Summary of Reports . . .

Seventh Annual
Beef Cattle Day

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Contents

Protein Levels in Finishing Rations for Yearling Cattle

W. H. KENNICK, E. N. HOFFMAN, and J. E. OLDFIELD

SUPPLEMENTAL PROTEIN has been demonstrated to be of economic value in many types of livestock rations, particularly in the young growing animal. It has also been demonstrated with poultry that very high rates of gain are obtained only with high levels of energy and protein. Our modern high energy rations are producing rates of gain far in excess of those accepted as excellent when our feeding standards were compiled. This suggests the possibility that protein levels may be marginal and limiting in some of our high energy rations, even for yearling cattle when they are gaining in excess of three pounds a day.

With these facts in mind, an experiment was designed to determine the effects of supplemental protein on growth rate, feed efficiency, and carcass characteristics when fed with a high energy ration to yearling steers and heifers. The experiment was conducted for two succeeding years using the following rations:

Lot 1—Steers, 12% crude protein
1. Steam rolled barley 50%
2. Dried beet pulp 25%
3. Ground ear corn 25%
4. Protein supplement
   a. 50% soybean meal
   b. 50% alfalfa meal

Lot 2—Heifers, 12% crude protein
1. Same as Lot 1

Lot 3—Steers, 10% crude protein
1. Steam rolled barley.............50%
2. Dried beet pulp 25%
3. Ground ear corn 25%

Lot 4—Heifers, 10% crude protein
1. Same as Lot 3

Lot 5—Steers, 9.3% crude protein
1. Long alfalfa hay
2. Ground ear corn

Lot 6—Heifers, 9.3% crude protein
1. Same as Lot 5

The ration fed to Lots 5 and 6 is a basic control ration which has been fed for many years at the Malheur Experiment Station.

Long alfalfa hay was fed to Lots 1 through 4 during the first three weeks of the feeding period to get them "on" the all-grain ration. The protein supplement was fed at the rate of 1 pound of supplement to 10 pounds of grain mix. Lots 1 through 4 received 20,000 I.U. of vitamin A per day in their feed which was also supplemented with salt at the rate of 2 pounds per 100 pounds of grain. Steam bonemeal and salt were available to all lots—free choice.

One-half of the animals in each lot were implanted with 36 milligrams of stilbestrol at the beginning of the feeding period.

In the first year, the steers were fed for 174 days and the heifers for 132 days. Because of heavy starting weights and high rates of gain, these feeding periods produced excessively heavy cattle the first year. As a result, it was decided to terminate the second year's trial on a final weight basis. Therefore, heifers were marketed at 975 to 1,000 pounds and steers at 1,175 to 1,200

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pounds. Under this procedure, the heifers were fed 84 to 133 days and the steers 119 to 161 days.

Results

Because group feeding was used, it is not possible to statistically analyze the feed conversion data from this experiment. It can be stated, however, that the control ration (pens 5 and 6) required about 9 pounds of feed to produce a pound of gain and that the two high concentrate rations (pens 1 thru 4) required about 7.5 pounds of feed per pound of gain.

The two high concentrate rations produced significantly higher ADG (average daily gains) than did the control, but there was no significant increase in ADG attributable to protein supplementation (Table 1).

There was a highly significant difference in ADG between the two years, probably attributable to the shorter feed period used the second year.

Stilbestrol increased the ADG of steers and heifers by 0.27 and 0.11 pounds, respectively.

All treatment groups produced carcasses with at least average choice conformation. However, there were some small but significant differences between years and sexes, as well as a stilbestrol x sex interaction. Stilbestrol improved conformation in heifers, while reducing it in steers.

With uniform cattle of this type, marbling tends to be the determining factor in grade. It is interesting to note, therefore, that the small difference in marbling attributable to nutritional treatment is significant only at the 10% level. The control, the protein supplemented, and the unsupplemented high energy rations produced carcasses with small minus, average small, and small plus amounts of marbling, respectively. There was no significant difference in marbling between years, in spite of the shorter feed period the second year. Stilbestrol reduced the amount of marbling in steers by approximately one-third of a degree.

The combination of effects on conformation and marbling mentioned above produced small (less than one-third of a grade) but significant differences in USDA carcass grade; heifers graded lower than steers; implanted steers graded lower than unimplanted steers (Table 2); and cattle on the control ration graded lower than those on the high concentrate ration (Table 3). There was no significant difference in USDA grade attributable to protein supplementation or (in heifers) to stilbestrol implantation.

Two of the factors used in estimating carcass cutout values are loin-eye area and thickness of fat over the loin eye. There was a highly significant difference in loin-eye associated

Table 1. Average daily gain as affected by nutritional regime

	HE + P	HE	Control	Year mean
1963	2.74	2.58	2.40	2.57[1]
1964	3.06	3.08	2.80	2.98
Nutrient mean	2.90	2.83	2.60[2]	

[1] Significantly different than 1964 at the 1% level.

[2] Significantly different than the HE rations at the 1% level.

Table 2. The affect of stilbestrol on the USDA grade[1] of steers and heifers

	Stilbestrol	Control	Mean
Steers	15.37	16.26	15.82
Heifers	15.13	15.20	15.17[2]
Mean	15.25[3]	15.73	

[1] 14 = average good; 17 = average choice.

[2] Significantly different from steers at the 1% level.

[3] Significantly different from control at the 5% level.

Table 3. USDA grade[1] as affected by nutritional regime

	HE + P	HE	Control	Mean
1963	15.65	16.15	15.25	15.68
1964	15.35	15.50	15.05	15.30
Mean	15.50	15.82	15.15[2]	

[1] 14 = average good; 17 = average choice.

[2] Significantly different than the HE rations at the 5% level.

with years and nutrition, which is accounted for by differences in carcass weight since the loin-eye areas per hundredweight of carcass are almost identical. The heifers, however, have a greater loin-eye area/cwt. (1.98 sq. in.) than do the steers (1.76 sq. in.).

There was a highly significant reduction in fat thickness in the second year (1.62 mm./cwt.) as compared to the first year (1.93 mm./cwt.) when the cattle were fed to a heavier weight. Also, the high energy rations produced thicker fat (1.85 mm./cwt.) than did the control ration (1.65 mm./cwt.).

Estimates of the yield of trimmed retail cuts from the carcasses indicate a significantly higher yield from heifers as compared to steers and from the second year's cattle as compared to the first. This is partially accounted for by the fact that lighter cattle yield a higher percent of trimmed cuts, but also contributing is the reduced fat thickness/cwt. the second year and the larger loin eyes/cwt. of heifers.

Conclusions

1. High energy rations produced faster gaining cattle that yielded higher grading carcasses than did cattle on a conventional hay and grain ration.

2. Protein supplementation did not improve rate of gain or the feed efficiency of high energy rations.

3. Stilbestrol improved the rate of gain of both steers and heifers but caused a very slight reduction in USDA grade of steer carcasses.

4. Heifers and steers were equal in average daily gains.

5. Heifer carcasses graded slightly lower than steers, but they had a higher estimated yield of trimmed retail cuts.

Measurement and Evaluation of Dietary Preferences of Grazing Animals

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Sustained high production of pasture and range forage and its conversion into high quality acceptable animal products is the acknowledged goal of range, pasture, and animal management. The term "management" implies knowledge of the multitude of factors involved in achieving and maintaining adequate production levels. A knowledge of the grazing animal's forage preferences and the nutritive value of these species may be properly included as factors in management.

If stockmen and land managers could predict animal preferences with reasonable accuracy in relation to the type of pasture grazed, it would be possible then to manipulate and manage vegetation to better meet animal needs and/or to better manage the animals in order to gain the greatest benefit from the type of vegetation produced.

General observations indicate that cattle prefer grasses to broadleaved plants and sheep prefer broadleaved plants to grasses. Very little is known about the relative preference of both classes of stock on the same pasture or range type. Changes in animal preference during the grazing season under differing stocking levels and the consequent dietary changes in nutritive value are largely unknown.

Both cattle and sheep are selective grazers, i.e., they show preferences for some plants over others and even for specific plant parts. During the last decade, studies have indicated that both cattle and sheep select diets of somewhat higher nutritive value than that contained in the total forage available to them. Differences in nutritive value of material selected while grazing exist between cattle and sheep; cattle diets may contain less crude protein but more energy than sheep diets.

Research at Oregon State University is presently under way to evaluate dietary preferences of both cattle and sheep on two improved dryland pasture types in western Oregon. These are tall fescue-subterranean clover and perennial ryegrass-subterranean clover; both types are grown on the same site on the Oregon State University Adair tract north of Corvallis. A first-year progress report on this research follows.

Objectives

Esophageal-fistulated animals are used to obtain dietary samples of both pasture types throughout the spring-summer grazing season to determine the following characteristics:

1) The percent species composition of the diet in relation to the percent species composition of the pasture as a whole.
2) The dietary crude protein content compared to that contained in the forage.
3) The digestibility of dietary samples compared to the digestibility of the available forage.

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Procedure

Estimation of the dietary composition of grazing animals is made much more accurate by using them to obtain dietary samples. Animals equipped with esophageal fistulas are ideally suited for this purpose. Prior to development of this method, visual observation of grazing animals and hand clipping of observed plants in the diet served as the primary method of estimating diet composition from a chemical standpoint.

An esophageal fistula is obtained by cutting a hole in the esophagus and suturing the esophageal tissue to the skin. A closure device consisting of a small pipe and a rubber plug allows them to subsist normally. With the plug removed, most of the ingested food passes out through the fistula rather than down the esophagus. To obtain diet samples on pasture, the plug is removed; a canvas, screen-bottomed bag is attached around the animal's neck; and the animal is allowed to graze freely. Thus, grazed forage can be recovered to serve as a sample of the diet. After approximately one hour or less of grazing, animals are caught and plugs reinstalled so that animals may be returned to pasture. Dietary samples are then taken to the laboratory where various analyses are conducted.

Both dietary and hand-clipped forage samples are analyzed for crude protein content at various times during the grazing season. Other chemical measures could be made, but it is felt that crude protein content is probably the best overall chemical index of forage value.

Estimated digestibility of the forage and diet dry matter is determined in the laboratory with the artificial rumen technique. The major objective is not to obtain an exact measure, but rather a relative ranking of the digestibility of forage and diet samples throughout the season. A ruminal-fistulated steer on good alfalfa hay in drylot provides the rumen fluid with which to inoculate the artificial rumen flasks.

Two, 2½-acre pastures each of fescue-clover and ryegrass-clover were fenced in early 1964. Esophageal-fistulated animals were introduced in mid-April and allowed to graze until September 1. Dietary and forage samples were collected at biweekly intervals until early July and at monthly intervals until September 1.

Stocking level in 1964 was very light. At no time during the 1964 season was amount of forage limited; thus, animals had complete choice of forage from both grass and clover at all times.

In 1965, pastures have been further divided so grazing intensity will be sufficiently great in some pastures to limit available forage to animals. The pattern of preferences may be different from 1964 after preferred forage becomes limited.

Results

Forage production reached a maximum in mid-June. On a 100% dry-matter basis, maximum available forage was approximately 5,400 pounds per acre under grazing in mid-June for both pasture types. Data from fenced plots indicated that the fescue-clover pastures produced approximately 1,600 pounds more total dry matter per acre than ryegrass-clover pastures.

Tall fescue remained green throughout the summer grazing period, whereas both ryegrass and subclover were above 60% dry matter by mid-July. Sheep preferences were affected by the differential in dry-matter content between fescue and subclover in summer, but cattle preferences were not greatly changed in either of the two pastures.

In ryegrass-clover pastures grazed by cattle, subclover comprised 60 to 70% of the available forage, and in the sheep-grazed pasture it made up 45 to 60% of the available plant material. Subclover in both cattle- and sheep-grazed fescue-clover pastures declined from about 45% in April to 30% in August on a weight basis.

Dietary species composition. As regards species preferences, cattle preferred both ryegrass and alta fescue to subclover, regardless of stage of maturity of either grass or clover (Table 1). The preference of cattle for fescue was slightly greater than for ryegrass during the summer period, probably because of the greater amount of moisture contained in fescue forage.

When grazing the ryegrass-clover pasture during April through mid-June, sheep exhibited a slight preference for subclover over ryegrass. As both ryegrass and subclover matured and dried, preference for dry clover was strongly accentuated (clover made up over 90% of the diet during August).

On fescue-clover pasture, during April through mid-June, sheep strongly preferred subclover to fescue, selecting 60 to 80% of their diet as clover. But as clover became dry, sheep preference changed strongly to the still-green fescue, which accounted for 75 to 85% of their diet during July and August.

Crude protein content. Ryegrass-subclover forage consistently contained more crude protein than did fescue-subclover forage. Two factors appeared to be responsible for this. Ryegrass contained more crude protein than did alta fescue even when ryegrass was dry and fescue green. Also, the ryegrass pastures contained more subclover which had a higher content of crude protein than either grass species, even when clover was dry.

Cattle on both pasture types selected diets slightly higher in crude protein content than present in the total forage, except for diets of ryegrass-clover after late June. Cattle selected only dry ryegrass which contained less crude protein than the total forage mixture.

In comparing cattle diets between pasture types, it was found that cattle on ryegrass-clover selected a higher protein diet until early June than did cattle on fescue-clover. Thereafter, crude protein content of fescue-clover cattle diets was greater than ryegrass-clover diets, even though available forage protein content of ryegrass-clover was higher throughout the season than fescue-clover.

Table 1. Preferences exhibited by cattle and sheep grazing alta fescue-subclover and perennial ryegrass-subclover pastures in western Oregon

Pasture type	Grazing period	Amount of grass or clover in the diet	
		Cattle	*Sheep*
Fescue-clover	April-June	75% fescue	60-80% clover
Fescue-clover	July-August	90% fescue	80% fescue
Ryegrass-clover	April-June	75% ryegrass	60% clover
Ryegrass-clover	July-August	90% ryegrass	75% clover

Sheep consistently selected a higher protein diet than did cattle, regardless of pasture type. Sheep also selected a diet containing much more protein than the average available in the total forage. This was especially pronounced in fescue-clover diets, probably due to a higher clover diet early in the season. Because of the greater clover preference early in the season by sheep on fescue-clover, their diets contained more crude protein than did those of sheep on ryegrass-clover, even though the available forage mixture of ryegrass-clover always contained more crude protein than fescue-clover.

Digestibility. The digestibility of available forage dry matter declined appreciably throughout the season for all pastures. The greatest decrease occurred during June which coincided with flower emergence of the major forage species. Only small differences existed between pastures at any one sampling period. During the summer period, the green fescue-dry clover forage was not digested to any greater degree than was the dry ryegrass-clover forage. This was probably due to a higher clover content in the ryegrass-clover forage which contributed to a greater digestibility of that mixture.

Esophageal-fistula diet samples did not digest properly in the artificial rumen. Consequently, no information on diet digestibility is available.

Conclusions

Definite preference differences existed between cattle and sheep on the same pasture types, except during the summer period on fescue-clover when both classes of stock preferred fescue to clover. Differences in species composition of diets were reflected in nutritive content differences between classes of animals and between pasture types. Hopefully, the 1965 work will further define dietary preferences of cattle and sheep on these two pasture types.

The Use of Fat in Beef Cattle Rations

D. C. Church

The use of fats in animal feeds has increased greatly over the past few years. Since the late 40's the United States has been a net exporter of fats. Consequently, more fat has been available, often at lower costs which have often been competitive with other feedstuffs.

The fats that are most commonly used in animal feeds are inedible animal fats designated as tallow or grease. These products are usually made from carcass parts or come from rendering plants and so forth, and cannot be used in human foods. Tallow is usually of higher quality than grease, although the two products are differentiated on the basis of their titer which is essentially a measure of the temperature of solidification. The names, tallow or grease, do not indicate the origin of the fat. Regardless of their source, fats with a titer of 40° C. or higher are called tallows, and those with titers less than 40° C. are called greases. Usually, fats used in animal feeds have antioxidants added to them. The antioxidants prevent the fat from becoming rancid and, consequently, allow feeds with added fat to be kept for a much longer period of time.

The nutritive value of added fat in ruminant rations has been investigated at a number of experiment stations in a variety of situations. Some of the work that has been done will be reviewed briefly.

Added fat has been used extensively in the preparation of manufactured feed because of its ability to reduce the dust problem. Many feed processors spray fat onto baled hay prior to grinding. The lubricant properties of fat also are an aid in pelleting, resulting in a greater rate of production and less wear on machinery.

From a nutritional point of view, fat is used as an energy source to replace carbohydrate feeds such as the cereal grains. Recent work reported by Lofgreen and others (*1*) from California indicates that the net energy value of fat is equivalent to 2.5 times the value of barley for fattening cattle. If this is the true value, then if barley is worth \$40 per ton, the fat should be worth 5¢ per pound; at \$50 per ton for barley, fat is worth 6¼¢ per pound; at \$60, fat is worth 7.5¢ per pound. These comparisons do not include the value of the protein in barley nor do they include the value of any minerals that may be present.

In research from Arizona (*2*) it was reported that the addition to steer fattening rations of 4% tallow and 1% dicalcium phosphate resulted in increased gain and improved feed conversion. Another report (*3*) indicated that the addition of either 4% tallow or 4% of a combination of vegetable and animal fat resulted in an increase in digestible energy along with variable effects on other nutrients. However, the added fat resulted in reduced storage of liver vitamin A.

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In some Texas work done in 1952 (*4*) fat was fed at levels of about 2.9% and 7.5% of the rations used. The authors reported that there was an improvement in feed efficiency, but they found no effect on rate of gain or carcass grade due to the addition of fat. Feeding the higher level of fat (cottonseed oil) resulted in higher blood carotene and blood fat. In addition there was less fat deposition over the rib, although the body fat showed a lower iodine number (indicating a harder fat). The color of the rib eye was considered more desirable in steers fed the 2.9% fat rations.

In a recent trial carried out at the Hermiston station (*5*), Ralston and others investigated the effect of adding fat to rations in which wheat was the predominant grain. In this trial either 3.5 or 7.0% stabilized beef tallow was added to the basal ration, and the experiment was carried out using yearling cattle. In this trial the cattle receiving the 3.5% added fat gained faster and were more efficient than those receiving the basal or basal plus 7.0% added tallow. There were no demonstrable differences in carcass characteristics studied (marbling, backfat thickness, grade, or estimated yield of trimmed cuts). It should be noted that if the improvement in feed efficiency usually found with fat additions is expressed on the basis of TDN (total digestible nutrients) or some other energy measure such as digestible energy, fat usually has little effect on feed conversion. This is so because such measures as digestible energy take into account the high energy value of fat.

Edwards and others (*6*) at North Carolina fed 2.5 or 5.0% animal fat to steers. They found that the addition of fat to rations resulted in an increase in percentage of separable rib fat in those animals previously receiving low-energy rations, but not in steers wintered on a higher energy ration. Similar results were noted with respect to thickness of the rind over the rib. Addition of fat resulted in an increase in stearic acid content of rib fat. In addition, they found that stilbestrol implants had some effect on various fatty acids in rib fat.

In further work from North Carolina (*7*), the authors added 5% of either yellow grease, hydrogenated cottonseed oil, or crude cottonseed oil to a ration containing about 70% ground shelled corn. Heavy steers (initial weight, 702 pounds) consumed less and gained less when fed rations containing added fat. Light steers (initial weight, 623 pounds) consumed about the same amount of feed and gained more when fed rations with added fat. Feed efficiency was improved about 8.5% by added fat. Steaks from steers fed hydrogenated cottonseed oil were less desirable in flavor than others, and steaks from steers fed crude cottonseed oil were less tender than other groups.

In recent Canadian research (*8*), either 5% crude rapeseed oil, crude sunflower seed oil, or prime tallow were added to a basal ration containing barley and oats. Although the authors found no statistically significant differences, the steers fed sunflower seed oil consumed more feed, were more efficient, and had an appreciably higher amount of separable fat in the 9-11 rib cut than did steers on the other treatments. Digestibility of energy was not influenced to any appreciable extent by added fat or oil. Some differences in body fat composition were noted.

Bohman and others (*9*) at Nevada have studied the use of fat in wintering rations for cattle. Their results indicate that fat can be used for wintering cattle; winter gains of cattle receiving 0.5 pound of fat were about the same as those without fat; however, total gains over the winter and summer grazing season resulted in somewhat greater gains for animals receiving added fat. The response obtained would not be economical at present fat prices, however.

Fat has been used successfully in North Carolina to control intake of grain when self-fed to cattle on summer pasture (Bermuda or orchardgrass). The research reported indicates that 10% fat added to ground shelled corn will limit intake to about 0.8 pound of feed per 100 pounds of body weight. This application, at least in the southeast, appears to be preferable to limit feeding with salt. Gains and profits have been greater with fat than with salt.

Fat has been used for one other important purpose—to control bloat. In this connection it has been used extensively by New Zealanders and has been sprayed onto pasture forage. In other cases, there is some indication that fat added to dry rations tends to reduce the amount of bloat in dry-lot fed animals.

REFERENCES CITED

1. Lofgreen, G. P. 1964. Fat and molasses as energy sources in feedlot rations. Proc. 4th Annual California Feeder's Day.
2. Hubbert, F., B. Taylor, E. B. Stanley, W. H. Hale, and J. Kuhn. 1961. Factors influencing tallow utilization in Arizona feedlot rations. Proc. West. Sec. Amer. Soc. Animal Sci., *12*:34.
3. Esplin, G., W. H. Hale, F. Hubbert, Jr., and B. Taylor. 1963. Effect of animal tallow and hydrolyzed vegetable and animal fat on ration utilization and rumen volatile fatty acid production with fattening steers. J. Animal Sci., *22*:695.
4. Willey, N. B., J. K. Riggs, R. W. Colby, O. D. Butler, and R. Reiser. 1952. The influence of level of fat and energy in the ration upon feedlot performance and carcass composition of fattening steers. J. Animal Sci., *11*:705.
5. Ralston, A. T. 1965. Wheat in current beef cattle rations. Feedstuffs, *37*(*16*) :18.
6. Edwards, R. L., S. B. Tove, T. N. Blumer, and E. R. Barrick. 1961. Effects of added dietary fat on fatty acid composition and carcass characteristics of fattening steers. J. Animal Sci., *20*:712.
7. Ellis, I. J., Jr., M. B. Wise, T. N. Blumer, and E. R. Barrick. 1962. Influence of degree of saturation of fats fed to steers in dry lot. J. Animal Sci., *21*:994.
8. Roberts, W. K., and J. A. McKirdy. 1964. Weight gains, carcass fat characteristics and ration digestibility in steers as affected by dietary rapeseed oil, sunflower seed oil and animal tallow. J. Animal Sci., *23*:682.
9. Bohman, V. R., M. A. Wade, and C. R. Torell. 1962. Effect of dietary fat and graded levels of alfalfa on growth and tissue lipids of the bovine. J. Animal Sci., *21*:241.

Crossing Lines of Cattle Within A Breed

RALPH BOGART

THREE INBRED LINES of Hereford cattle at Corvallis and one at Union were started in 1947. These lines have been called (1) Lionheart, (2) Prince, (3) David, and (4) Union. With the exception of some original cows that were common in the Prince and David lines, the four lines were established from unrelated material.

Selection has been concerned with improvement of fertility, milking ability, rate of gain, feed efficiency, and carcass merit as appraised in the live animal. In addition, animals showing inherited defects were culled.

Both bulls and heifers were put on feed test at Corvallis, whereas only the bulls were tested for feed efficiency at Union. The cattle at Corvallis were on test from a weight of 500 pounds to a weight of 800 pounds, while at Union they were fed for a given time. The ration used at Corvallis was composed of two parts roughage to one part concentrate, while that used at Union was one part roughage to two parts concentrate.

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After the cattle had been bred as closed lines with rigid selection for a period of approximately 10 years, bulls from each of the four lines were mated to randomly selected grade cows at the Union station to obtain a comparative appraisal of the lines for their genetic merits.

The data obtained concerned the production and carcass characteristics of the steers sired by bulls of each of the four lines and the calf-producing ability of heifers sired by bulls of the four lines.

Data on the production of the three lines of Herefords at Corvallis are presented in Table 1 to show how these lines differed.

It can be seen that the calves in the Prince line have been the most efficient in use of feed even though their rates of gains have been similar to that of calves of the other two lines. In general, suckling gains of calves in the David line have been lower than gains of calves in the other two lines, and the Lionheart line calves have been superior to the other two lines in suckling gains.

Table 1. Performance of calves produced in the three lines of Herefords at Corvallis

Line	Sex	Number	Suckling gains	Feed test gain	Feed per 100 lbs. gain
Lionheart	Male	64	1.85	2.84	702
	Female	59	1.66	2.13	944
Prince	Male	54	1.78	2.89	661
	Female	50	1.60	2.25	815
David	Male	59	1.68	2.87	708
	Female	42	1.63	2.28	894

Table 2. Production and carcass characteristics of steers sired by bulls of four inbred lines

Line sire	No. steers	Average daily gain during nursing period	Daily gain in feedlot	Slaughter weight	Carcass weight	USDA grade
Lionheart	18	1.56	2.26	1,014	596	14.9
Prince	15	1.52	2.10	978	577	15.5
David	25	1.55	2.26	1,032	605	14.6
Union	21	1.49	2.13	958	556	13.8

The production and carcass characteristics of steers sired by bulls of the four lines are shown in Table 2.

It can be seen from Table 2 that live animal and carcass weights were highest for steers sired by bulls of the Lionheart and David lines, intermediate for steers sired by bulls of the Prince line, and lowest for steers sired by bulls of the Union line. These differences in final weights were attributable to differences in suckling and feedlot gains. The steers sired by bulls of the Lionheart and David lines made more rapid gains than those sired by bulls of the Prince and Union lines in both the suckling and feedlot periods.

USDA grades were superior for steers sired by bulls of the Prince line, intermediate for those sired by bulls of the Lionheart and David lines, and lowest for those sired by bulls of the Union line.

The production of heifers sired by bulls of the four lines is shown in Table 3.

It can be seen from Table 3 that the calving percentage and weaning weights adjusted to 205 days were highest in heifers sired by bulls of the Lionheart and David lines, intermediate in those sired by bulls of the Prince line, and lowest for those sired by bulls of the Union line. These differences in calving percentages and weaning weights resulted in marked differences in pounds of calf produced per cow per year by these two- and three-year-old cows.

Scores for conformation and condition were generally comparable among the groups of calves, even though those raised by cows sired by bulls of the Prince line were somewhat higher in both scores than the other calves.

All possible crosses have been made

Table 3. Production of heifers sired by bulls of four inbred lines

Line of sire of heifers	Live calves	Calving	Weaning wt. adjusted to 205 days	Calves produced per cow bred	Conf. score	Cond. score
	No.	*Percent*	*Lbs.*	*Lbs.*		
Lionheart	46	85.2	389	331	8.55	8.40
Prince	36	69.2	377	261	9.00	8.70
David	26	83.9	387	324	8.58	8.38
Union	39	57.4	357	205	8.66	7.74

Table 4. Performance of inbred and linecross calves

Kind of calves	Sex	Number	Suckling gain	Feed test gain	Feed per 100 lb. gain	Conf. score	Cond. score
			Lbs.	*Lbs.*	*Lbs.*		
Inbred	Male	15	1.78	2.80	610	11.8	11.5
	Female	11	1.79	1.95	859	11.6	11.5
Linecross	Male	37	1.79	2.89	595	11.9	11.7
	Female	29	1.66	2.26	740	12.0	12.1

among the three lines at Corvallis, and results are available on calves produced during a two-year period. The performance of inbred and linecross calves is presented in Table 4.

It can be seen from Table 4 that linecross calves did not show any advantage over inbred calves for suckling gains. This is largely a reflection of the fact that milk production of the inbred dams of both groups of calves was not sufficient for better-doing calves to be able to express their genetic advantage. Feed-test gains and efficiency were superior for the linecross calves when they were compared with the inbred calves. A much greater advantage was shown by the linecross heifers over the inbred heifers for rate and efficiency of gains than for linecross bulls over inbred bulls for these two traits. Thus, hybrid vigor in rate and efficiency of gains was markedly greater in the females than in the males. This same tendency for greater hybrid vigor in the females than in the males was also evident in scores for conformation and condition.

The three kinds of crosses are compared in figures presented in Table 5 for production records on 1 x 2, 1 x 3, and 2 x 3 linecross calves.

It can be seen from Table 5 that rate of gain and scores for conformation and condition were lowest for 2 x 3 calves. Feed efficiency was best in the crosses in which the Prince line (2) was involved. One can recall that this inbred line also was the most efficient.

Table 5. Performance of linecross calves according to type of linecross

Type of linecross	Sex	No.	Suckling gain	Feed-test gains	Feed per 100 lb. gain	Conf. score	Cond. score
			Lbs.	*Lbs.*	*Lbs.*		
1 x 2 and 2 x 1	M	11	1.82	2.85	606	12.5	12.1
Lionheart x Prince	F	15	1.64	2.29	750	12.0	12.0
1 x 3 and 3 x 1	M	14	1.76	2.98	588	11.5	11.4
Lionheart x David	F	8	1.73	2.27	725	12.3	12.4
2 x 3 and 3 x 2	M	12	1.80	2.82	592	11.8	11.6
Prince x David	F	6	1.59	2.16	733	11.7	11.8

Summary

In general, lines showing superiority produce calves showing superiority when combined with a common population of grade females or when these lines are crossed in all possible ways. Also a line which possesses an outstanding trait will tend to transmit this outstanding trait to its offspring when this line is used for crossing within a breed. There appears to be more heterosis (hybrid vigor) expressed in females than in males when lines are crossed within a breed of cattle.

Range Seeding Can Pay!

THOMAS R. BUNCH

OREGON HAS 42 million acres of rangeland. Range livestock products account for approximately 25% of the agricultural income of the state, an amount in excess of $120,000,000 annually. Additional benefits are derived from unknown recreation, conservation, and watershed values. The potential for increasing carrying capacity and, therefore, increasing income to the range livestock producer, is tremendous; possibly greater than most realize.

Range research was activated in east-central Malheur County, Oregon, to evaluate potential range production and provide physical-biological information for a range economic study using linear programming.

Methods

Paired exclosures were located on range sites throughout the study area; one exclosure on the improved (seeded to crested wheatgrass) and one on the unimproved portion of the same range site. Four, 9.6-square-foot plots were clipped from each exclosure in 1963 and 1964. Frequency samples were obtained at each location to evaluate the condition of the crested wheatgrass stand. Frequency is defined here as the ratio between the number of sample areas that contain crested wheatgrass plants and total number of sample areas (percentage of square-foot units stocked by crested wheatgrass).

Results

Herbage production was variable between plots and between years. Table 1 shows the average production for eight paired exclosures occurring on one range site sampled. This site was characterized by big sagebrush (*Artemisia tridentata*) and bluebunch wheatgrass (*Agropyron spicatum*).

Total herbage production increased three times on improved plots compared to unimproved plots. Crested wheatgrass production was two and one-half times the total herbage production of the unimproved plots. Herbage production on improved plots consisted predominantly of crested wheatgrass (*Agropyron desertorum*), with

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Table 1. Total herbage and crested wheatgrass production on the same range site in improved and unimproved situations (two-year average)

	Unimproved	Improved	
	Total herbage	Total herbage	Crested wheatgrass
	Lbs./A.	*Lbs./A.*	*Lbs./A.*
	150	600	450
	250	400	350
	250	700	600
	200	300	250
	200	1,200	1,050
	50	1,400	1,350
	350	550	400
	500	850	600
Total	1,950	6,000	5,050
Average	250	750	650

Table 2. Crested wheatgrass production and associated frequency and stand evaluation

Production	Frequency	Stand evaluation by frequency
Lbs./A.	%	
450	48	Good
350	46	Good
600	50	Excellent
250	54	Excellent
1,050	70	Excellent
1,350	78	Excellent
400	40	Good
600	35	Fair

the remainder predominantly cheatgrass (*Bromus tectorum*). Total herbage production on unimproved plots was predominantly cheatgrass, as few or no perennial species occurred on any of the plots sampled.

Four of the plots (crested wheatgrass stands) sampled were classified excellent, three good, and one fair, using the standards of Hyder and Sneva (1954).[1] Table 2 reveals the crested wheatgrass production and frequency.

It appeared that there was no direct correlation between frequency and production. The lowest producing plot was evaluated by frequency as excellent. The lone plot classified as fair outproduced four of the other plots. This may have been due to the erratic weather conditions in 1963 and 1964.

Full value of range seedings is realized only when they fill the need of obtaining a balanced year-around forage supply. Improvements must increase livestock products (income) to

[1] Donald N. Hyder, and Forrest A. Sneva, A method for rating the success of range seeding, Journal of Range Management, 7:89-90, 1954.

be of maximum value. Range seedings without management will never obtain their maximum potential.

Costs of seedings are the same regardless of whether herbage production is increased 2 or 10 times. Therefore, selection of seeding site, seedbed preparation, proper drilling, and management are important controlling factors determining success of the seeding and amount of gain to be derived from a particular project.

Table 3 indicates a cost of 86¢ per acre per year to obtain a crested wheatgrass seeding. Projected costs for six seedings of over 29,000 acres provided the basis for these figures.

Table 3. Crested wheatgrass seeding costs per acre

Initial costs	
Plowing and drilling	$ 9.71
Fencing	.99
Water development	2.20
Non-use	.63
	$13.53
Annual costs	
Fence maintenance	$ .08
Water maintenance	.10
	$ .18
Interest	?
Twenty-year life of the seeding	
$\frac{\$13.53}{20}$ = \$.68 + \$.18 = \$.86 per acre per year[1]	

[1] Darwin B. Nielsen, Economics of federal range use and improvement. Ph.D. thesis. Corvallis, Oregon State University, 1965. 165 numb. leaves.

Individual costs would not be identical to those indicated in Table 3. In most situations interest would be a cost. Also, management may be intensified under an improvement program; but all of the above categories are real and should be considered when determining the cost of seeding.

The range site presented in Table 1 produced an average of 750 pounds per acre total herbage. At 86¢ per acre per year for 20 years, this seeding can pay.

For analyses, the following assumptions are made:

(1) Grazing occurs at times when it will not be detrimental to the plant's physiological processes.

(2) Utilization will remove vegetation until 200 pounds per acre or one-third of total herbage remains on the ground. In the author's judgment, this is sufficient litter and cover to promote sustained production.

(3) One animal unit month is equal to 800 pounds of air-dry forage.

Based on the above assumption, approximately one and one-half acres are required for one animal unit month $(750\text{-}200 = 550; \frac{800}{550} = 1.45)$ on the improved area. On the unimproved area, it takes approximately five acres $(2/3 \times 250 = 167; \frac{800}{167} = 4.8)$ for one animal unit month. Therefore, it takes only one third as many acres per animal unit month on improved areas as on unimproved areas, or you can run about three times as many cows on the improved area as the unimproved (based on above data and assumptions). Also the improved forage is available over a longer period of time.

Based on costs of 86¢ per acre per year, the animal unit month cost is $1.25 (1.45 x 86¢) on the seeded area. Calves sold from this seeded range at 20¢ per pound would need an additional gain of approximately six and one-half pounds per month over the calves sold from the unimproved range to recover initial and annual costs.

Production of perennial grass species is more reliable and fluctuates less between years than production of annual grass species. Between 1963 and 1964, production of crested wheatgrass varied 29% and cheatgrass varied 53%. Protein of crested wheatgrass runs about 10 to 12% and cheatgrass about 7 to 9%. Seedings lengthen the time and availability of good forage, take pressure off of native range, provide areas to be used as breeding pastures, and help to provide flexibility in the year-long forage use pattern.

It can be concluded that if a seeding such as those described fills a niche in your year-around operation and is properly managed, it will pay a return on your investment.

Hormonal Castration of Beef Cattle

A. T. Ralston

Research reported from Arizona, Arkansas, Indiana, Ohio, Oregon, and Texas indicates that bulls make more rapid and economical gains than steers. This is accompanied by a reduction of subcutaneous and intermuscular fat and a loss in tenderness.

Packer discrimination against bulls and the management problems some bulls cause for the feedlot operator have slowed down the acceptance of this more economical method of producing beef.

The use of diethylstilbestrol (DES) with poultry has increased fat deposition and carcass quality with little change in growth rate or feed efficiency. The combs and wattles of male birds tend to shrink and lose their red color. The ruminant reacts differently when treated with DES. Castrates have greater protein deposition and less fat deposition and make greater gains.

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If early use of DES on bull calves would inhibit the development of secondary sex characteristics and reduce feedlot-management problems without loss of preweaning gains, post-weaning gains, or feed efficiency, the intact male might be more readily accepted by both the producer and the packer.

The experiment reported herein was designed to study what effect DES implanted at two stages of maturation would have upon preweaning and feedlot growth, feed efficiency, and carcass characteristics.

Methods

Forty-eight bull calves were randomly assigned to three DES treatments (0, 12 mg. implanted at birth and 12 mg. implanted at about 300 pounds). The environment for all calves was similar. The average daily gain from birth to time of intermediate implantation and to weaning was calculated by subtracting the birth weight from the weight at the end of each period and dividing by the animal's age. Grading was done by a committee of three, and although grade is affected by factors other than condition, it is usually related to condition. Testicular development at weaning was measured with calipers at the widest portion of each testicle.

Results

Although the treatment effects are not significantly different, they are encouraging (Table 1). In each of the characteristics measured, the use of a DES implant at birth was at least equal to, if not slightly better than, the use of DES at a later date or the bull calves with no treatment.

The early (at birth) use of DES had a much greater effect upon average daily gain up to an average calf weight of 300 pounds than from that weight on, indicating that perhaps additional gain might have been realized if another implant had been used at that time. The use of implants after 300 pounds on nontreated males had no effect upon gain.

The early implanted animals seemed to have more milk fat or bloom than the nontreated or late treated animals, as reflected by their grade.

Average testicular development was similar for both DES implant groups and below that of the nontreated males. The testicles of DES treated animals were not as firm and well shaped as those of nontreated animals. This was reflected also in lack of sexual response and quieter dispositions.

Forty of these animals were placed on a feeding trial at which time the nontreated animals were castrated either by knife or with Burdizzos and all animals received an additional 24 mg. implant of DES. Their feedlot performance and carcass characteristics will be reported at a future date. This work is being continued with 1965 bull calves.

Table 1. Summary of growth, grade, and testicular development as affected by stilbestrol implantation

Treatment	ADG to 300 lbs.	ADG to wean	Grade*	Testicular diameter
	Lbs.	*Lbs.*		*mm.*
12 mg. implant at birth	2.48	2.01	2.5	32
12 mg. implant at 300 lbs.....	2.26	1.90	3.0	30
No implant	2.25	1.90	2.8	41

* 1 = 1-, 2 = 2+, 3 = 2, etc.

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