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AUTHORS: Robert J. Raleigh is Associate Professor of Animal Nutrition, and Joe D. Wallace is Assistant Professor of Animal Science, Oregon State University.

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Robert J. Raleigh and Joe D. Wallace

SLAUGHTER STEERS FROM RANGE FEED

As human populations over the world continue to increase, there will be increasing demand for cereal grains for human consumption. Cattle feeding, by necessity, may then become more dependent upon forage and pasture crops and range land will again be looked to as an area for the production of slaughter cattle.

Yearling cattle rapidly adjust from meadow hay feeding to range forage in the spring of the year. Work at this Station has shown that yearling gains in excess of two pounds per day can be maintained until about mid-August by supplying a very limited amount of the proper supplements. A decision must then be reached as to whether these animals should remain on range feed, go directly to the feedlot, return to the meadows for aftermath bunched-hay forage, or possibly be moved to irrigated pasture. Our experience has indicated that when cattle of this type are moved either to irrigated pasture or back to the meadow area, they go through an adjustment period (two to four weeks) when virtually no gain is made. Since the yearlings have considerable condition by mid-August, it should require a relatively short feeding period to develop them to a reasonable slaughter grade. The purposes of this experiment were to determine if yearling steers can be supplemented on range to finish at a reasonable slaughter grade and also to compare costs of finishing cattle on range with finishing them in dry lot.

Experimental Procedures

Twenty head of yearling steers were grazed together on crested wheatgrass from May 18 until August 3. At the beginning of the grazing period, the steers averaged 567 pounds. In addition to forage, the animals were supplemented each day according to the schedule shown in Table 1.

On August 3, the animals were separated into two groups of 10 head each. One group was placed in dry lot and the other group remained on crested wheatgrass range. Each group was then supplemented at the same rate, while those in dry lot were fed meadow hay free choice and those on range had free access to crested wheatgrass forage. During the feeding period, the supplement was increased at a moderate rate to a level of about 1.75% of body weight. Supplementation remained at this level for each group until the steers were marketed on November 1. At the start of the growing period (May 18) and again at the start of the finishing period (August 3), five steers from each finishing group (range and dry lot) were implanted with 12 mg. of stilbestrol.

Table 1. Daily supplementation schedule during the grazing period

Date	Barley	Cottonseed meal
	(lb./hd.)	(lb./hd.)
5/18-5/31	1.00	----
6/1-6/7	.75	----
6/8-6/14	.50	----
6/15-6/21	.25	.25
6/22-6/28	.25	.50
6/29-7/5	.25	.70
7/6-7/12	.35	.85
7/13-7/19	.45	1.00
7/20-7/26	.65	1.10
7/27-8/3	1.10	1.20

Observations

Average daily gains made by the steers during the growing and finishing periods as well as the effect of stilbestrol treatments on gain are shown in Table 2. Data on feed consumption and cost of gain are presented in Table 3. During the growing period when all the steers ran together their gains averaged 2.72 pounds per day with a feed cost of less than 2¢ per pound of gain. During

Table 2. Average daily gains made by steers during different periods and effect of stilbestrol on gains

Period	Group	Stilbestrol b/ Implanted	Control	Avg.
		(lb.)	(lb.)	(lb.)
Growing (5/18-8/3)	(Grazed) (together)	2.86	2.57	2.72
Finishing (8/3-11/1)	Dry lot	2.78	2.33	2.55
	Range	2.53	2.07	2.30
	Avg.	2.65	2.20	2.43
Total period (5/18-11/1)	Dry lot	2.87	2.41	2.64
	Range	2.62	2.34	2.48
	Avg.	2.74	2.38	2.56

a/ Steers were split into two groups on 8/3 - one group finished in dry lot and the other on range.

b/ 12 mg. implants given on 5/18 and 8/3.

Table 3. Summary of feed consumption and gain costs by periods

Period a/	Item	Finishing group Dry lot	Range
Growing (5/18-8/3)	Avg. da. barley cons., lb.	0.6	
	Avg. da. CSM cons., lb.	0.5	
	Avg. da. feed cost, $	0.045	
	Cost per lb. gain, $ b/	0.016	
Finishing (8/3-11/1)	Avg. da. barley cons., lb.	10.8	10.8
	Avg. da. CSM cons., lb.	1.4	1.4
	Avg. da. hay cons., lb.	11.9	----
	Avg. da. feed cost, $	0.446	0.337
	Cost per lb. gain, $ b/	0.175	0.146
Total (5/18-11/1)	Avg. da. feed cost, $	0.261	0.202
	Cost per lb. gain, $ b/	0.10	0.08

a/ Steers ran together during the growing period, then they were split into two groups for finishing - one group was finished in dry lot and one group on range.

b/ Cost includes range feed @ $.30 per A.U.M., barley @ $50 per ton, CSM @ $80 per ton, and hay at $20 per ton.

the finishing period, dry lot steers gained more rapidly than those on range (2.55 vs. 2.30 lb./da.) but their gains were not as economical (18 vs. 15¢ per pound of gain). For the total period (May 18 until November 1), feed costs per pound of gain were 10¢ and 8¢ for those finished in dry lot and on range, respectively. Stilbestrol increased rate of gain by 10% during the growing period and 17% during the finishing period.

Carcasses from steers finished on range were 19 pounds lighter in weight, but had more marble and consequently averaged about one-third of a grade higher than those from steers finished in dry lot (Table 4). When feed costs were deducted from carcass value, the steers finished on range returned $5.03 more per head than those finished in dry lot.

More work will be conducted on this subject during the current year. The data collected thus far indicate that with proper supplementation yearling cattle can be finished to a reasonable slaughter grade very economically directly on the range. With current trends in consumer preference for leaner beef, the demand for cattle yielding good to low choice carcasses should increase.

Table 4. Average carcass and financial return data

Item	Finishing group: Dry lot	Range
Carcass weight, lb.	563	544
Conformation score a/	16.5	16.2
Maturity rating	A-	A-
Marbling score	8.4	10.6
Rib eye/100 lb. carc. wt., sq. in.	2.23	2.36
Backfat, in.	0.27	0.25
Dressing percent, %	57.0	56.8
Preliminary, yield grade	2.7	2.7
Final carcass grade a/	13.8	14.7
No. carcasses grading:		
Choice	2	4
Good	7	6
Standard	1	0
Carcass value, $ b/	197.01	192.23
Total feed cost 5/18-11/1, $	43.62	33.81
Return above feed cost, $	153.39	158.42

a/ Good 13-15; Choice 16-18.

b/ Steers sold to Wells and Davies, Payette, Idaho, on grade and yield basis Choice @ 37¢/lb., Good @ 36¢/lb., Standard @ 35¢/lb.

UREA IN THE RATION OF WEANER CALVES

Urea and other non-protein nitrogen compounds have been used as protein extenders for ruminants for several decades. Urea usage has fluctuated, depending on natural protein feed costs and livestock prices. In more recent years, with small profit margins and the higher prices of protein supplements, various methods of reducing feed costs have come under study. The use of urea as a substitute for protein in ruminant rations has more than doubled in the last 5 years.

Ruminants can utilize urea to replace some of their feed protein because the bacteria in the rumen are able to convert the nitrogen of urea to useful nitrogenous products. The extent that urea can be utilized is determined by energy level and source, type of other protein or other non-protein nitrogen, and mineral or trace mineral component of the diet. Even the introduction of hormones such as diethylstilbestrol affects nitrogen retention in the ruminant and thereby has an effect on urea utilization.

Feed grade urea contains 41% nitrogen, giving an equivalent of about 262% crude protein compared to 5.5 to 7.5% nitrogen or 35 to 46% crude protein for common protein feeds. On this basis, one pound of urea can supply the protein equivalent of about 6.5 pounds of cottonseed meal. Urea can be toxic if fed at high rates with an improper balance of other nutrients. However, when rations are properly balanced, urea can be used safely at high levels. Also, urea can be used to either decrease the cost of the feed mixture or improve its quality. If one or both of these are not accomplished, there is little to be gained through the use of urea. If one pound of urea is used to replace 6 pounds of cottonseed meal, a good energy feed can be substituted for the other 5 pounds which will increase the quality of the ration and may lower the total cost, depending on feed prices. If a trash or filler feed is used that contributes little to the ration, the price and values of the ration should be reduced accordingly.

Previous work at this Station and many others has shown that urea cannot be used as a successful replacement for a protein supplement with native meadow hay roughage unless adequate energy feeds are also provided. The purpose of the work reported here was to investigate various protein-energy-urea combination that would give most efficient and economical gains.

Experimental Procedures

Two levels of urea and two levels of energy supplement were used to compare feed intake and efficiency, animal performance, and economy of performance. These were also compared with a standard supplement of 2 pounds of barley and 1 pound of cottonseed meal per head daily.

Fifty-four weaner calves were stratified by weight and sex into 9 lots of 6 animals each and lots were randomly allotted to treatments as shown in Table 5.

Table 5. Experimental design

Nitrogen source lbs./head/day	Energy (lbs. barley/head/day) 2	2 1/2	3
Cottonseed meal (1 lb.)	1 1/		
Cottonseed meal (1/4 lb.) Urea (0.11 lb.)		2 1/	2
Cottonseed meal (1/8 lb.) urea (0.14 lb.)		2	2

1/ The control treatment had one replication of six animals. Other treatments had two replications of six animals each.

The supplemental rations were formulated by substituting rolled barley for the amount of cottonseed meal replaced by urea. This made both supplements containing 2.5 pounds of barley practically equal in crude protein, energy, and cost. The supplement including 3 pounds of barley per day was higher in energy and cost more than the others. Crude protein was nearly equal in all supplements.

The urea and cottonseed meal were premixed and put in the feed trough where they were mixed with the rolled barley. When fed in this manner, the animals picked out the rolled barley and refused the urea-cottonseed mixture. The urea-cottonseed meal mixture was then mixed with ground barley in a proportion which allowed 1 pound of ground barley per head daily along with the urea-cottonseed meal mixture. The control lot also received 1 pound of ground barley per head daily. The remainder of the barley for respective groups was fed rolled. Native meadow hay was fed free choice in covered mangers. Fresh hay was weighed in daily and refusals were weighed out each week. The supplement was fed daily about 8 a.m. Water, salt, and a salt-bonemeal mixture were available at all times other than for 12 hours before each weighing.

The animals were weighed prior to going on the study and at 4-week intervals during the trial. All weights were taken after an overnight restriction from feed and water. The trial was conducted over a 20-week period.

Observations

The animal production data are presented in Table 6. In general, animal performance in the control group was on the low side of that normally obtained from the ration. Response to the lower level of urea feeding was greater than that of the higher level, suggesting that the higher level of urea was not as well utilized even with the additional energy supplement. Probably the most

Table 6. Average daily gain, feed efficiency, and cost per pound of gain for each treatment

Treatment	Average daily gain	Feed/lb. gain	Cost/lb. gain 1/
	(lb.)	(lb.)	(~~lb.~~ #)
1 (Control)	1.20	10.04	0.15
2 (Low barley-low urea)	1.48	7.61	0.11
3 (High barley-low urea)	1.48	8.14	0.12
4 (Low barley-high urea)	1.26	8.94	0.13
5 (High barley-high urea)	1.21	9.25	0.14

1/ Native hay was priced at $20, cottonseed meal at $80, urea at $120 and barley at $50 per ton in arriving at cost figures. No labor or yardage costs were charged.

interesting point in the data is the lack of response from the extra 0.5 pounds of barley at either level of urea (treatments 3 and 5 as compared to treatment 2 and 4). This may be due to protein limitation, or restricted or erratic hay intake with the higher level of barley feeding. This is similar to what happens when additional barley (energy) is given to range animals without additional protein. Also, it is interesting that the hay intake was lower for the animals on all the urea-containing rations than for the control animals. It has been reported that urea usually causes an increase in voluntary roughage intake.

Economy of gain followed the same pattern as gain, with the low barley-low urea giving the lowest cost gain (Table 6). The extra half pound of barley in the high barley rations did not increase gains or replace enough hay to lower the cost of gain. The daily supplement and average daily hay intake for each treatment are given in Table 7 and the average daily nutrient intake is given in Table 8. Hay intake was higher in the control group than all other groups and lowest in the high barley-high urea treatment.

Table 7. Daily intake of each feed component of the ration

Treatment No.	Barley	Cottonseed meal	Urea	Hay
	(lb.)	(lb.)	(lb.)	(lb.)
1 (Control)	2.0	1.0	----	9.05
2 (Low barley-low urea)	2.5	0.25	0.11	8.41
3 (High barley-low urea)	3.0	0.25	0.11	8.38
4 (Low barley-high urea)	2.5	0.125	0.14	8.50
5 (High barley-high urea)	3.0	0.125	0.14	7.93

Crude protein intake of animals in each treatment was adequate for them to make their respective gains. However, the calculated digestible energy intake of the control group was 7% above that which the National Research Council considers necessary for the gains made; whereas, in each of the urea-containing diets less or equal digestible energy was used for the particular gain of each treatment. The most efficient and economical gains were made by the low barley-low urea treatment group that used 9% less digestible energy than the National Research Council recommends.

Feed required per pound of gain was low on all treatments. These low averages might indicate that the quality of roughage was above average, although conventional chemical analysis did not bear this out. However, the feed conversion values of 7.61 and 8.14 found in the low urea rations are nearly equal to values found with feedlot cattle. This is especially interesting since the ration of the animals in this trial was nearly 75% meadow hay.

Table 8. Average daily crude protein and energy intake by animals on each treatment and calculated requirement of digestible energy for the gains made on each respective treatment

Treatment No.	Crude protein intake (N x 6.25)	Digestible energy Intake	Digestible energy Needed	TDN
	(lb.)	(Kcal)	(Kcal)	(lb.)
1 (Control)	1.37	14,260	13,320	7.13
2 (Low barley-low urea)	1.35	13,320	14,608	6.66
3 (High barley-low urea)	1.43	14,060	14,608	7.03
4 (Low barley-high urea)	1.40	13,280	13,596	6.64
5 (High barley-high urea)	1.41	13,362	13,366	6.69

Results of this trial and others conducted here indicate that urea can be substituted economically for some of the protein of the supplement. The extent to which it can be used depends on quality of the roughage, level of energy supplement, and method of feeding. Thorough mixing of the urea with enough other ration components to assure good distribution is important. Even with the proper urea:protein:energy ratio, improper mixing can lead to poor utilization of urea or toxicity.

LEVEL OF PROTEIN FOR TWO-YEAR-OLD HEIFERS DURING PREGNANCY

Calving difficulties of two-year-old heifers may be affected by the nutritional level of the heifer during the winter prior to calving. It has been well established that over-conditiong during the pregnancy period results in increased calving difficulty and poor reproductive performance. This leaves a choice of whether to feed heifers for moderate, continuous growth or "rough" them through the pregnancy period.

Some ranchers feel that feeding the two-year-old heifer more than a bare maintenance ration during pregnancy may increase the size of her unborn calf and thereby cause more calving difficulty. Previous work at this Station and at other locations has indicated that feeding level of the dam prior to calving has little or no influence on the birthweight of her offspring. Wintering heifers so that they fail to gain enough weight during the pregnancy period to compensate for their weight loss at parturition may be placing an undue burden on them during the lactating period. They must not only provide milk for their calves but also make continued growth if they are to reach maturity at a reasonable age.

When heifers are wintered on native meadow hay, protein is the primary limiting nutrient. Heifers fed meadow hay alone have a daily crude protein intake of about 1.2 pounds, depending on hay quality and the amount which they consume. The daily intake of crude protein suggested by the National Research Council for wintering a 700-pound pregnant heifer is 1.5 pound. Two years ago, studies were initiated to investigate the effect of protein intake during the winter pregnancy period on calf production in two-year old heifers. This past winter the effect of exercise during the later part of the pregnancy period on calving difficulty was included in the study. Further work is being conducted on both aspects of the experiment.

Experimental Procedures

In each of the past two years, 28 head of pregnant two-year old heifers have been equally allotted to two levels of protein intake for the wintering period. One group received a daily protein level of 1.2 pounds which was supplied by feeding either meadow hay alone or meadow hay plus a small amount of rolled barley. The other group received the same ration along with supplemental protein (cottonseed meal) to increase their daily protein intake to 1.8 pounds. The heifers were individually fed from mid-November until they calved in the spring. Length of feeding period varied from 107 to 137 days among individual heifers. This past winter, half of the animals receiving each level of protein were walked for two miles each day, while the other half were confined in a holding lot after the daily feeding. This phase of the work was imposed during the last 40 to 70 days prior to parturition.

Once the heifers had calved, they were removed from the study and were all given the same ration which was calculated to provide adequate nutrition for continued growth and lactation. During the following summer, the heifers were grazed in common on desert range and re-bred for their second calves.

The heifers used in this work had all been bred to the same sire during a 60-day period (June and July) of the previous summer. The animals were about 15 months of age at the start of the breeding season and averaged 600 pounds.

Observations

Measurements on the effect of protein intake during pregnancy on subsequent calf production are shown in Table 9. Heifers fed the higher level of protein gained almost four times as much as those fed the lower protein level; however, calf birthweights were not materially influenced by treatments imposed on the heifers. Heifers in thriftier condition at calving time as a result of higher protein intake through the winter had less calving trouble than those fed the low protein ration.

Gains made by the heifers during lactation favored those wintered on the low protein ration, although it would appear that a part of this gain may have been made at the expense of sufficient milk provision to their calves. Their calves averaged 22 pounds lighter at weaning time as compared to calves from heifers wintered on the high protein ration. The percent calves weaned and the number of heifers re-bred for their second calf was greater for the high protein group.

Table 9. Effect of protein intake during pregnancy on calf production

Measure	Level of protein Low	High
Number of heifers	28	27
Daily gain during pregnancy, lb.	0.20	0.75
Birthweight of calves, lb.	64.1	65.5
No. requiring assistance in calving	11	5
Daily gain of heifers during lactation, lb.	0.72	0.50
Weaning weight of calves, lb.	398	420
Percent calves weaned 1/	81	85
Percent heifers re-bred for 2nd calf	73	82

1/ Percent of heifers bred.

Heifers that were exercised daily during the late pregnancy period gained less weight than those confined; however, other observations made between these treatments failed to show any real differences (Table 10). This phase of the study has been conducted for only one year and the number of animals involved was quite limited. Another trial is currently in progress and upon its completion a more thorough evaluation of both phases of the study can be made.

Table 10. Effect of exercise during late pregnancy on calving difficulty and calf production 1/

Measure	Treatment Exercise	Confinement
Daily gain during late pregnancy, lb.	0.45	0.98
Birthweight of calves, lb.	65	62
Percent heifers requiring assistance	26	20
Weaning weight of calves, lb.	451	456
Percent heifers re-bred for 2nd calf	75	75

1/ Includes only one years' data.

FALL CALVING PROGRAM

Two years ago the Squaw Butte Experiment Station workers decided that studies should be conducted to determine some of the advantages and disadvantages of fall calving. A program was set up by which 60 cows would be bred so they would calve in the fall period rather than the usual March-April period.

Reasons for undertaking the study are listed as follows:

1. Light weaning weights of spring calves. Weaning weights of spring calves have increased through the years by employing a rigid selection and culling program, through the use of good management, nutrition, and range management practices. However, weaning weights have reached a level above which further progress is slow under this environment.
2. Better use of high quality early-season range forage. Range forage quality on the sagebrush-bunchgrass range area is such that yearling cattle gain in excess of 2 pounds per day during May, June, and part of July. Spring calves are not able to take full advantage of this and they gain about 1.75 pounds during May and early June and then drop off so they are gaining about 1 pound per day by the latter part of July, 0.5 pounds by the end of August, and relatively no gain if left on range after the first of September. Fall calves should have enough size and age so they can make good use of high quality forage during the May-July period.
3. More size and age on heifers. About 5 years ago, the Station started breeding heifers to calve at 2 years of age. Prior to that most of the heifers were calved at 3 years of age. Research and records have shown that, while we get a high calf crop in th first year with the two year-olds, conception drops to about 75% when these heifers are bred back for their second calves. By using spring-born heifers in the fall calving herd and fall-born for the spring calving herd, these heifers are 20 to 21 months old at first breeding rather than 14 to 15 months old.
4. More flexibility and lower cost of selection and culling. By maintaining a spring and fall calving herd, females that do not breed in one group can be put in the other group for a second chance with a half year's loss of production rather than the usual year with a one-calf season. This makes it possible to give an animal with a sizeable investment in it another opportunity to prove itself at only a half year's extra maintenance cost.

5. Lower cost of breeding. By splitting the cow herd and breeding in two seasons, the size of the bull herd can be reduced by one-half. It will probably take extra feed and care of the bulls, but savings in initial investment should far exceed the extra feed cost. Also, the fall calving group, bred during the winter under more confined quarters than on the range, offers a good possibility for artificial insemination practices, or for single-sire matings.

6. Disease and sanitation. Calving in spring on the flood meadows always presents a disease and sanitation problem. Scours of various types, pneumonia, and even drowning contribute to a baby calf loss ranging up to 10% in some years. Fall calving provides dry meadows, and disease and sanitation problems should be considerably fewer with the winter freeze.

The problems and possibly the disadvantages of fall calving that need to be studied are as follows:

1. Time to drop fall calves. Should calves be early to take advantage of better weather when calves are young? This lengthens the time for winter feeding of lactating animals and increases costs. Also, it decreases the possibility of getting increased milk production from the cows when they get on green feed in the spring. Calves born earlier may, however, be able to take advantage of spring feed better than those born later.

2. Nutrition and management for winter lactation. Cattle coming off range in good condition in the fall and due to calve in the spring can be wintered at a relatively low plane of nutrition; whereas, those calving in the fall will need a considerably higher level of nutrition to provide for the milk production necessary to nourish their calves. The extra size of the calves will be necessary to offset this cost.

3. Nutrition and management for winter breeding. Cows dropping calves in fall will have to breed back in the winter, and, if high conception rates are achieved the cows will need to be on a good plane of nutrition. However, if nutrition is adequate to maintain milk production, this should also meet the breeding requirements. Also, the closer confinement of animals during the winter should favor higher conception rates than breeding on the range.

4. Nutrition and management of calves. Creep feeding of suckling calves has been shown to be economical. With range cattle this is not always practical, or even possible in many cases. However, fall calves on meadows during the winter offer an excellent opportunity to evaluate creep feeding. Supplementing yearlings on range during the time when forage quality is high results in gain increases that are economical. Similar responses should be expected from fall calves; however, levels of various nutrients required need to be studied.

5. Marketing fall calves. Spring-born calves are usually marketed in the fall as weaners or held over and sold as long yearlings off the range the following summer or fall. These yearlings usually weigh between 600 and 800 pounds, and by the time they are finished in the feedlot their carcasses are generally heavier than desired by packers. If fall calves gain at a normal growth rate, 1.75 to 2.0 pounds per day, during the suckling period, they should weigh about 550 pounds by July 1 or 600 pounds by August 1. This would put 8 to 9 month old cattle directly into the feedlot with 8 months to a year less age on them than with the present calf-yearling operation.

Experiment Procedures

Current goals of the Station, regarding this project, are to adjust the Station cattle so about equal numbers are in the fall and spring calving groups. This will give adequate numbers to study the various fall calving problems and compare them to the spring calving group. As resources and time permit, research will be conducted to provide answers to the problems and questions raised and others that will surely arise as the study progresses. Practical, economic, and academic questions will be considered.

At the present time, we have 60 fall calves, born in October and November, that are suckling their dams and being creep fed a cottonseed meal, barley, and alfalfa pellet supplement. The bulls were with these cows, and 48 additional cows, during January and February. Rate of conception will be determined by pregnancy testing just prior to the start of summer breeding (June 1) for the spring calf group. Depending on individual production records, cows that fail to conceive will either receive a second chance or will be culled at that time. This should give approximately 100 calves next fall which will permit more detailed studies.