant sale price was used, thus no consideration was given to the fact that season of marketing may influence sale price. The fact that an attempt was made, fairly well accomplished, to market cattle when they reached a comparable grade should justify the use of a common sale price.

All calculations are figured on a weight gain adjusted to 60% yield to eliminate different weigh conditions when the steers were marketed. The fixed profit per head was determined by the group that finished for market first. The figure of $30/cwt. was selected as the value of that group and the other groups were related to them.

The lightest steers at the beginning of the trial were worth

Table 4. Average per head costs and relative initial value of steers using a fixed profit based on that of the steers finished first, 1969.

	Av. daily winter gain, lb.				
	1.78	1.38	1.04	0.38	—0.03
Sale value ($28/cwt.)	299.32	290.64	286.44	309.68	303.52
Feeding costs					
Feed cost	54.01	57.59	60.17	77.71	77.52
Yardage[a]	8.33	8.33	9.45	11.97	11.97
Interest[b]	7.17	6.95	7.70	10.42	10.21
Total	69.51	72.87	77.32	100.10	99.70
Sale value-feeding cost	229.81	217.77	209.12	209.58	203.82
Fixed profit per head[c]	9.01	9.01	9.01	9.01	9.01
Relative cost of steers[c]	220.80	208.76	200.11	200.47	194.81
Relative cost/cwt.[c]	30.00	29.74	30.98	37.47	40.93

[a] Seven cents per head per day.
[b] Eight percent per annum figured on the investment in cattle and feed.
[c] Assuming 30¢ per pound for heaviest steers at the start of the finishing period.

$37.35 and $40.93/cwt. in 1968 and 1969, respectively, with a rather straight line decline in worth as the groups of steers were heavier at the onset. The initial weight and value have a straight line relationship until the weight of the steers approached 700 pounds (Figure 1). At this point, there was little difference in value as the weight increased.

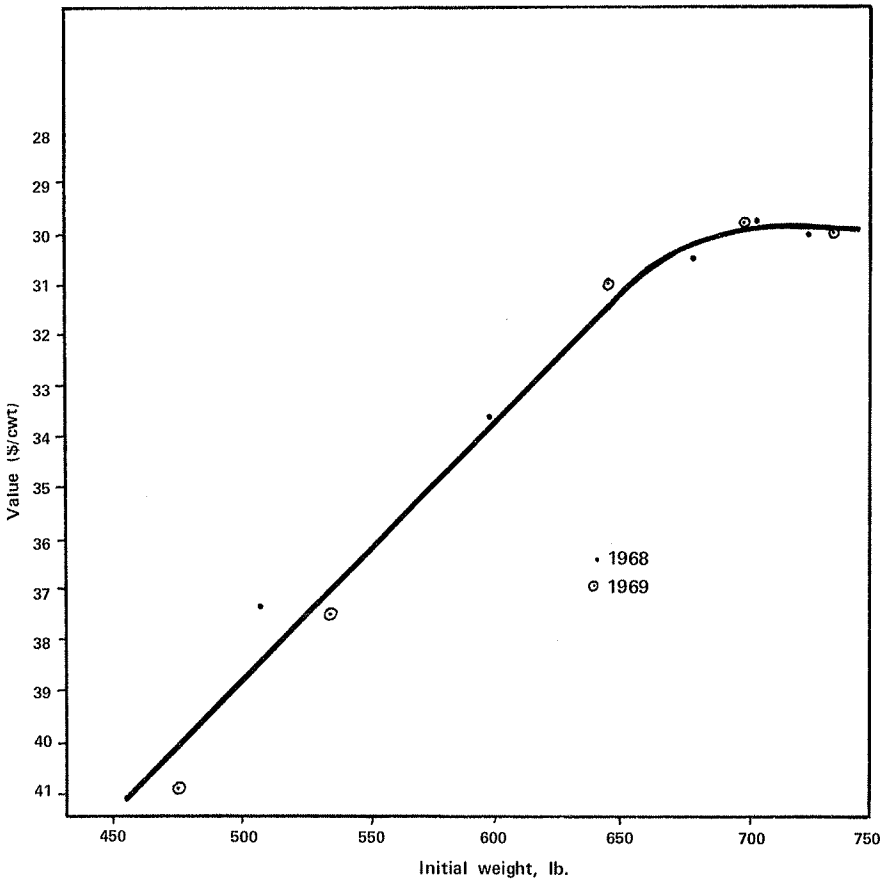

Fig. 1. Relative value of steers with varying starting weights resulting from different levels of winter feeding.

Wheat In Cattle Rations

By Larry Varner
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Wheat has always been included in livestock rations. However, it has not been a major feed grain in beef cattle rations in the past because of its price and/or availability in relation to other feed grains.

More recently, because of lower wheat prices, higher prices for other feed grains, especially corn, and increased yields of new wheat varieties, utilizing increased amounts of wheat in rations has become feasible.

Current recommendations for feeding wheat in beef cattle rations are:

1. When wheat is fed in minimum roughage (15% or less) finishing rations it should be limited to no more than 30% of the total ration. With higher roughage finishing rations the upper limit for wheat is probably 50% of the ration. In a high roughage growing ration, all the supplemental grain (up to 1% of body weight) in the ration can be wheat. Precautions should be taken to insure uniform intake.

The wheat should be worked into the ration gradually rather than shifting abruptly to the 30% level of wheat if it is added after the cattle are on grain. Care should be given to avoid sudden and high intake of wheat because of the possibility of digestive upsets.

2. Wheat should be coarsely rolled or ground when fed to beef cattle. Prepare wheat carefully to avoid the possibility of increased problems encountered with digestive disturbances and reduced feed intake.

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Wheat in Rations

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3. Since wheat contains from two to six percentage units more protein than either corn or grain sorghum, less protein supplementation is needed than with corn or milo. Mineral, vitamin and feed additive supplements need not be changed when wheat is substituted for corn or milo.

4. On an equal moisture and weight basis, wheat should be valued at 100 to 110% the value of corn for beef cattle rations when fed at restricted levels.

Feeding Problems

Research is currently underway at Nebraska and other research stations to study some of the problems that may be encountered when wheat is fed to beef cattle.

The addition of wheat to beef cattle rations at a level to supply 30 to 50% or more of the finishing ration often results in decreased feed intake and reduced animal performance. Increased digestive disturbances (acidosis) and abscessed livers may be encountered when high levels of wheat are fed.

Although feed consumption may be reduced when wheat is fed, efficiency of feed conversion is often increased because of the higher digestibility of wheat as compared to other feed grains.

Table 1 shows animal performance from six Nebraska trials when wheat and corn were fed in high concentrate rations during the late 50's. Studies at other research stations have indicated a similar picture with regard to feed intake and performance when wheat is compared to barley or grain sorghum.

Table 1. Summary of average daily gains, feed intake and feed efficiency in six Nebraska trials.[a]

Item	Source of grain		
	Corn	50% corn 50% wheat	Wheat
Av. daily gain, lb.	1.98	2.03	1.92
Daily feed intake, lb.	22.3	21.7	19.8
Feed/100 lb. gain	1142	1082	1038

[a]Baker and Baker, 1960 (Nebraska Agr. Exp. Sta. Bul. 454).

Table 2. Rumen lactic acid level and feed intake by cattle fed wheat-containing rations.[a]

Ration	Rumen lactic acid concentration 1 hour after feeding	Av. rumen pH	Av. feed intake for 29 days
	(ug/ml)		(lb.)
Corn	12	6.67	16.8
Corn-Gage wheat (50:50)[b]	42	6.62	14.4
Gage wheat	88	6.44	12.8

[a]Ration contained 80% concentrate and 20% roughage (corn cobs).
[b]Proportion in the grain mix in the ration.

Table 3. Rumen lactic acid level and feed intake by cattle fed different wheat varieties.

Ration[a]	Rumen lactic acid concentration 1 hour after feeding	Av. rumen pH	Av. feed intake for 35 days
	(ug/ml)		(lb.)
Corn	32	6.82	16.7
Gage wheat[b]	55	6.84	14.4
Trapper wheat[b]	150	6.88	13.7
Scout 66 wheat[b]	255	6.54	12.2

[a]Ration contained 90% concentrate and 10% roughage (corn cobs).
[b]Wheat substituted for corn on a lb. for lb. basis.

Recent Nebraska Research

The present program at Nebraska has as its objective to explain the reasons for the reduced feed intake when high levels of wheat are fed, and to study factors which may allow utilization of higher amounts of wheat in beef cattle rations.

Table 2 shows the results of a study involving six steers which were fed one of three 80% concentrate rations, which differed only in source of grain (corn; 50% corn, 50% Gage wheat; Gage wheat).

Feed intake was measured for 29 days and during this time rumen samples were taken on eight different days at one, two, three and four hours after feeding. Rumen lactic acid concentration and pH were measured at each sampling time. High levels of rumen lactic acid may be associated with the reduced feed intake and digestive disturbances often encountered in the feed lot. As level of wheat was increased in the ration feed intake was reduced and lactic acid levels increased as compared to the corn ration.

Initial studies at Nebraska utilized Gage wheat, the most available variety of known origin. Initially wheat variety was felt not to be an important factor involved in reduced feed intake. However, laboratory evaluation

of various wheat varieties indicated that they may differ greatly in the way they are fermented in the rumen. Therefore, animal studies were started in addition to the laboratory studies on varieties and sources of wheat.

Table 3 shows the results of a short-term feeding study conducted to evaluate three wheat varieties that had shown marked differences in fermentation characteristics by laboratory evaluation. Rumen samples were taken on days 10 and 20 at one, two and four hours after feeding for lactic acid and rumen pH determination.

Results

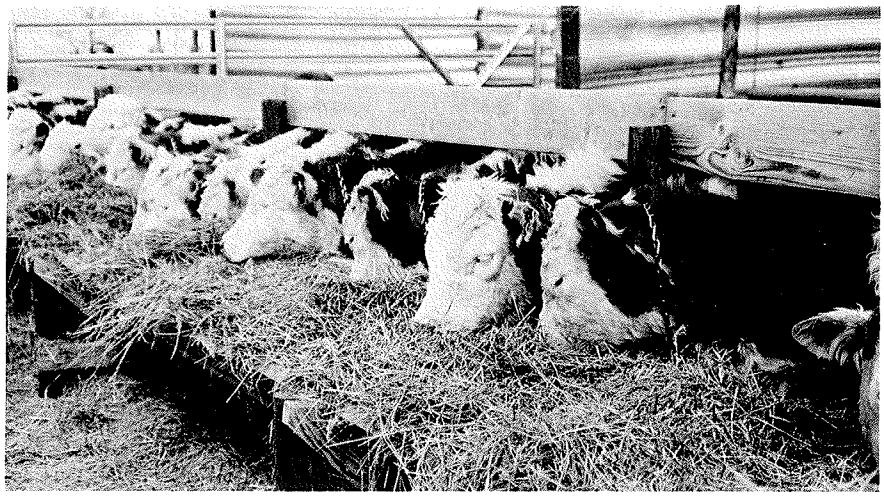
This study involved 12 steers individually fed for 35 days. Three steers were on each treatment. The rations were 90% concentrate and 10% corn cobs and differed only in source of grain. Grain sources were: 1. corn, 2. Trapper wheat, 3. Gage wheat, and 4. Scout 66 wheat. All grains were dry rolled.

There was a reduction in feed intake and an increase in lactic acid concentration with all wheat varieties as compared to corn. However, there was also a difference in both feed intake and lactic acid concentration among cattle fed the three wheat varieties.

Cattle fed Scout 66 had the highest lactic acid level and lowest feed intake.

Those fed Gage wheat had the lowest lactic acid level and the highest feed intake of wheat fed cattle.

Remember, these studies are short-term in nature and involve only small numbers of cattle. More intensive long-term studies involving more animals are now underway. Data from these studies should be evaluated before varieties can be selected for better feeding characteristics. However, preliminary data indicate that wheat varieties differ in the way they are fermented in the rumen and thus may differ in feeding value.



Cattle on trial.

Effect of Feeding Antibiotics

By Walter Woods
Professor, Beef Nutrition

The use of antibiotics in beef cattle rations has been a common practice for several years.

This practice has been based on research proving antibiotics increased animal performance and reduced problems under stress conditions. Changes occurring in the feeding of beef cattle over the last decade have caused an increase in the practice of feeding antibiotics.

Included in these changes and practices are:

1. The development of larger lots or greater numbers of cattle in one location.
2. The feeding of higher concentrate rations for faster growth and for increased efficiency.
3. The increased emphasis upon

(continued on next page)

Table 1. Summary of performance of cattle fed low levels of antibiotics continuously. Data collected in 1960's.

Comparison	No. trials	No. cattle	Daily gain	Improvement	Feed required per lb./gain	Improvement
			lb.	%	lb.	%
			Zinc Bacitracin[a]			
Control	20	1164	2.40		8.99	
Fed antibiotics		1172	2.52	5.0	8.50	5.4
			Aureomycin[b]			
Control	20	403	2.18		9.35	
Fed antibiotics		403	2.29	4.8	8.93	4.5
			Terramycin[c]			
Control	10	330	2.37		9.04	
Fed antibiotics		328	2.51	5.9	8.73	3.4
			Bacitracin - methylene disalicylate			
Control		286	2.46		7.70	
Fed antibiotics	5	286	2.56	4.1	7.32	4.9

[a]Level fed ranged from 35 to 80 mg./head/day.
[b]Level fed ranged from 70 to 100 mg./head/day.
[c]Level fed ranged from 70 to 80 mg./head/day.

Antibiotics

(continued from page 25)

disease control and animal management.

4. The movement of cattle long distances which may increase animal stress.

The cattle feeder has turned to antibiotics to aid in the control of problems brought about by the changes occurring in beef production and feeding.

Effect of Antibiotics

The purpose of this paper is to review data reported during the 1960's upon the effect of antibiotics in beef cattle feeding programs upon animal performance.

In 1959, Burroughs and others summarized data on Aureomycin feeding to beef cattle. In their review the effects of the antibiotics upon animal performance in both high grain and high roughage diets were reported. The improvement in gain of 4.3 and 5.6% and the improvement in efficiency of feed conversion of 3.7 and 7.0% in the higher and lower performing rations respectively, demonstrated that feeding antibiotics was beneficial in the 50's.

Data reported in the last 10 years on the influence of antibiotics in beef cattle programs were evaluated. Positive responses reported from feeding antibiotics include:

1. Increased gains.
2. Decreased feed required per pound of gain.
3. Reduced incidence of liver abscesses.
4. Reduced incidence of shipping fever.
5. Disease control and prevention.
6. Increased ease of adaption of cattle to feed lot conditions following shipment.

These economic factors are basic to the beef cattle industry.

Table 3. Reduction of liver abscess by feeding antibiotics[a].

Station	Type of ration	No. head	% Abscess Livers
Nebraska, 1969	Aureomycin	20	15
	Control	19	79
Nebraska, 1969	Terramycin	199	14.6
	Control	197	21.8
Texas Tech, 1967	Aureomycin	—	3.0
	Control	—	27.0
Texas Tech, 1969	Zinc Bacitracin	—	27.7
	Control	—	36.1
Nebraska, 1969	Bacitracin	100	40.0
	Control	99	30.3
	Bacitracin	170	40.4
	Control	171	39.4
No. Carolina	Bacitracin	40	72.0
	Control	40	72.0
So. Dakota, 1964	Heavy-88 days		
	Aureomycin (350mg./2wk-70mg.)	9	22.2
	Bacitracin (350mg./2wk-70mg.)	9	11.1
	Control	9	55.6
	Light-203 days		
	Aureomycin (350mg./2wk-70mg.)	8	1.0
	Bacitracin (350mg./2wk-70mg.)	5	20.0
	Control	8	50.0
Texas Tech, 1963	Aureomycin	30	38.0
	Control	30	72.0

[a]Where low levels were fed. Level range from 70-75 mg. per head per day except where indicated for higher levels initially.

Table 2. Roughage levels as related to liver abscess from five Nebraska trials.

Roughage level in finishing ration	No. head	% Abscessed livers
Comparison 1		
All concentrate	84	65.0
5% roughage	86	38.0
10% roughage	87	32.6
15% roughage	84	32.2
Comparison 2		
All concentrate	100	56.0
15% roughage	99	14.0
Comparison 3		
All concentrate	29	24.5
15% roughage	29	0.0
Comparison 4		
3 pounds of hay	71	19.7
5 pounds of hay	72	4.7
Comparison 5		
5% roughage	12	41.6
15% roughage	12	33.3

Animal Performance

Results from the continuous low level of feeding of antibiotics (35 to 100 mg.) are summarized in Table 1. The data reviewed included extensive studies with antibiotics. Aureomycin, Terramycin, zinc bacitracin and bacitracin methylene disalicylate.

These data (Table 1) are a summary from industry and University trials reported in the 60's.

Table 4. Summary of performance of cattle fed chlortetracycline-sulfamethazine.

Location	No. Trials	Age of cattle	Daily gain			Improvement in feed/lb. gain
			Control	Treated	Improvement	
			lb.	lb.	%	%
Arizona (1967-68)	4	Light yearlings	2.5	3.4	39	26
Iowa (1967)	2	Yearlings	1.2	1.4	11	17
Kansas (1967-68)	5	Calves	2.0	2.3	10	14
Purdue (1967-68)	4	Calves	1.9	2.5	29	27
South Dakota (1966-69)	9	Calves	1.4	1.6	14	27
Texas Tech	2	Calves	2.1	2.5	20	10
Wyoming (1968)	1	Calves	1.3	1.7	32	29
Nebraska (1970)	2	Calves	1.3	1.5	18	14
Average					21.6	20.5

The average response in gain from feeding antibiotics was 4.95% and the average decrease in feed required per pound of gain was 4.55%. Performance values represent 4,372 head of cattle in these 55 comparisons.

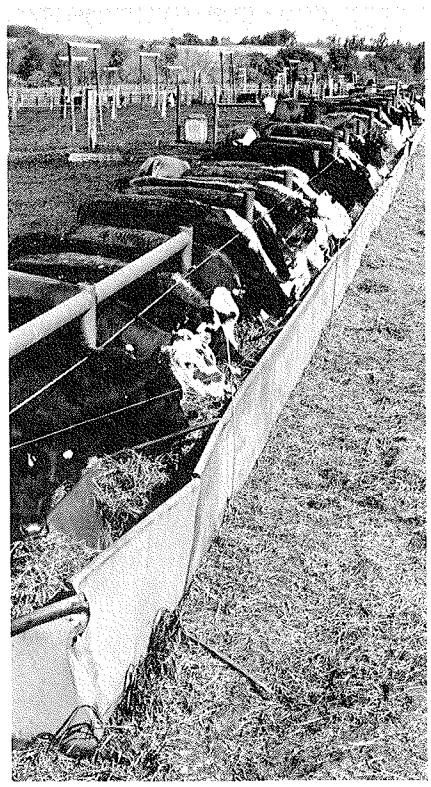
Cattle have been shown to respond significantly to antibiotics in increased daily gains in low performing (high roughage) as well as high performing (high grain) rations. The data suggest that cattle respond positively to antibiotic feeding at low, continuous levels (30 to 100 mg.). Thus, ration energy level, nitrogen source or grain source have not restricted the response to antibiotics.

The data reviewed indicate that the response in increased weight gain and decreased feed required per pound of gain may be small. However, out of all comparisons (Table 1) the following results were found. In 92.7% of the comparisons, the antibiotic-fed cattle had a higher rate of gain than those fed no antibiotic. In 80.4% of the comparisons, the antibiotic fed cattle required less feed per pound of gain than the controls. These values reported in the last 10 years indicate a positive response to antibiotic feeding consistent with data reported by Burroughs and others.

Thus, it appears that the average response in weight gain and feed conversion to antibiotic feeding has not been lessened in the second decade of feeding antibiotics in comparison to the first decade.

Liver Abscess

The incidence of liver abscesses in slaughter cattle has increased with the use of high concentrate rations. The influence of concentrate level in the rations upon incidence of liver abscess is shown in Table 2. Thus, the use of higher concentrate rations, which is encouraged for economy of gain, has increased the incidence of liver abscesses.



Antibiotics fed in the ration.

The impact of an abscessed liver upon the livestock industry is two-fold. First, the direct economic loss of the liver at slaughter. Second, significantly lower animal performance has been reported for cattle with abscessed livers compared to those with healthy livers.

The feeding of antibiotics results in a reduction in the incidence of abscessed livers (Table 3).

Adaption to Feedlot

Antibiotics and a combination of an antibiotic and sulfamethazine has been widely used in beef cattle feeding to help adjust new cattle to the feed lot. This program has been particularly effective with calves, which are more susceptable to the stresses associated with weaning and shipment.

A summary of 29 trials in which chlortetracycline and sulfamethazine were fed to cattle is given in Table 4. The average response in weight gain and improvement in efficiency of feed conversion was 21.6 and 20.5%, respectively. This represents a consistent picture in improvement in animal performance from antibiotic feeding or antibiotic-sulfamethazine feeding during the initial period in the feed lot. However, it is possible part of this indicated advantage would be lost over the entire feeding period.

Summary

This paper has summarized results of studies involving the feeding of antibiotics to beef cattle during the 1960's.

Data reviewed showed feeding antibiotics resulted in consistent improvements in economic traits influencing beef cattle production: improved rates of gain, improved efficiency of feed conversion, reduction in incidence of liver abscesses and decreased incidence of shipping fever.

Animal Science

Animal science is the art and science of animal agriculture whereby meat and fiber are produced for America's millions. Today Animal Science requires knowledge of all biological sciences, botany, zoology, bacteriology, genetics and physiology. It also requires a knowledge of mathematics, chemistry and physics as well as the agricultural sciences dealing with forages, feed grains, insects, animal health, nutrition, breeding and meats.

The person who likes science will find Animal Science challenging. Many Animal Science positions require considerable contact with people. For those who would rather work by themselves, there are positions in laboratories and offices. So, whether you prefer the outdoors or the indoors, the market place, the laboratory or the classroom, there is a place for you in Animal Science if you like livestock.