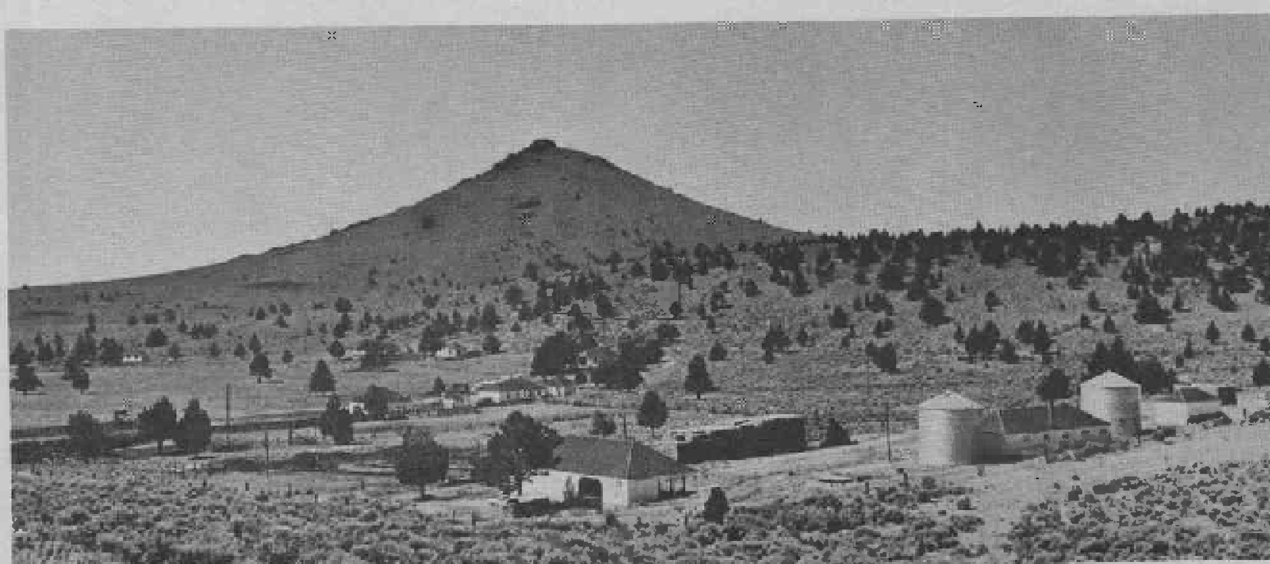
1975 Progress Report . . .

Research in Beef Cattle Nutrition and Management



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Index to previous progress reports on back pages.

Cover picture : Squaw Butte looks down on the summer version of the Squaw Butte Experiment Station.

COMPARATIVE RANGE FORAGE INTAKE OF SPRING AND FALL CALVING COW-CALF PAIRS

R. J. Kartchner, R. J. Raleigh and L. R. Rittenhouse

Fall calving research was initiated at the Squaw Butte Station in 1965. One of the questions that arise is the comparative range forage requirements of fall calving and spring calving cow-calf pairs. This report is the last of three studies designed to answer that question. The first study, conducted during the summer of 1972 was a dry lot study in which spring and fall calving cow-calf pairs were fed, in dry lot, daily harvested forage selected to be comparable in quality to the range forage at that season of growth.

The second study, during the summer of 1973, was a before and after grazing clipping study in which spring and fall calving cow-calf pairs grazed respective pastures of which samples were clipped before and after grazing to determine the intake of each pair. The results of these studies were similar and showed that over the summer grazing period the fall pairs consumed about 20% more forage than the spring pair. However, when fall calves were weaned in July, as has been recommended, the fall pairs consumed 2 to 5 percent more forage than the spring pairs.

The final study reported here involves direct measurement of grazing cows and calves from each calving group.

EXPERIMENTAL PROCEDURE

Six spring and six fall cow-calf pairs were grazed continously in crested wheatgrass pasture from April 22 to September 2, 1974. Six 5-day total fecal collection trials were conducted periodically throughout the summer grazing season to determine forage intake. Following each collection period, 24-hour milk production of each cow was determined by the weigh-suckle-weigh technique.

Forage samples were collected by esophageal fistulated animals and used for determining crude protein and *in vitro* matter digestibility values (Table 1).

Table 1. Crude protein content and in vitro dry matter digestibility of grazed forages on a dry basis

Trial	Harvest date	Crude protein	Dry matter digestibility
		%	%
1	4/29 - 5/3	16.81	68.0
2	5/20 - 5/24	14.88	74.1
3	6/10 - 6/14	13.94	65.8
4	7/1 - 7/5	9.50	51.6
5	7/29 - 8/2	7.00	49.2
6	8/26 - 8/30	5.06	48.8

RESULTS AND DISCUSSION

Forage intake for cows and calves is shown in Table 2. The fall calves, with an average weight of 325 pounds going on the study, had an average daily intake of 9.35 pounds during the summer period as compared to 2.07 pounds for the spring calves with an average weight of 120 pounds going into the study. However, the spring calving cow's intake was significantly greater than the fall cow's, having an average daily intake of 26.4 pounds compared to 24.0 pounds for the fall cows.

Table 2. Daily forage dry matter intake of cows and calves on range

		Calf		Cow	
Trial	Date	Spring	Fall	Spring	Fall
		lb	lb	lb	lb
1	4/29 - 5/3	.26	5.78	27.96	26.40
2	5/20 - 5/24	1.19	10.27	39.42	35.24
3	6/10 - 6/14	1.50	8.22	25.07	20.99
4	7/1 - 7/5	1.98	8.29	23.60	23.58
5	7/29 - 8/2	3.76	12.17	21.74	18.08
6	8/26 - 8/30	3.76	11.81	20.24	19.65
Avg. 1-6	4/29 - 8/30	2.07	9.35	26.36	23.98

The combined cow-calf intake is presented in Table 3. The average fall pair intake was 4.90 pounds, or 17 percent more than the spring pair over the entire period.

Table 3. Combined daily forage dry matter intake of cows and calves on range

Trial	Date	Cow group: Spring	Cow group: Fall
		lb	lb
1	4/29 - 5/3	28.23	32.16
2	5/20 - 5/24	40.61	45.50
3	6/10 - 6/14	26.64	29.22
4	7/1 - 7/5	25.21	31.86
5	7/29 - 8/2	25.52	30.25
6	8/26 - 8/30	23.98	31.43
Avg. 1 - 6	4/29 - 8/30	28.43	33.33

Milk production was higher in the spring calving cows (Table 4) but daily gains were higher in the fall born calves (Table 5). The rates of gain for the period May 4 to July 5 were 2.90 pounds daily for the fall calves compared to 1.88 pounds for the spring calves. During the period from July 6 to August 30 gains dropped and each group gained 1.39 pounds per head per day. Normally we recommend that the fall calves be weaned some time in July and put in the feedlot or on better pasture and the spring calves be weaned by early September. Gains on each group had dropped to less than 0.5 pound per head by the end of August.

Table 4. Average daily milk production

Trial	Date	Cow group: Spring	Cow group: Fall
		lb	lb
1	5/4	13.62	7.35
2	5/25	13.33	6.87
3	6/17	13.92	7.41
4	7/6	12.54	3.37
5	8/5	9.59	2.70
6	9/1	6.14	0.84
Avg. 1 - 6	5/4 - 9/1	11.53	5.43

Table 5. Average daily body weight change of cows and calves

Period	Calf Spring	Calf Fall	Cow Spring	Cow Fall
	lb	lb	lb	lb
5/4 - 5/24	1.78	2.79	3.80	4.27
5/25 - 6/14	2.16	3.65	3.65	4.68
6/15 - 7/5	1.72	2.24	1.71	2.90
7/6 - 8/2	1.72	1.87	-0.44	0.59
8/3 - 8/30	1.10	.92	-0.77	-0.35
5/4 - 8/30	1.65	2.20	1.40	2.16

The fall cow-calf pair consumed 17% more forage from May 4 to August 30 than the spring pair with the fall calves gaining 255 pounds compared to 191 for the spring calf. Up to the recommended weaning time of the fall calf, about mid-July, this difference in forage intake would have been about 5%. At this point, May 4 to July 15, fall calves had gained 200 pounds compared to 184 pounds for the spring calf. Normally the spring pair would remain as pairs on range to September 1 or later. Under these conditions we recommend September 1 weaning but many calves are not weaned until much later due to individual range livestock operator's patterns of management.

These data indicate that the fall cow-calf pair consumes 10 to 20 percent more forage during the summer grazing period, but the total forage requirement per pound of saleable calf gain is from 10 to 20 percent less with the fall calf than the spring calf.

There are several factors that need to be taken into consideration. During the early part of the grazing season, when grazing pressure is more critical to the range than late season, the fall pairs consume only 2 to 3 percent more than the spring pairs. Also it has been observed that fall pairs tend to cover more area and give a better distribution and use pattern on the range than the spring pair with the smaller calves. This may offset the additional requirement with regard to range pressure. The winter nutrition and management of both the fall and spring calving herds, the potential for weaning fall calves before going to range and other alternatives need to be considered.

FEEDING GRASS STRAW TO WINTERING BEEF COWS

R. L. Phillips and M. Vavra

The grass seed producer is faced with the problem of disposing of grass straw if field burning is banned. Also, cattle producers are faced with increasing costs of wintering cattle. Wintering costs for beef cattle could be reduced by feeding grass straw while grass seed producers could recover the cost of removing straw from their fields. Research on the use of grass straw in wintering rations for beef cattle has been underway at the Union Station of the Eastern Oregon Agricultural Research Center for the past three years. This report will cover the work of the past two years.

EXPERIMENTAL PROCEDURE

The 1973-74 feeding trial was started on December 5, 1973 and continued for 57 days. The trial consisted of 3 treatments with 20 cows in each treatment. Cows averaged about 1,250 pounds body weight and were in a fleshy condition. Each cow was injected with one million I.U. vitamin A at the beginning of the trial. All cows had access to fresh water and salt-mineral mix. The treatments were: (1) hard fescue straw free choice plus two pounds of supplement, (2) Merion bluegrass straw free choice plus one pound of supplement, and (3) twenty-five pounds of alfalfa-grass hay. The supplement in treatments 1 and 2 consisted of two parts oats to one part cottonseed meal.

The 1974-75 feeding trial was conducted for 82 days starting October 23, 1974. There were 3 treatments with 20 cows in each. Cows were similar in size and condition to previous year. All cows were injected with one million I.U. vitamin A prior to the trial. All animals had access to fresh water and salt-mineral mix. The three treatments were: (1) hard fescue straw free choice plus five pounds of alfalfa-grass hay, (2) hard fescue free choice plus nine pounds alfalfa-grass hay and (3) hard fescue straw free choice plus two pounds of supplement (3:1 oats:cottonseed meal). In addition to the feeding trials, two digestion trials were conducted using sheep and a digestion and rate of passage trial was conducted using cows.

RESULTS AND DISUCSSION

The results of the 1973-74 feeding trial are shown in Table 1. Cows fed hard fescue straw lost 0.37 pound a day while cows fed Merion bluegrass straw gained 0.18 pound a day and cows fed alfalfa-grass hay gained 0.60 pound a day. Cows fed hard fescue straw gave birth to heavier calves than cows in the other two groups. This difference was consistent but further work is needed to determine if this is real or by chance. Conception rate was highest (95%) for the cows fed Merion bluegrass straw followed by cows fed hard fescue straw (90%) and cows fed alfalfa-grass hay (85%). Numbers were too few to determine if this was significant. Also these cows were too fat to start with and added weight in this case may actually be a detriment to conception rate. When averaging the conception rate for cows in the 1972-73 and 1973-74 feeding trial there was no difference between the three treatments.

Table 1. Results of feeding grass seed straw and alfalfa-grass hay to pregnant cows during the winter of 1973-74

Treatment	Average daily roughage consumption	Average daily weight change	Calf birth weight	Conception rate
	lb	lb	lb	%
Merion bluegrass straw	25.4	0.18	79	95
Hard fescue straw	20.1	-0.37	84	90
Alfalfa-grass hay	25.4	0.60	78	85

One cow that was fed hard fescue straw died of an abomasal compaction two weeks after she had been removed from the trial. Two cows on the same treatment died of compaction the previous year.

The results of the 1974-75 feeding trial are shown in Table 2. The cows fed straw plus 9 pounds alfalfa-grass hay consumed the most roughage (24.6 pounds) followed by cows fed straw plus 4 pounds alfalfa-grass hay (22.3 pounds) and cows fed straw plus supplement (19.8 pounds). Cows fed straw plus 9 pounds of hay gained 1.08 pounds per day compared to 0.46 pound for those cows fed straw plus 4 pounds hay and 0.29 pound for those fed straw plus supplement.

Table 2. Results of feeding two levels of alfalfa-grass hay or supplement in combination with hard fescue straw to pregnant cows during the winter of 1974-75

Treatment	Average daily straw consumption	Average daily hay consumption	Average daily weight change	Cost of[a] feed/head/day
	lb	lb	lb	¢
Straw + 4 lb alfalfa-grass hay	17.6	4.7	0.46	25.5
Straw + 9 lb alfalfa-grass hay	16.0	8.6	1.08	34.4
Straw + concentrate supplement	19.8	-	0.29	32.6

a Cost of feed: hard fescue $15/ton, alfalfa-grass hay $50/ton, oats $150/ton and cottonseed meal $220/ton. Cows of similar condition and size would require about 20 pounds of good quality alfalfa-grass hay per day for wintering which would make the wintering cost at 50¢ per head per day.

Two cows became compacted on the straw plus nine pounds of hay. The first cow became compacted after 55 days on feed. She responded to medication and lived. The second cow became compacted after 69 days on feed and died even though she was treated the same as the first animal. Possibly treatment was not started soon enough.

The lowest cost ration for the winter period was the straw plus four pounds of hay followed by straw plus supplement with straw plus nine pounds of hay being the most costly. Hard fescue grass straw can reduce the cost of wintering cows when compared to alfalfa-grass hay (Table 1).

Digestibility data from sheep trials indicates that hard fescue straw for a dry matter digestibility of about 46% (Table 3). The digestibility of Merion bluegrass straw was 47%, similar to the hard fescue. Good quality alfalfa will have average values of about 60% for digestible dry matter.

Table 3. Crude protein and dry matter digestibility of grass straw fed in feeding and digestion trials during 1973-74 and 1974-75

Forage	Crude protein	Dry matter digestibility
	%	%
Hard fescue straw (1973)	5.76	46.13[a]
Hard fescue straw (1974)	4.92	43.49[b]
Merion bluegrass straw (1973)	6.34	47.09[a]

a Digestibility determined using sheep fed chopped straw.

b Digestibility determined using cows fed baled straw.

There is considerable variation in the quality of straw. Crude protein values of different varieties and farming practices such as cutting time, irrigation and fertilization on bluegrass straw, range from as low as 2.5% to a high of 9% with corresponding variations in energy values. We find these same variations in the ryegrass and fescue varieties. Due to this extreme variation the nutrient quality of the straw to be fed should be determined before the winter feed program is established.

The results of the work at the Union Station indicate that Merion bluegrass straw can be fed with an energy and protein supplement to wintering cows with no ill effects.

The feeding of hard fescue straw to wintering cows could result in compaction. Compaction usually occurs between 25 and 70 days on feed. Studies at the Union Station have shown that rate of passage slows down and digestion decreases after 45 days of feeding hard fescue straw. These two situations can lead to compaction. Work will continue in this area to find a solution to the compaction problem and to determine the effect of various cultural practices on the nutrient quality of grass and straw.

COW SIZE AS RELATED TO EFFICIENCY

H. A. Turner

The question of optimum cow size has been discussed, debated, and researched since the early 1800's. The pendulum has swung all the way from the early "Durham Ox" that weighed about two ton to the "compress" cattle that matured at less than one-fourth that weight. Currently, we are back on the road towards big cattle, both within breeds and by the introduction of new breeds.

Interest in cow size and how it relates to overall efficiency is probably at an all time high because of the cost-price squeeze. Efficiency is a trait of livestock that will become more important as the world's food problem becomes more acute and as the raw materials for meat production become more expensive and less plentiful.

For each calf produced, the cow's responsibility ends at weaning. However, the cost of maintaining the cow throughout the year must be charged to the calf. Feed expense constitutes a large portion of the variable costs of producing a market animal and a very high proportion of the total feed required is attributable to the cost of maintenance of the cow. It takes about two animals in the breeding herd to produce one slaughter animal, so efficiency of the cow herd is extremely important and this would include energetic efficiencies of various size groups.

Data presented here were collected from a cow-calf confinement system at the University of Missouri. The studies were designed to look at cow size efficiency and to a partition energy utilization. Experimental animals consisted of 100, 12 year old, Charolais and Hereford cows. Cows were divided into large or small groups with cow size measured by body weight and with body composition determined by measuring the radioactive istope K^{40} Cows were individually fed, mechanically, a corn silage ration plus appropriate supplements. Cows were artifically bred with Charolais cows bred to Hereford bulls and vice versa. Calves were creep fed.

A summary of results from the maintenance trials are presented in Table 1. Requirements were substantially higher during the winter than in the summer. Most, or all, of this difference was probably due to severe environmental conditions. In addition to cold windy weather, precipitation levels were also high during the winter causing extremely muddy and sloppy lot conditions. This undoubtably erased any energetic savings due to less traveling in confinement.

Table 1. Maintenance requirements

Item	Large	Small
	lb	lb
Average weight maintained	1221	895
Weight 0.75 power	206	163
Summer		
Maint. reg/lb wt. (TDN)	.0069	.0069
Maint. reg/lb wt. 0.75 (TDN)	.0415	.0378
Winter		
Maint. reg/lb wt. (TDN)	.0078	.0092
Maint. reg/lb wt. 0.75 (TDN)	.0456	.0506
Combined		
Avg. maint. reg/lb wt. (TDN)	.0073	.0081
Avg. maint. reg/lb wt. 0.75 (TDN)	.0436	.0442

Comparing results of the summer and winter trials we see that small cows required less energy in relation to large cows over the summer period than they did in the winter. This difference may be due to differences in degree of fleshiness. The whole body K^{40} count data indicate that large cows were about 3% fatter than small cows. Additional fat cover in the summer may have acted as a detriment to large cows and as an advantage to them during the winter months. Fat may serve as an insulator and help reduce heat loss during the winter and conversely make it more difficult to eliminate heat in the summer months. Also body surface area would be greater per unit of body weight with small cows and this may cause them to lose more heat in the winter and enable them to cool themselves more efficiently in the summer.

The combined results of the winter and summer trials presents a good analysis of year round maintenance requirements and indicates that requirements increase proportionately by body weight to the 0.75 power. This relationship between differences in size and expected maintenance energy is often expressed in terms of the concept of "metabolic size" (weight to the 0.75 power). Maintenance requirements vary in proportion to this metabolic size rather than actual size. In other words a cow twice as big as another does not require twice as much feed. Metabolic weight reduces this discrepancy and allows us to predict relative requirements.

Table 2 presents the calf data and shows the large cows' calves gaining slightly more per day, requiring more total TDN, eating less creep feed and receiving more milk than the calves from small cows. Table 3 shows the TDN requirements for maintenance and lactation for large and small cows and presents the estimated milk production values. These results indicate that the small cows gave less milk, but were somewhat more efficient in terms of energy requirements to produce a given unit of milk.

Table 2. Calf data

Item	Large cows	Small cows
Days	176	170
Avg. daily gain (lb)	2.07	1.96
TDN required (lb)	5.17	4.60
TDN from creep (lb)	1.67	1.87
TDN from milk (lb)	3.50	2.73
Daily milk consumption (lb)	14.1	11.7

Table 3. Lactation data

Item	Large	Small
	lb	lb
Initial wt.	1155	924
Initial wt.$^{0.75}$	198	168
Final wt.	1151	926
TDN req. for maint. & lact.	14.1	12.1
Estimated maint. (TDN)	9.0	8.5
TDN left for lactation	5.1	3.6
Estimated milk production	14.1	11.7
TDN/lb of milk produced	0.36	0.31

Cow size efficiency data are presented in Table 4. Calves from large cows were only 13 pounds heavier at weaning. Total TDN over a year's time shows that large cows required 785 pounds more than small cows. In terms of energy conversion to product. However, the lowered energetic efficiency of the fatter, large cows may be partially due to increased maintenance requirements due to this fat, rather than a difference in the utilization of the surplus feed over maintenance. However, it is doubtful that this would have made up for the total differences.

Table 4. Projected cow size efficiency

Item	Large	Small
Dam weight, after calving (lb)	1155	924
Adjusted 205 day calf wts. (lb)	508	495
Daily TDN for maintenance (lb)	8.69	7.35
Total over 365 days (lb)	3170	2682
Daily TDN for lactation (lb)	5.06	3.61
Total over 205 days (lb)	1038	741
Total TDN, maint. & lact. (lb)	4208	3423
Carrying capacity/unit of feed - excluding creep	100	123
Daily TDN from creep (lb)	2.29	2.57
Total over 205 days (lb)	469	528
Total TDN, dam & calf (lb)	4677	3951
TDN per lb of calf (lb)	9.20	7.98
Wt. of calf req. for equal efficiency (lb)	585	495
Carrying capacity/unit of feed - including creep	100	118

With the current trend and promotion towards larger cattle, we tend to believe that because of higher rates of daily gain, large animals are more efficient. However, there is nothing in the literature that would indicate that any size or type of animal is any more energetically efficient than another. Increased efficiency requires that an animal gain more in relation to its maintenance requirement. Feed efficiency and rate of gain are highly correlated only when animals of the same size, on the same stage of the growth curve and of the same potential size are being compared. Otherwise, rate of gain is not a measure of comparitive efficiency.

To again emphasize the importance of the efficiency of the cow herd let us consider that less than 15% of the total energy fed to cattle is recovered in the final product. This means that over 85% of the energy is being used to simply maintain the cow-calf unit. Therefore, efficiency of the producing cow herd is more important efficiency of the sale calves, even if the producer keeps them to slaughter.

It should be emphasized that energetic efficiency does not represent the total picture of economic efficiency. Economic efficiency is dependent on percent calf crop, rate and economy of gain, ability to utilize available feedstuffs, performance under various environmental conditions, consumer demands, marketing conditions, salvage value of cows, system of production, type and cost of feedstuff, and energetic efficiency along with many other factors. The optimum size of cows under one set of conditions may be different under a different set of circumstances. All other things being equal, the large cow may have an inherent economic advantage in that any cost that is derived on a per head basis, such as taxes, breeding costs, veterinary costs and in some situations even feed costs, will favor the large cows because there will be fewer of them. However, it is questionable whether these advantages will make up for the reduction in efficiency.

Reproductive efficiency is probably the most important consideration of all. It makes little difference how efficient the cow may have been or how good her calf would have been if she doesn't have one. When we go to extremes in any trait, reproductive problems seem to follow and this may hold true for cow size. Many advocate retaining small cows and using large bulls. However, if calving problems arise due to large calves, then increased calf losses, cow losses, veterinary costs, reduced or delayed conception, labor costs, etc., may more than wipe out the advantages. Extremely large cows may not be able to consistantly produce a calf every 12 months but may require 13 or 14 months instead and again reduce any advantage the large cow may offer.

When it is all said and done the most profitable cow is the one which has a calf every year, is efficient, and her offspring is capable of producing lean and economical gains. One may conclude that medium is the size, simply because one will end up with some large and some small cows and many in between, which all averages out to medium. So select for overall reproductive and productive performance, taking into account all the previously discussed considerations, and the size of cow you end up with more than likely will be the "optimum" size.

EARLY WEANED FALL-BORN CALVES ON IRRIGATED PASTURE

R. Phillips & M. Vavra

Several water reclamation projects in Oregon have made water available for land previously considered marginal for irrigation purposes. Much of these lands are going into irrigated pasture which offers new management opportunities for livestock producers. The producer can increase production through intensive management without acquiring additional land. Also, with the need to produce red meat with less dependence on grain and more fully utilizing forages, improved pastures enhance these opportunities. The purpose of the pasture work at the Union Station is to investigate the use of irrigated pastures in beef cattle management systems for increased red meat production.

EXPERIMENTAL PROCEDURE

Pastures were seeded in 1973 to fawn fescue and Ladino clover. Seeding rates were 10 pounds of grass per acre and 6 pounds of clover seed per acre. The soil is well-drained and interspersed with shallow-soiled gravel bars. The grazing season started May 20 and continued until September 19. Pastures were sprinkler irrigated every two weeks from mid-June until the first of September. The grazing system consisted of two 2-acre pastures being grazed 21 days, followed by 21 days of rest. Animals were weighed on and off the pastures. Pasture forage quality and animal consumption were measured during the first and third weeks of grazing on each pasture during the entire summer.

Sixteen fall-born Hereford x Simmental and Hereford x Angus cross calves with an average weight of 380 pounds were divided into groups with respect to sex and breed. Eight of the calves were weaned on May 8 and grazed on irrigated pasture for the duration of the trials. Eight calves remained with their dams and grazed native forested range at the Hall Ranch from May 20 to June 28. The calves were then weaned on June 28 and moved to the station headquarters for a post weaning adjustment period. These late weaned calves were moved back to the range and grazed on a seeded forest clear-cut from July 8 to August 12.

RESULTS AND DISCUSSION

There was some seasonal variation in pasture quality which was probably influenced by irrigation and grazing practices as well as plant response to seasonal temperature change. Crude protein values of the pasture forage ranged from a high of 24.60% in early June to a low of 19.40% in mid-July (Table 1). Clear-cut forage crude protein values averaged 9.13% from July 8 to August 12.

Table 1. Crude protein content, on a dry basis, of the forage consumed by the calves during each grazing period

Period of grazing	Crude Protein
	%
5/8 - 6/10	21.21
6/11 - 6/28	24.23
6/29 - 7/19	19.40
7/20 - 8/12	21.67

The gain data for the calves under the two management systems are shown in Table 2. Little difference in gain was evident between early-weaned calves on irrigated pasture and calves left on their dams, with weaned calves gaining 0.14 pound per day less for the period of May 8 to June 28. During the period June 28 to July 8, which was a post weaning adjustment period for the late weaned group, the early weaning calves gained 1.43 pounds per head per day as compared to 1.40 pounds for the late weaned group. The drop in the late weaned group would be expected due to weaning stress but the drop in the early weaned group was not expected. There was a drop in forage nutrient quality as measured by crude protein changes (Table 1) that may partially explain it. However, the forage should have been high enough in quality to sustain a better gain. However, it does represent the latter half of the 21 day grazing period.

Table 2. Weight gains for early-weaned and late-weaned fall-born calves

	Average daily gain			
	May 8 to June 28	June 28 to July 8	July 8 to August 12	May 8 to August 12
	lb	lb	lb	lb
Early-weaned	2.57	1.43	1.83	2.20
Late-weaned	2.71	1.40	1.17	2.01

High quality pasture forage presents an opportunity to increase calf gains through intensive management. Early-weaned fall-born calves continued to gain well throughout the season while calf gains on range fell below 1 pound per day during July and early August. Irrigated pastures may also offer other management opportunities including finishing yearlings on pasture, possibly using low levels of energy supplementation, thereby reducing costly grain feeding.

PREVIOUS LIVESTOCK FIELD DAY REPORTS
SQUAW BUTTE EXPERIMENT STATION

These reports are available upon request from the Squaw Butte Experiment Station, P. O. Box 833, Burns, Oregon 97720.

Special Report 106 1961 — Page

Performance of Calves as Influenced by Time of Weaning - - - - - - - 1

Feed Intake and Performance of Steer Calves Wintered on Meadow Hay With and Without Added Protein - - - - - - - - - - - - - - - - - - 2

The Effect of Copper and Iron Injections on Rate of Gain and on Hemoglobin and Packed Cell Volume of the Blood of Range Calves From Birth to Weaning - 6

The Influence of an Antibiotic Supplement, a Flavor Additive, and an Arsenical Appetite Stimulant on Weaner Calf Performance - - - - 9

Low Levels of Alfalfa in the Winter Ration for Weaner Calves - - - - 11

Special Report 126 1962

Influence of Different Levels of Salt in a Cottonseed Meal Supplement for Yearling Cattle on Crested Wheatgrass Range - - - - - - - - 1

The Influence of Salt and Water Intake on the Performance of Protein Supplemented Yearlings - 4

Response of Weaner Calves to Various Levels of Energy and Protein Supplementation - 8

The Influence of Enzyme Additions to Meadow Hay Rations for Weaner Calves - 11

Special Report 145 1963

Protein and Energy Supplements for Yearlings on Crested Wheatgrass Pasture - 1

Energy, Protein, and Urea Supplements with a Meadow Hay Roughage for Weaner Calf Rations - 6

Digestibility measurements on Native Meadow Hay and their Effect on Animal Performance - 9

Wintering Mature Cows on Limited Rations - - - - - - - - - - - - - - 12

Performance Traits in Weaner Calves ad Indicators of Future Performance and as Related to Weight of Their Dams - - - - - - - - - - - - 15

Special Report 171 1964 — Page

Supplemental Energy and Protein Requirements for Weaned Calves Fed Early and Late Cut Meadow Hay - - - - - - - - - - - - - - - - - - - 1

Supplementing Yearlings on Native Range - - - - - - - - - - - - - - - 4

Calf Production from aged cows in the Squaw Butte Breeding Herd - - - 9

Comparison of Hereford and Charolais x Hereford Cattle - - - - - - - -14

Special Report 189 1965

Natritive Value of Range Forage and Its Effect on Animal Performance - 1

Yearling Cattle Gains on Native Range Forage and Bunched Hay - - - - - 7

Performance of Calves Fed Vitamin A with Baled and Chopped Meadow Hay - 10

Vitamin A Nutrition and Performance of Hereford Heifers Fed Different Levels of Nitrate - 12

Special Report 210 1966

Slaughter Steers from Range Feed - - - - - - - - - - - - - - - - - - 1

Urea in the Ration of Weaner Calves - - - - - - - - - - - - - - - - - 4

Level of Protein for Two-Year-Old Heifers During Pregnancy - - - - - - 8

Fall Calving Program - 11

Special Report 232 1967

Urea in a Growing Ration for Beef Cattle - - - - - - - - - - - - - - - 1

Digestibility of Rye Hay - 3

Production of Fall Calves -6

Finishing Steers on Range Feed - - - - - - - - - - - - - - - - - - - 9

Special Report 251 1968

Comparative Value of Barley and Meadow Hay with Two Sources of Nitrogen for Wintering Calves - 1

Vitamin A in Range Livestock Production - - - - - - - - - - - - - - - 5

Biuret, Urea, and Cottonseed Meal as Supplemental Nitrogen for Yearlings on Range Forage - 9

High Quality Fall Range Feed by Chemical Curing - - - - - - - - - - - 14

Page

Special Report 270 1969

Fall Calf Production - 1

Nonprotein Nitrogen for Wintering Calves - - - - - - - - - - - - - - - - 3

Energy Sources for Wintering Calves - - - - - - - - - - - - - - - - - - 5

Comparative Value of Alfalfa and Meadow Hay in the Wintering Ration of Weaner Calves - 8

Special Report 288 1970

Commercial Cow Herd Selection and Culling Practices - - - - - - - - - - 1

Weaning and Post-Weaning Management of Spring Born Calves - - - - - - - 5

The Comparative Value of Hay and Barley in the Wintering Ration of Weaner Calves - 8

Alfalfa Hay for Weaner Calves - 11

Special Report 322 1971

Daily Versus Alternate Feeding of Range Supplements - - - - - - - - - - 1

Management of Cattle Grazing Native Flood-Meadows - - - - - - - - - - - 4

Fall Calf Production - 9

Energy Level and Nitrogen Source for Fall Calving Cows - - - - - - - - 13

Special Report 352 1972

Creep Feeding Fall-Born Calves - 1

Ralgro and Stilbestrol Implants for Beef Cattle - - - - - - - - - - - - 5

The Value of Quality Hay for Weaner Calves - - - - - - - - - - - - - - 10

The Effect of Winter Gains on Summer Performance - - - - - - - - - - - 13

Special Report 380 1973

A Comparison of Long vs Chopped Alfalfa or Meadow Hay for Wintering Weaner Calves - 1

Nitrogen and Energy Relationships in Wintering Steer Calves - - - - - - 6

Copper and Molybdenum Nutrition in Pasture Management - - - - - - - - 13

Profit from a Short Breeding Season - - - - - - - - - - - - - - - - - - 17

Special Report 407 1974 — Page

Liquid Supplements in Beef Cattle Production - - - - - - - - - - - - 1

Ralgro - Suckling Calves to Slaughter - - - - - - - - - - - - - - - - 4

Relative Forage Requirements of Spring and Fall Cow-Calf Pairs on Range - 7

Some Implications of Early Spring Turnout - - - - - - - - - - - - - - 11

Special Report 431 1975

Comparative Range Forage Intake of Spring and Fall Calving Cow-Calf Pairs - 1

Feeding Grass Straw to Wintering Beef Cows - - - - - - - - - - - - - - 5

Cow Size as Related to Efficiency - - - - - - - - - - - - - - - - - - 9

Early Weaned Fall-Born Calves on Irrigated Pasture - - - - - - - - - - 14