Winter Feeding and Management of Range Calves

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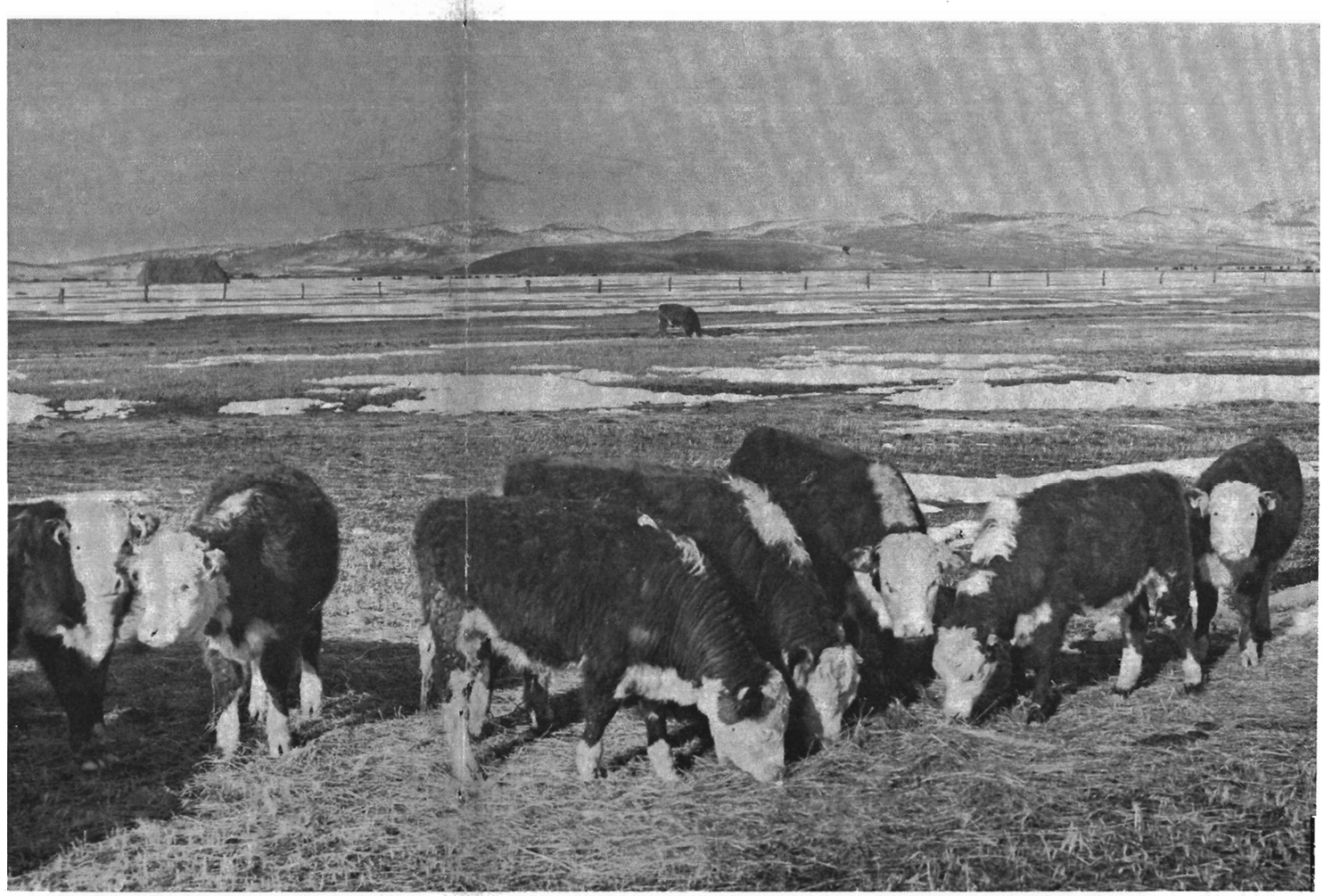

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Winter Feeding and Management Of Range Calves

JOE D. WALLACE, R. J. RALEIGH, FARRIS HUBBERT, JR., and W. A. SAWYER

WHAT WAS FOUND

- Feeding phosphorus-fertilized hay as opposed to unfertilized hay resulted in increased calf performance.
- A protein supplement combined with a meadow hay wintering ration brought about marked increase in calf gains.
- No advantage was obtained by feeding higher levels of phosphorus than calves normally consume from a salt-bonemeal mix.
- When calves were fed rations containing 5.5%, 6%, 9%, and 12% protein, gains increased with each additional level of protein.
- Cottonseed meal was superior to either urea or a cottonseed meal-urea combination as a protein source for calves.
- Calves fed pelleted hay gained at a faster rate than similar calves fed chopped or wafered hay.
- Transportation costs and processing costs involved in pelleting roughages tended to offset advantages derived from feeding meadow hay as pellets or wafers.
- Gains made by yearling animals on spring and summer range were not materially reduced by previous winter gains until winter gains exceeded 1.6 pounds per day.
- Return (gain value minus winter feed cost) was considerably lower for calves wintered on meadow hay alone than for those wintered on meadow hay plus supplements.
- Calves weaned in mid-September gained at a higher rate during winter than similar calves weaned approximately a month later.
- Feeding an antibiotic supplement resulted in increased calf performance, especially during the first few weeks following weaning.
- Feeding either a yeast additive, a flavoring material, or an arsenical compound with a meadow hay ration did not materially influence calf performance.
- Copper supplementation is needed with a meadow hay ration for calves to correct an apparent imbalance of trace minerals.

INTRODUCTION

Experimental work summarized in this bulletin was conducted at the Squaw Butte Experiment Station located in southeastern Oregon near Burns. In general, this locality is similar to large areas in the intermountain west where ranchers rely on native flood meadows for winter hay supplies and on sagebrush-bunchgrass ranges for summer grazing.

A large number of cattle are marketed both in spring as yearlings and off

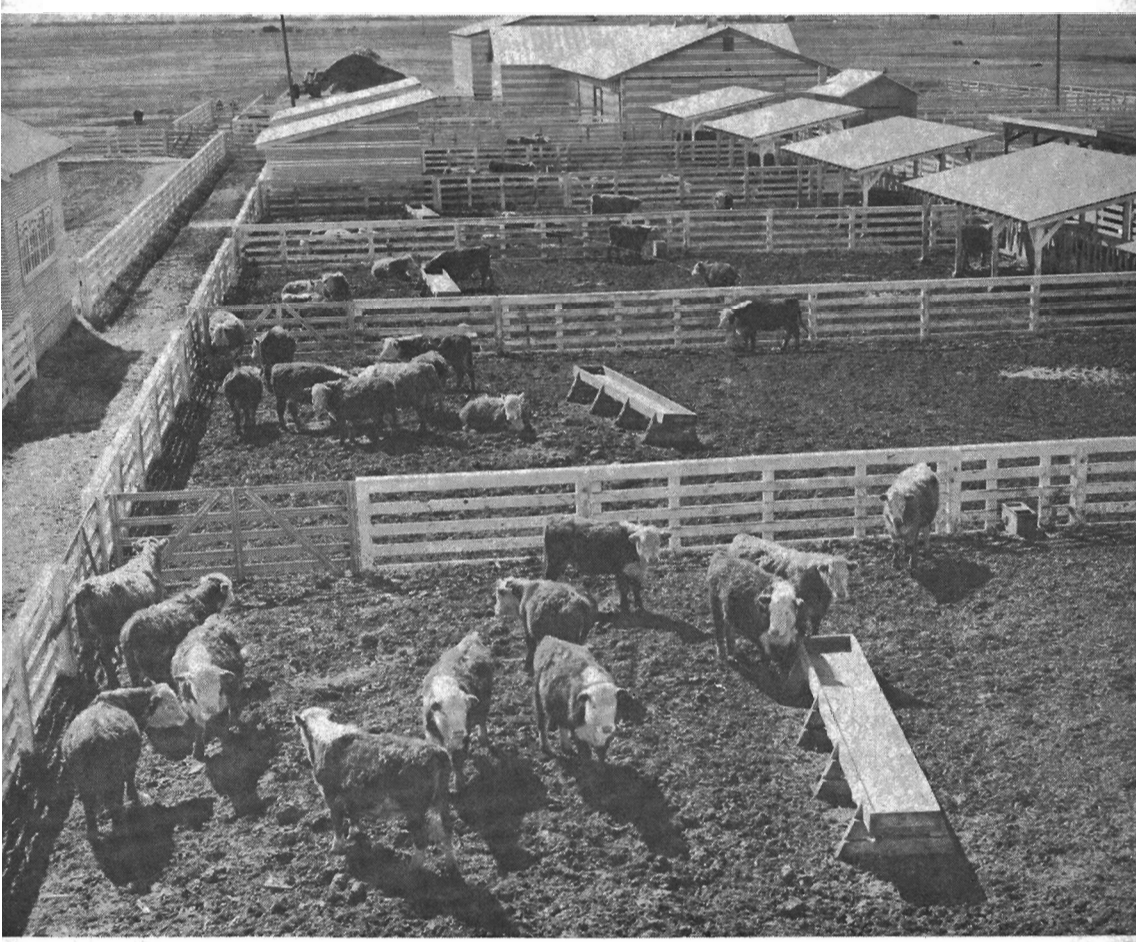
summer range as long yearlings. In this day of higher cost of production and reduced margin of profit, the need for a sound calf-wintering program becomes increasingly important. When cattle are marketed off summer range as long yearlings, the rancher's problem is to winter calves so a maximum profit may be obtained for the combined winter and summer period. When cattle are marketed in spring as yearlings, the rancher's chief concern is in making most efficient use of his winter feed supply and keeping cost per unit of winter gain at a minimum.

The primary objective of experimental studies summarized in this bulletin was to investigate feeding and management practices that would lead to improved winter performance of weaner calves. Research reported in this bulletin was conducted from 1951 to 1961.

The following prices were used for computing cost of gains:

Meadow hay	$20.00 per ton
Meadow hay (watered)	$30.00 per ton
Meadow hay (pelleted)	$34.00 per ton
Barley	$50.00 per ton
Cottonseed meal	$70.00 per ton
Alfalfa meal	$45.00 per ton
Urea	$120.00 per ton
Terramycin	$110.00 per cwt.
Copper sulfate	$23.15 per cwt.

An aerial view of six experimental lots in which group feeding experiments were conducted. The calves fed phosphorus-fertilized hay gained about .3 pound more per day than those fed unfertilized hay.



SECTION 1. Feeding Value of Phosphorus-Fertilized Meadow Hay

Phosphorus fertilization on proper sites in native flood meadows increases yield and quality of hay produced. These results occur because of an increase in white-tip clover content in hay produced on phosphorus-fertilized areas. Higher clover content in meadow hay increases crude protein and phosphorus content of hay. Unfortunately, not all flood meadow areas will respond to phosphorus fertilization. Areas on which white-tip clover is found are generally considered promising sites for phosphorus fertilization.

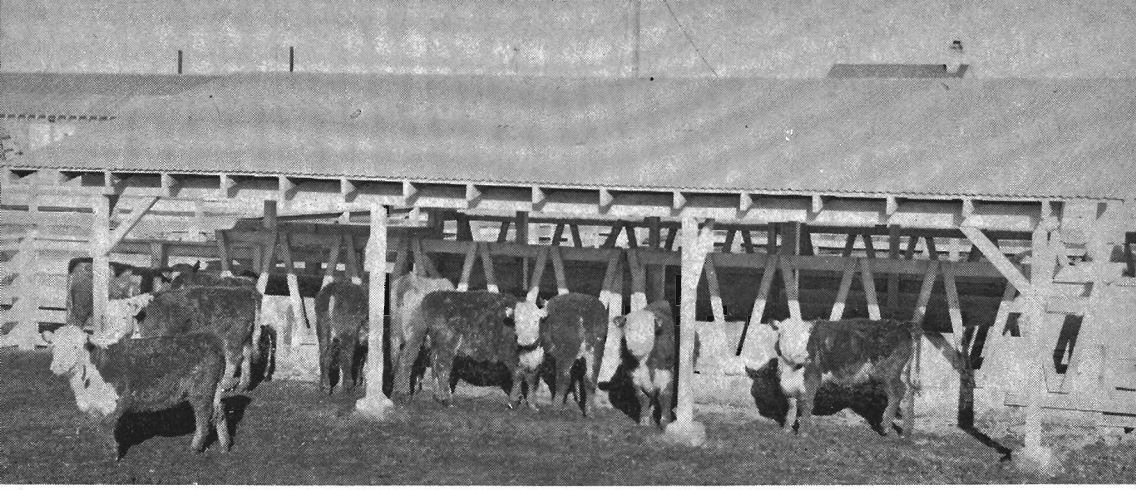
A 132-day feeding trial was conducted during winter of 1957-58 to compare unfertilized meadow hay with hay from clover sites that had been fertilized with 40 pounds of available phosphorus per acre. Weaner calves were used in the study. Half the calves receiving each type of hay (fertilized and unfertilized) were fed 1 pound of cottonseed meal per head daily while the other half received no protein supplement. All calves were fed rolled barley at the rate of 2 pounds per head daily.

Results showed a definite advantage in favor of feeding phosphorus-fertilized hay and a protein supplement (Table 1). Later studies were conducted to determine whether increased performance resulting from feeding phosphorus-fertilized hay was due to higher protein content, higher phosphorus content, or both. These studies are discussed in sections 2 and 3.

Table 1. Effect of phosphorus fertilization and protein supplementation on feeding value of meadow hay

	Unfertilized hay		Phosphorus-fertilized hay	
	No CSM	CSM	No CSM	CSM
Lot no.	*1*	*2*	*3*	*4*
Calves per lot	10	10	10	9
Avg. initial weight (lb.)	409	403	399	404
Avg. final weight (lb.)	520	551	543	595
Avg. daily gain (lb.)	0.84	1.12	1.09	1.45
Avg. daily feed consumed (lb.)	12.9	13.7	12.6	13.7
Feed per lb. gain (lb.)	15.4	12.2	11.6	9.4
Feed cost per lb. gain[1] (¢)	18.9	17.1	14.3	13.2

[1] The same charge was assessed for fertilized and unfertilized hay. Greater yields on fertilized areas more than paid fertilizer costs. Prices used for computing costs are listed in the introduction, page 4.



A representative group of weaner calves typical of those used in lot-feeding studies. In this trial feeding high levels of phosphorus in winter rations failed to improve calf performance.

SECTION 2. High Levels of Phosphorus in Winter Rations

Results of feeding phosphorus-fertilized hay to calves during winter of 1957-58 suggested that additional phosphorus in the ration (above what they normally consume from a salt-bonemeal mix) might prove beneficial.

High levels of phosphorus were fed to weaner calves in three different feeding trials during 1958 and 1959 to determine whether additional phosphorus would increase performance. In each trial bonemeal was mixed with cottonseed meal at a rate which supplied an additional phosphorus intake of 5 grams per head daily. The additional phosphorus intake was essentially the same as that provided by feeding phosphorus-fertilized hay in the earlier trial. All calves used in these studies had access to salt and a 50:50 salt-bonemeal mix.

No apparent advantage resulted from feeding higher levels of phosphorus than calves normally consume when a salt-bonemeal mix is provided. (See Table 2.)

At the conclusion of these trials, it was assumed that increased legume content (or higher protein level) of phosphorus-fertilized hay was probably the major factor which stimulated calf performance. (See Table 1.)

Table 2. Effect of high phosphorus feeding on average daily gain of weaner calves

Trial no.	Added phosphorus	No added phosphorus
	(lb.)	*(lb.)*
1 (126 days)	1.44	1.42
2 (96 days)	1.19	1.35
3 (42 days)	1.32	1.28
Avg. of 3 trials	1.32	1.35

SECTION 3. Low Levels of Alfalfa in Winter Rations

Legume forages provide an excellent source of protein for cattle and also are believed to provide a stimulatory effect on utilization of other ration ingredients. Only a small quantity of legume forage is needed to produce this effect.

To determine the effect of adding small amounts of a legume to a meadow hay ration, calves were fed three levels of alfalfa meal during winter 1960-61. Alfalfa meal was fed as a substitute for part of the protein supplement normally supplied by an oilmeal supplement. Calves in this trial were fed 2 pounds of rolled barley per head daily and received a full feed of native meadow hay.

Alfalfa meal fed at the rate of ⅔ pound per head daily (lot 4) increased calf performance while higher levels (lots 2 and 3) reduced performance when compared to a straight cottonseed meal supplement (lot 1) as shown in Table 3. Levels of alfalfa meal fed to lots 2 and 3 reduced intake of meadow hay and increased feed cost per pound of gain.

Results indicate that adding a small amount of alfalfa to a meadow hay ration will promote gains which are just as efficient and economical as those obtained from feeding phosphorus-fertilized (clover) hay. This is noted when feed per pound of gain and feed cost per pound of gain in this trial are compared with those of the phosphorus-fertilized hay trial (Table 1). It should be kept in mind, however, that phosphorus fertilization on proper meadow sites not only resulted in increased gain per pound of hay fed, but also increased hay yields from fertilized areas.

Table 3. Effect of low levels of alfalfa in a meadow hay ration

	Source and amounts of daily protein supplement[1]			
	(lb./head)	(lb./head)	(lb./head)	(lb./head)
Alfalfa meal:	.....	2.00	1.33	0.67
Cottonseed meal:	1.00	0.22	0.50	0.75
Lot no.	*1*	*2*	*3*	*4*
Calves per lot	10	10	10	10
Avg. initial wt. (lb.)	446	454	447	440
Avg. final wt. (lb.)	601	598	595	618
Avg. daily gain (lb.)	1.38	1.29	1.32	1.59
Av. daily hay intake[2] (lb.)	10.6	9.8	10.0	10.9
Avg. total feed intake (lb.)	13.6	14.0	13.8	14.3
Feed per lb. gain (lb.)	9.8	10.8	10.5	9.0
Feed cost per lb. gain (¢)	13.8	15.6	15.1	12.6

[1] The daily protein supplement per animal for all lots was calculated to supply total crude protein equivalent to 1 pound of cottonseed meal.

[2] Includes meadow hay but not alfalfa meal.

Supplemental protein is essential to promote growth when wintering calves on native meadow hay. Calf on the left received meadow hay alone while calf on the right was fed hay plus a protein supplement.

SECTION 4. Different Levels and Sources of Protein in Winter Rations

The low crude-protein content of native meadow hay is one of its major faults as a winter feed for calves. When calves are wintered on meadow hay alone they do little more than maintain their weight. Additional protein is necessary to promote adequate growth of weaner calves. Oilmeal products are probably the most widely used protein supplements in eastern Oregon, but urea has been used as a protein extender in some cases.

Thirty head of uniform calves were individually fed during winter 1960-61 to compare value of various levels and sources of protein when combined with a meadow hay ration. Levels of crude protein fed were 5.5%, 6%, 9%, and 12%. Meadow hay, especially selected for low protein content, was used as the sole source of protein in the 5.5% ration. Additional protein supplied as urea, cottonseed meal, and a mixture of urea and cottonseed meal was added to the hay to increase crude-protein content of each of the higher levels fed. All rations used in this trial were thoroughly mixed, finely ground, and pelleted before feeding. Pelleting eliminated selection of different ration ingredients by the animals used in the experiment.

Results show quite clearly the need for adding protein supplement to native meadow hay (Tables 4 and 5). Other studies conducted at the Squaw Butte station point out the need for protein supplementation with meadow hay considerably higher in crude-protein content than the hay used in this study. Protein supplementation increases protein digestibility and improves utilization of other nutrients in meadow hay.

Calf gains increased as level of protein increased (Table 4). When cottonseed meal was used to supply additional

protein, gains were generally higher than when urea or the combination of urea and cottonseed was used. Since the rations were pelleted, all gains were higher than would be expected if they had been fed loose; however, similar differences due to level and source of protein might be expected regardless of physical form of hay fed. The influence of pelleting is discussed in section 5, page 10. Feeding the 9% crude-protein ration resulted in the most economical gains (Table 5). Perhaps the 12% ration would have appeared more favorable if additional energy had been supplied. Protein is the primary limiting nutrient in meadow hay, but when protein level is increased to a certain point through supplementation, energy can become a limiting factor.

A combined supplement of 1 pound of cottonseed meal plus from 1 to 2 pounds of barley with a full feed of meadow hay provides a well-balanced growing ration for weaner calves.

Table 4. Effect of level and source of crude protein on average daily gain of weaner calves

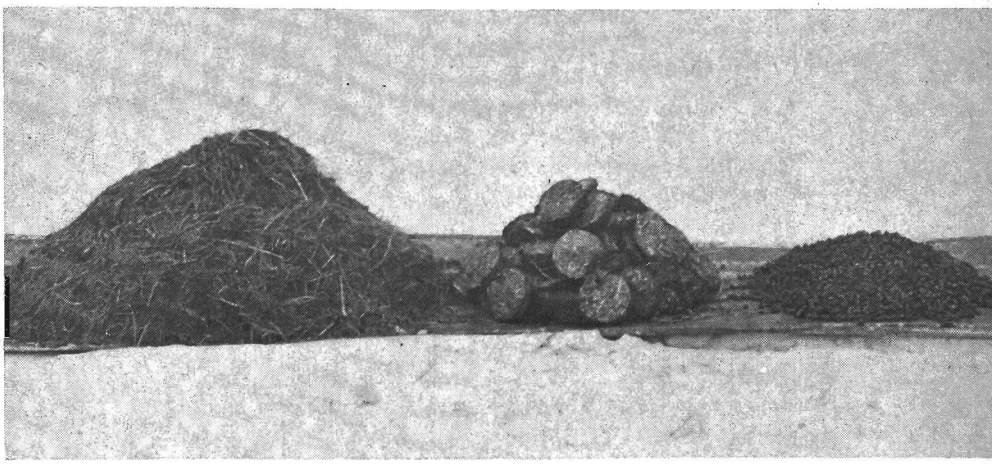
Crude protein source	Crude protein level			
	5.5%	6%	9%	12%
	(lb.)	*(lb.)*	*(lb.)*	*(lb.)*
Meadow hay alone	0.27			
Meadow hay + urea		0.39	1.23	.....[1]
Meadow hay + CSM		0.26	1.62	1.83
Meadow hay + urea and CSM		0.41	1.35	1.51
Average	0.27	0.35	1.40	1.67

[1] Urea as the sole source of supplemental protein on the 12% ration caused ammonia toxicity in calves.

Table 5. Effect of level and source of protein on cost per pound of winter gain[1]

Crude protein source	Crude protein level			
	5.5%	6%	9%	12%
	(¢)	*(¢)*	*(¢)*	*(¢)*
Meadow hay alone	35.3			
Meadow hay + urea		26.2	11.8	.....[2]
Meadow hay + CSM		37.3	11.6	12.2
Meadow hay + urea and CSM		27.6	12.3	12.3
Average	35.3	30.3	11.9	12.2

[1] These costs include only the cost of ration ingredients and not cost of processing.
[2] Urea as the sole source of supplemental protein on the 12% ration caused ammonia toxicity in calves.



Relative bulk of 10 pounds of chopped, wafered, and pelleted meadow hay.

SECTION 5. Winter Performance of Calves Fed Chopped, Wafered, and Pelleted Meadow Hay

Bulk density (weight per unit volume) of meadow hay restricts intake by calves so that only limited gains can be made if hay is fed alone. Condensing meadow hay bulk through different processing methods offers an opportunity for greater consumption and, consequently, an improvement in calf performance.

Pelleting or wafering hay greatly reduces handling, storing, and feeding problems. Feeding a roughage such as meadow hay in a processed form can also reduce feed refused or wasted by animals. In many cases the amount of waste by cattle fed low-quality roughages can be quite high.

During winter of 1959-60, a 126-day feeding trial was conducted to compare performance of calves wintered on chopped, wafered, and pelleted meadow hay. No concentrates were fed during this trial. All hay used in this study was grown in the same meadow at the Squaw Butte station. Following harvest the hay was coarsely chopped and stored. Part of the chopped hay was transported to Redmond, Oregon, and processed into 4-inch wafers. Hay fed as pellets was trucked to a commercial feed mill in Haines, ground through a $\frac{1}{8}$-inch screen, and processed into $\frac{3}{8}$-inch pellets.

Calves receiving pelleted hay consumed approximately 25% more hay and gained about twice as much as similar calves fed either chopped or wafered hay (Table 6). Considerably less feed was required per pound of gain on the pelleted hay ration than on the other two forms of hay fed. Most of the hay consumed as chopped and wafered rations was used for maintenance. When feed costs per pound of gain were figured, based on hay actually consumed by calves fed the different forms, calves receiving chopped hay had cheaper gains. How-

ever, when these costs were computed, using amounts fed or offered (including waste) to produce resultant gains, calves fed pelleted hay had cheaper gains. This difference is attributed to reduced amount of refusal or waste on the pelleted hay ration.

Pelleting lower-quality roughages offers a greater opportunity for improvement in animal performance than pelleting high-quality roughage. Wafering of hay improves physical handling properties but seems to have little effect on animal performance.

Main disadvantages of processed hays are added costs of grinding and pelleting or wafering along with transportation costs to and from a feed mill. Under present conditions in southeastern Oregon, added expenses may be great enough to more than offset advantages of feeding processed hay.

Table 6. Results of wintering calves solely on chopped, wafered, and pelleted meadow hay

	Chopped	Wafered	Pelleted
Calves per lot	10	10	10
Avg. initial weight (lb.)	358	357	360
Avg. final weight (lb.)	404	394	449
Avg. daily gain (lb.)	0.37	0.30	0.71
Avg. daily hay fed (lb.)	12.1	11.8	12.6
Avg. daily hay consumed (lb.)	9.9	10.1	12.3
Avg. daily hay refused (lb.)	2.2	1.7	.3
Hay consumed per lb. gain (lb.)	26.8	33.7	17.3
Hay fed per lb. gain (lb.)	32.8	39.5	17.8
Feed cost per lb. gain[1]			
As consumed basis (¢)	26.8	50.5	29.4
As fed basis (¢)	32.8	59.0	30.2

[1] Includes processing costs but not cost of transporting to and from feed mill.

Method used to weigh chopped hay for experimental feeding lots. In the trial described below winter performance of calves was substantially improved by the addition of an antibiotic to the winter ration.

SECTION 6. Response of Calves to an Antibiotic Supplement in the Winter Ration

Weaning time is a stress period for range calves. When a calf is weaned, he must pass through an adjustment period while his digestive system is becoming accustomed to the physical change in feed intake. During this adjustment period susceptibility to scours, shipping fever, and other infectious diseases is at a maximum. These diseases cause serious production losses to the beef cattle industry and are of great concern to producers.

Four feeding trials designed to evaluate the effect of including an antibiotic in meadow hay rations for weaner calves have been conducted at the Squaw Butte station. Calves used in these studies received a full feed of meadow hay, 2 pounds of barley, and 1 pound of cottonseed meal per head daily. Calves receiving antibiotics were fed 75 milligrams of Terramycin per head daily. Daily cost of providing the antibiotic in these trials was less than 1¢ per head.

A summary of the four trials using antibiotic feeding is presented in Table 7. Trials 1, 3, and 4 were conducted during fall immediately after weaning, while Trial 2 was carried out during winter beginning about 10 weeks after weaning. Terramycin was mixed and fed with the protein supplement (cottonseed meal) in all four trials. In the first trial a soluble form of Terramycin was provided in the drinking water for one group of calves. In Trial 3 the antibiotic was fed with a loose salt mix to one experimental group.

Antibiotic feeding resulted in increased gains, improved feed efficiency, and cheaper gains in each trial con-

ducted. In these trials the greatest response from antibiotic feeding occurred during the first few weeks after weaning. When calves are wintered under unsanitary conditions or where disease levels are relatively high, a more prolonged response would be expected from antibiotic feeding. Antibiotic feeding should not, however, be a substitute for careful sanitation and good management practices.

In Trial 4, half the calves receiving Terramycin were vaccinated for shipping fever and half were not. Increased performance resulting from antibiotic feeding was essentially the same in vaccinated and nonvaccinated calves.

The method of feeding antibiotic with cottonseed meal provided more uniform intake than other methods used. Water consumption varies with weather conditions and salt consumption varies among individual animals; therefore, it is difficult to maintain uniform intake of an additive when feeding it with salt or mixing it in drinking water.

Table 7. Effect of adding terramycin to a meadow hay wintering ration for calves (summary of 4 trials)

Trial no.	Time and length of trial	Treatment[1]	Avg. daily gain	Avg. daily feed cons.	Feed/lb. gain	Feed cost/ lb. gain
			(lb.)	*(lb.)*	*(lb.)*	¢
1[2]	Fall 1958 (29 days)	Control	.30	7.1	23.7	32.0
		Terr./CSM	.68	7.6	11.2	16.0
		Terr./drinking water	.60	7.4	12.3	17.8
2	Winter 1958-59 (112 days)	Control	1.34	13.1	9.8	13.8
		Terr./CSM	1.48	13.2	8.9	13.2
3	Fall 1959 (42 days)	Control	1.28	8.8	6.9	11.2
		Terr./CSM	1.60	9.8	6.1	10.1
		Terr./salt	1.50	9.7	6.5	10.7
4	Fall 1960 (76 days)	Control	0.59	9.3	15.8	25.1
		Terr./CSM	1.03	10.2	9.9	16.0
Avg. of 4 trials		Control	0.88	9.6	14.0	20.5
		Terr./CSM	1.20	10.2	9.0	13.8

[1] Ten calves were assigned to each treatment during each trial.
[2] No barley was fed during this trial.

SECTION 7. Influence of Certain Feed Additives in the Winter Ration

Among feed additives currently being marketed are various yeast preparations, flavoring materials, and arsenical compounds.

Various types of yeast materials (wood yeast, brewer's yeast, and baker's yeast) have been tested in beef cattle rations. Response of cattle to yeast additives has been varied.

Flavoring materials for all types of livestock feed are commercially available. Most of these are composed chiefly of sweetening compounds. Inclusion of such an additive supposedly makes the ration more desirable.

Small amounts of arsenical compounds have been shown to have appetite- and gain-stimulating properties when added to swine rations. Value of arsenical additives in cattle rations is questionable.

Feeding trials designed to evaluate use of a brewer's yeast (Amber BYF), a flavor compound (Sessalom flavorstat), and an arsenical additive (3-Nitro) in meadow hay rations for calves have been conducted at the Squaw Butte station. In these trials yeast was fed to calves at the rate of 0.15 pound per head daily. The yeast was mixed and fed with ground barley. Calves receiving the flavor additive were fed meadow hay which was treated with ½ pound of Sessalom powder (dissolved in water) per ton of hay. The arsenical additive was mixed and fed with cottonseed meal at a rate which supplied 1.75 grams of 3-nitro per head daily.

Feeding each additive involved in these studies resulted in a slight improvement in calf performance (Table 8). However, benefits derived from additive feeding in these trials would hardly seem sufficient to offset the cost of the materials.

Table 8. Effect of including various additives in a meadow hay wintering ration for calves

Length of trial	Treatment	Avg. daily gain	Avg. daily feed consumed	Feed/lb. gain	Feed cost/ lb. gain[1]
		(lb.)	*(lb.)*	*(lb.)*	*(¢)*
112 days	Control	0.73	11.5	15.8	19.9
	Yeast	0.81	12.0	14.8	18.5
76 days	Control	0.59	9.3	15.8	25.1
	Flavor	0.61	9.1	14.9	23.9
76 days	Control	0.59	9.3	15.8	25.1
	Arsenical	0.68	9.5	13.9	22.1

[1] Feed costs do not include cost of additives.

Weaner calves tied to feeders in the individual feeding barn at the Squaw Butte winter headquarters. Copper supplementation reduced scours in weaner calves and thus increased winter performance.

SECTION 8. Influence of Copper Supplementation in the Winter Ration

Cattle require small quantities of certain mineral elements known as "trace" or "minor" elements. Iron, copper, sulfur, iodine, cobalt, molybdenum, and certain other elements fall into this category. Requirement of cattle for these elements is so small that it is usually expressed as parts per million in rations.

Interrelationships among certain trace elements in feeds and, in some cases, an overabundance of one or more of these elements may present special problems. For example, beef cattle require a small amount of molybdenum, but an excess tends to disrupt copper utilization and may increase the requirement for copper. High sulfur content in feed may also inhibit copper utilization. Too little selenium in cattle rations may cause white muscle disease; too much is highly toxic.

Small amounts of iron and copper are required for hemoglobin formation. Copper also has certain other basic roles in the animal body. Animal feeds (except milk) contain a sufficient quantity of iron in most areas, and iron deficiency is generally not pronounced in beef cattle. Copper deficiency is recognized worldwide and is prevalent in various parts of Oregon. Symptoms of copper deficiency include low appetite, loss of condition, anemia, stunted growth, rough hair coat, suppressed estrus, and diarrhea.

Copper analyses of native meadow hay from southeastern Oregon show a range of 2 to 3 parts per million, while cattle require feeds that contain between 4 and 8 parts per million. Native hay from this area also contains moderately high levels of molybdenum as well as high sulfur levels. Under these

conditions, it is quite possible that impaired copper utilization could occur.

Blood samples taken from animals may be analyzed for copper content to determine the current supply of copper in the animal body. To determine the reserve or storage of copper in cattle, a liver sample may be analyzed for copper content.

Southeastern Oregon cattle wintered principally on native meadow hay are usually below normal in both blood-copper and liver-copper storage. Experiments have shown that blood-copper content and liver-copper storage of these animals can be readily restored to a safe range if copper is supplied in the ration.

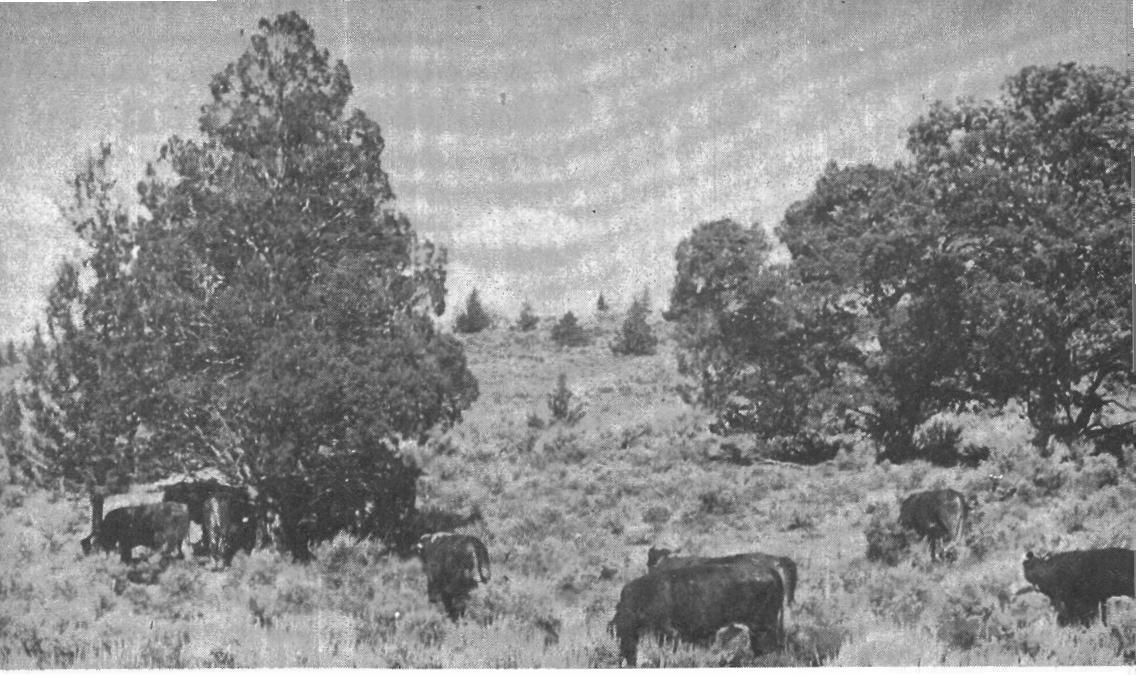
Extent to which copper shortage in meadow hay affects performance of calves seems to vary from year to year. During certain years a copper deficiency in meadow hay (or the imbalance of copper, molybdenum, and sulfur) has contributed to outbreaks of severe scouring and, consequently, a depression in winter performance of weaner calves. Addition of a copper supplement, such as copper sulfate or copper oxide, to the ration has proved beneficial in preventing or correcting this condition.

A 96-day feeding trial was conducted during winter of 1958-59 to study the influence of copper supplementation on performance of weaner calves. All calves in this trial received a full feed of meadow hay, 2 pounds of barley, and 1 pound of cottonseed meal per head daily. Calves receiving copper supplementation were fed one gram of copper sulfate per head daily. Results (Table 9) show a definite advantage in providing a copper supplement for calves wintered primarily on native meadow hay. Suitable copper supplements are relatively inexpensive, and should be included in meadow hay rations for calves as a means of maintaining normal blood and liver copper and as a safeguard against depressed performance resulting from the high incidence of scouring in calves. Copper supplementation should, however, be carried out with caution as excessive copper may be toxic to cattle.

Table 9. Effect of copper supplementation in a meadow hay winter ration

	Control group	Copper-supplemented group
Calves per treatment[1]	10	10
Avg. initial weight (lb.)	312	311
Avg. final weight (lb.)	434	452
Avg. daily gain (lb.)	1.27	1.47
Avg. daily feed consumed (lb.)	10.4	11.3
Feed per lb. gain (lb.)	8.2	7.6
Feed cost per lb. gain (¢)	12.5	11.5

[1] Calves in this trial were individually fed.



Yearling cattle grazing sagebrush-bunchgrass range in southeastern Oregon. Weaner calves gaining from 0.4 to 1.6 pounds daily during winter gained at about the same rate on summer range as yearlings.

SECTION 9. Relationship Between Winter Gains and Gains on Range the Following Summer

Sale of long yearling feeder cattle represents a large share of ranch income in southeastern Oregon. Selling long yearlings necessitates wintering animals as weaner calves and pasturing them as yearlings on grass or range.

Ranchers are faced with the question of how much winter gain calves can make without appreciably depressing their gains on grass the following summer. It is a common belief that increasing winter gains of calves results in reduced summer gains. Consequently, many cattlemen "rough" weaner calves through the winter hoping that compensatory summer gains will produce a high total selling weight. However, under high-desert grazing conditions of eastern Oregon the summer grazing period is quite short and high rate of daily gain during the summer may not result in a high total gain.

The weaner calf is at a stage in its growth cycle during which it can make more efficient conversion of feed to beef than at any later stage of development. Addition of a small amount of supplemental feed to a meadow hay ration during winter can result in efficient and economical rate of gain in growing calves. Winter is the most convenient time to provide supplementary nutrients for growing calves,

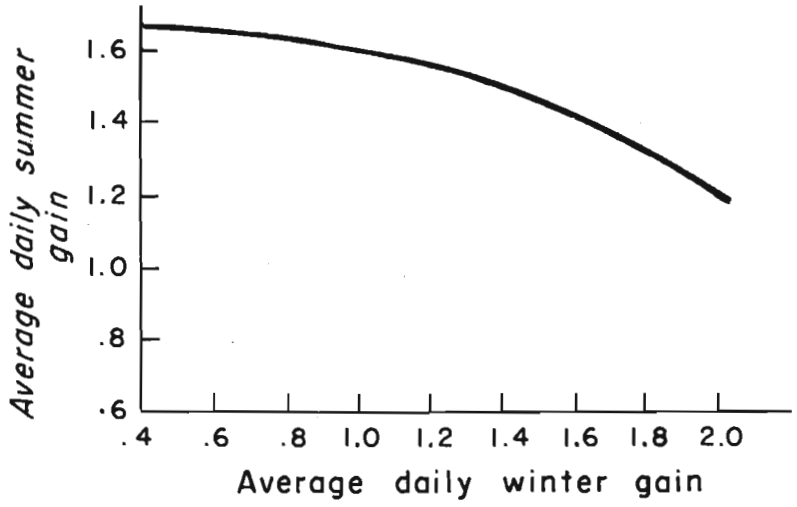


FIGURE 1. Daily winter and summer gain relationships.

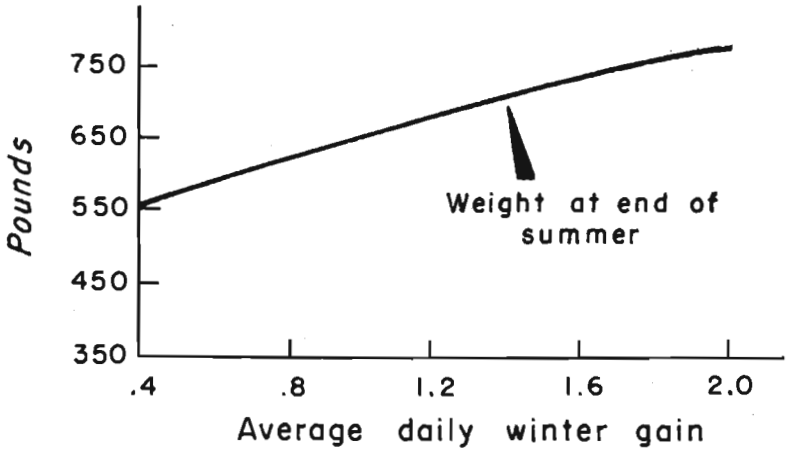


FIGURE 2. Effect of winter gain on weight at end of summer.

since most operators have their herds confined to meadow areas for hay feeding.

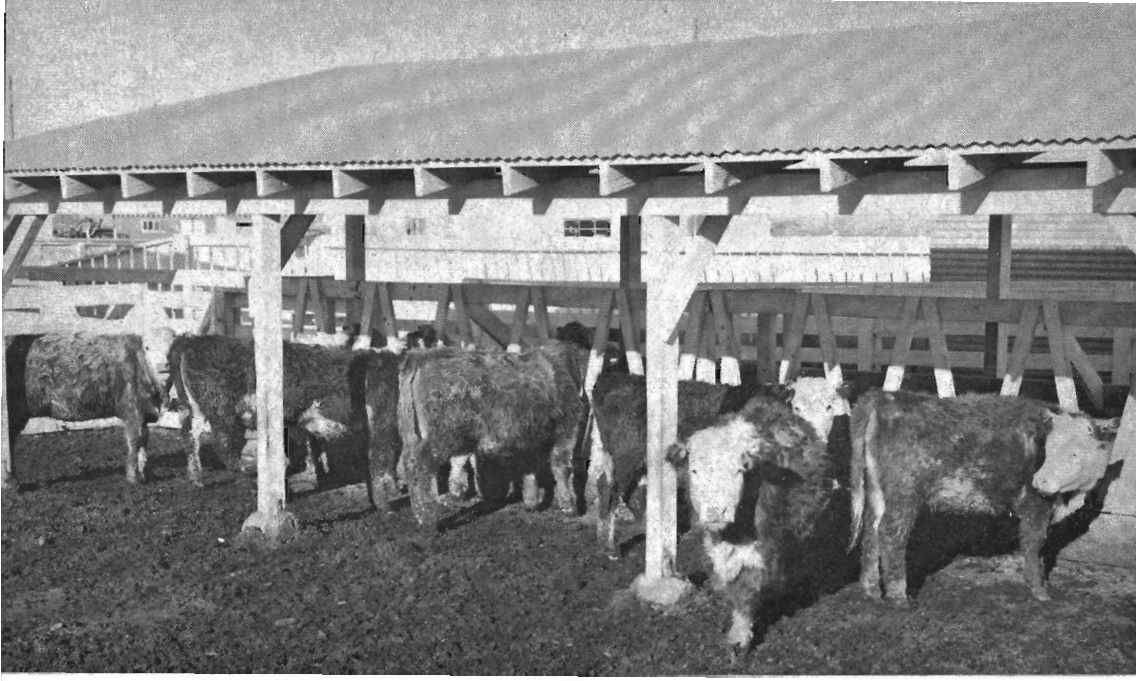
Winter and summer gains of 184 weaner calves were studied over a 7-year period (1951 to 1958) to determine gain relationship between the periods. During winter these calves were individually fed rations consisting of varying amounts of native meadow hay, barley, and cottonseed meal, and a considerable range in daily gain was obtained. During summer the animals were grazed together on sagebrush-bunchgrass range typical of southeastern Oregon.

Summer gains were not materially reduced in this study until winter gains of 1.6 pounds per day were exceeded and even then the decline was not great (Figure 1). Calves restricted to limited winter gains were considerably lighter at the end of the summer grazing period (Figure 2).

Effects of wintering calves with meadow hay alone and meadow hay plus supplements on summer gain and return on feed investment are shown in Table 10. When winter and summer gains were totaled, calves receiving supplemental feed during winter outgained those wintered on hay alone by 148 pounds per head. Evaluating total gains at $25 per hundredweight and deducting winter feed costs showed that supplement-fed calves returned $19 per head more than those wintered on hay alone.

Table 10. Effect of winter ration on subsequent performance and return on feed investment

	Winter ration	
	Meadow hay alone	Meadow hay + 2 lb. barley + 1 lb. CSM
Winter period (180 days)		
Avg. daily gain (lb.)	0.40	1.30
Total gain (lb.)	72	234
Feed per lb. gain (lb.)	25	10
Cost per lb. gain (¢)	25	15
Total winter feed cost ($)	18.00	36.00
Summer period (120 days)		
Avg. daily gain (lb.)	1.62	1.50
Total gain (lb.)	194	180
Total (winter + summer)		
Total gain (lb.)	266	414
Gain value @ $25 cwt. minus winter feed cost ($)	48.50	67.50



Weaner calves in lot-feeding studies are being fed meadow hay in sheltered mangers. In this study calves weaned in mid-September gained at a higher rate than similar calves weaned one month later.

SECTION 10. Influence of Weaning Time on Winter Performance of Calves

Native grasses found on high-desert range areas of the northwest are usually fully mature by early July and thereafter decline rather steadily in nutritive value. In dry years range operators are often faced with a shortage in total range feed late in the grazing season. Consequently, milk production of range cows and weight gains of their offspring during the latter part of the summer grazing period are usually reduced.

Weaning calves before the period of reduced performance and placing them on a growing ration would seem to promote a more continuous growth pattern. This would depend on whether or not calves were able to make a satisfactory weaning adjustment at the earlier age. A program of earlier weaning of range calves would also seem advantageous in that taking suckling calves off cows during the period when range feed is low in quality and quantity would allow the cows to make some recovery before going into the wintering period.

Winter performance of calves weaned in mid-September was compared to that of calves weaned in mid-October during two separate studies. Studies were conducted over a 70-day period in fall 1959 and over a 208-day period in fall and winter of 1960-61. A group of uniform calves was randomly assigned to two experimental groups about mid-September each year. One group was weaned, trucked 45 miles to

the Squaw Butte winter headquarters, and placed on a growing ration. Calves assigned to the other group were left on summer range with their dams until approximately one month later when they were weaned and transported to winter headquarters and placed on the same ration as the calves weaned earlier.

In both trials calves weaned in mid-September gained at a higher rate than similar calves weaned approximately one month later. (See Table 11 for comparative data.)

When weight gains were valued at $25 per hundredweight and feed costs deducted, early-weaned calves returned $.95 more per head over a 70-day period and $3.77 more per head over a 208-day period. Early-weaned calves in both trials went on feed more readily following weaning and maintained a more constant growth rate than calves weaned at the later dates.

Table 11. Effect of time of weaning on winter performance of calves

	Trial 1 (70 days)		Trial 2 (208 days)	
Weaning date:	Sept. 9	Oct. 7	Sept. 15	Oct. 18
No. calves per treatment	10	10	27	27
Age at weaning, days	169	189	177	214
Avg. initial weight (lb.)	312	296	370	380
Avg. final weight (lb.)	399	359	618	594
Avg. daily gain (lb.)	1.24	0.90	1.19	1.03
Avg. total gain (lb.)	87	63	248	214
Avg. feed cost ($)	11.06	6.01	36.29	31.51
Value of gain @ $25 cwt., less feed cost ($)	10.69	9.74	25.76	21.99

LIST OF REFERENCES

Listed below are some Oregon Agricultural Experiment Station technical papers and reports used as sources of information for the material summarized in this bulletin. While supplies last, single copies are available from the Squaw Butte Experiment Station, Burns, Oregon.

1. Response of beef cattle to phosphorus and unfertilized flood meadow hay with *in vitro* observations on factors influencing rumen micro-organism activity. Technical Paper No. 1136.
2. Annual reports of beef cattle research at the Squaw Butte Experiment Station (1958, 1959, and 1960).
3. A Progress Report—Research in beef cattle nutrition and management. Miscellaneous Paper No. 106.
4. The performance of weaner calves as influenced by low levels of alfalfa in the wintering ration. Technical Paper No. 1425.
5. Response of beef cattle to pelleted and coarsely chopped mountain meadow hay with digestibility comparisons. Technical Paper No. 1239.
6. Utilization of chopped, wafered, and pelleted native meadow hay by weaned Hereford calves. Technical Paper No. 1396.
7. Optimum feeding rates for wintering weaner calves. Technical Bulletin No. 56.
8. Effect of time of weaning on winter performance of Hereford calves. Technical Paper No. 1424.
9. Oxytetracycline and high levels of phosphorus in the wintering ration of beef cattle. Technical Paper No. 1238.
10. The influence of yeast in a high roughage wintering ration for Hereford calves as measured by digestibility and performance. Technical Paper No. 1335.
11. Beef cattle research at the Squaw Butte station (Mimeographed field day report—1960).