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Costs and Returns of Producing

Feeder Cattle in Wyoming Mountain Valley Areas

W. Gordon Kearl Stephen V. Gleason Dillon Feuz

Department of Agricultural Economics
University of Wyoming

College of Agriculture
The University of Wyoming

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Colin Kaltenbach, Director, Agricultural Experiment Station, University of Wyoming, Box 3354, University Station, Laramie, WY 82071.

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COSTS AND RETURNS OF PRODUCING FEEDER CATTLE IN WYOMING MOUNTAIN VALLEY AREAS

by

W. Gordon Kearl
Stephen V. Gleason
and Dillon Feuz [1/]

SUMMARY AND CONCLUSIONS

The objective of this study was to make economic comparisons of production alternatives which may be used to produce cattle suitable for slaughter without feeding grain .

During 1975-1984, an average of 613,000 calves were produced annually in Wyoming. Heifers for replacement averaged 133,000 head, leaving a potential of 480,000 head to be sold as calves, yearlings, 2-year-olds and fattened cattle combined.

Seasonality and total amount of gains are an important consideration as they relate to the size and condition of "grass-fed" cattle and seasonal availability for slaughter. Useful experimental data are available from a number of sources. When allowances are made for differences in grazing season, there is a high degree of consistency in seasonal and total gains reported from areas as diverse as Miles City, Mont., the Central Plains Experimental Range 25 miles south of Cheyenne, Wyo., the Divide area near Baggs, Wyo., and on the Uinta Mountains, southwest of Flaming Gorge Reservoir.

Gains for yearling or 2-year-old steers or heifers at various locations are summarized below:

1/ Professor of Agricultural Economics, Research Associate and Graduate Student, Department of Agricultural Economics, University of Wyoming, Laramie, Wyoming.

Location	Kind [a]	Grazing Period	Gains (Lb.)
Uinta Mts. (Utah)	Heifers (1)	June-Sept	200
Divide Area (near Baggs, Wyo.)	Steers (1)	May-Aug	263 [b]
Miles City	Steers (1's)	4-7/9-29	292
	Steers (2's)	3-30/8-18	257
	Heifers (1's)	197 days	276
Gains on ranges in Colorado were as follows:		May-Sept	May-Oct
Central Plains	Heifers (1)	269	270
	Steers (1)	274	287
Shortgrass Range	Steers (1)	285	295
	Heifers (1)	247	252
	Heifers (2)	257	255

Attempts to market cattle earlier than the September-October period will result in a revenue sacrifice because of lower weights. Attempts to carry animals longer increases interest and feed expenses, with little or no increase in weight, unless it is done by a feeding program. Also, cattle carried for a significant period at very low gains are not very suitable for slaughter, regardless of weight.

During June-August 1985, a detailed ranch survey was conducted throughout Wyoming to obtain data on resource base, cattle inventories, sales, winter feeding, pasture requirements, costs of operation, machinery, equipment and improvement inventories, labor use and management practices.

Following the data-gathering phase, data were analyzed and ranches were classified by type: (1) cow-calf, (2) cow-spring yearling, or (3) cow-yearling; and by size: (1) small, 100-375 cows, or (2) large, more than 375 cows. Data were then summarized to represent each of the six size/type groups and a common size of 355 animal-units (AUs) for the small size and

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[a] Numbers in parentheses indicate age of animals, either yearlings (1) or 2-year-olds (2).

[b] The mid-point of weights for four treatments.

865 AUs for the large size was selected.

If a program to produce grass-fed slaughter cattle is to be viable, it will likely depend upon: (1) the ability of Wyoming producers to produce unusually heavy yearling cattle; or (2) upon the economic feasibility of carrying yearling cattle through another winter and summer to sell as "2-year-olds" at about 28-32 months of age. The possibilities were analyzed by considering the economic effect of converting a cow-calf or cow-spring yearling basic ranch to the cow-yearling type and subsequently from the cow-yearling to cow-2-year-old type of operation, holding the resource base constant. The conversions were as follows:

Basic ranch	Convert to	Convert to
Cow-calf	Cow-yearling	Cow-2-year old
Cow-spring yearling	Cow-yearling	Cow-2-year old
Cow-yearling	----	Cow-2-year old

The conversions are made by reducing the number of cows and heifers to calve in the cow-calf operation in order to release grazing for yearlings carried over on the ranch converted to cow-yearlings. Cow-calf-yearling inventories are then reduced to provide capacity for 2-year-olds. Carrying heifers to 2-year-olds was not considered because of difficulty of carrying heifers through the yearling and 2-year-old breeding seasons.

Some of the most important production coefficients found in the survey and the needed adjustments in the cow herd are summarized in Table 1.

Weights of steer and heifer calves on the small cow-calf operation, 464 and 430 lb., are higher than expected, but plausible. Assuming those calf weaning weights for the small cow-yearling operation, then yearling sale weights of 790 and 733 lb. represent weaning to yearling gains of 326 and 303 lb. These are quite reasonable. The large cow-calf group, with calf weights of 525 and 510 lb., included three exceptional managers using crossbreeding programs involving some large-breed influence. The weight of yearling steers from the large cow-yearling operation is also plausible given a calf weight

of 464 lb. However, weights in general are likely to be considerably less than that.

Table 1. Production Coefficients for Small and Large Sized Cow-Calf, Cow-Spring Yearling and Cow-Yearling Ranches, Mountain Valley Areas of Wyoming.

	Types of Operation					
	Small Sized			Large Sized		
Item	Cow-Calf	Cow-Spring Yrlng	Cow-Yrlng	Cow-Calf	Cow-Spring Yrlng	Cow-Yrlng
Cows to calve	259	228	188	593	544	474
Calf crop weaned	88.1%	77.4%	82.3%	85.6%	91.0%	89.4%
Average weights (lb.)						
Cull cows	985	1,027	1,075	1,073	1,041	995
Steer calves	464	-	-	525	-	-
Heifer calves	430	-	-	510	-	-
Yearling steers	-	539	790	-	606	763
Yearling heifers	-	508	733	-	529	644

The data reveals a distinct tri-modal distribution of steer weights. Most of the steers under 625 lb., 29% of the total, were calves. About 37% of the steers were in the yearling feeder cattle range with very few of them more than 900 lb. Only 0.5% of yearling feeder steers were in the 926-1025 lb. range, averaging 940 lb. About 19% of the steers were custom fed and about 15% were of the spring-yearling group.

Very few yearling heifers weighed over 825 lb. About 20% of the heifers were put through the custom feedlot to be sold for slaughter and about 18% were in the spring-yearling sales category.

The yearling sales weights reported (R) or projected (P) after allowing for winter gains of 150 lb. for heifers and 165 lb. for steers were as follows:

Size and Type of Operation	Fall Yearling Sale Weights (Lb.) Heifers	Steers
Small		
Cow-calf	780 (P)	850 (P)
Cow-spring yearling	745 (P)	805 (P)
Cow-yearling	733 (R)	790 (R)
Large		
Cow-calf	850 (P)	900 (P)
Cow-spring yearling	750 (P)	840 (P)
Cow-yearling	644 (R)	763 (R)

Net returns are summarized in Table 2. Cash receipts from cattle and sales or increase in hay inventory are shown as sold in Table 2. Average 1980-84 cattle prices for the Eastern Wyoming-Western Nebraska area (Torrington) were used in this analysis.

Net cash income is calculated by subtracting cash expenses not shown in Table 2 from cash receipts. It is the amount of cash actually available for family living, debt retirement and purchase of new equipment, etc.

The total tons of hay fed tends to increase for those producers converting from cow-calf to yearling and 2-year-old operations. Conversions from spring-yearling operation bases tend to feed the same or lesser amounts of hay. Cow-yearling and cow-2-year-old systems feed about the same hay tonnages. Cash expenses vary almost entirely due to changes in feed requirements on the small cow-calf operation compared to conversions. For all other type and size operations, the variation in feed requirements affects the hay available for sale or inventory increase.

Owner-operated ranches must provide funds to meet family living expenses. That item is not included in cash expenses unless the operation is incorporated and officers salaries cover it. In this study, 10% of gross receipts from cattle sales is used as income to the operator. Depreciation amounts to $17,000 on the small-sized operation and $24,600 on the large-sized. The allowances for operators labor and management and the

charge for depreciation are subtracted from net cash income to arrive at return to total capital.

Return to fixed capital (land and improvements) is calculated by deducting a 10% interest charge on the investment in cattle, horses, and

Table 2. Summary of Net Returns by Size and Type of Operation (Dollars)

	Total Income	Net Cash Income	Return to Total Capital	Return to Fixed Capital
Small Operation				
Basic cow-calf	70,285	19,520	-4,680	-29,318
Convert to cow-yearling	81,608	24,367	167	-25,304
Convert to cow-2-year-old	74,264	19,216	-4,984	-31,507
Basic cow-spring yearling	70,990	21,120	-3,080	-27,603
Convert to cow-yearling	70,670	21,595	-2,605	-28,251
Convert to cow-2-year-old	68,053	19,572	-4,628	-31,164
Basic cow-yearling	71,302	20,558	-3,642	-29,206
Convert to cow-2-year-old	67,124	17,575	-6,625	-33,348
Large Operations				
Basic cow-calf	192,908	94,532	50,732	-6,865
Convert to cow-yearling	196,371	100,057	56,247	-3,474
Convert to cow-2-year-old	179,621	84,745	40,945	-21,605
Basic cow-spring yearling	195,678	68,670	24,870	-34,685
Convert to cow-yearling	192,521	71,287	27,487	-34,135
Convert to cow-2-year-old	182,137	64,286	20,486	-43,377
Basic cow-yearling	185,136	53,708	9,908	-52,469
Convert to cow-2-year-old	180,795	53,275	9,475	-53,617

machinery. Interest on machinery was $11,036 on the small and $23,772 on the large-sized operations. Variations in total interest on working capital are due to variations in investment in livestock.

In general, returns improve with the conversion from cow-calf to cow-yearling systems, but are reduced with the conversion to the 2-year-old steer program.

Ranchers considering the production of grass fat animals will be concerned with the reduced returns of converting to a cow-2-year-old operation. In order to offset these reductions, a premium price must be commanded in the market place. Assuming that cow-yearling operations currently tend to be most profitable, Table 3 shows the premiums needed to make 2-year-old operations an equally feasible alternative, based on returns to fixed capital.

The data used in the analysis indicates that premiums of 1.1-17.6% would be required. On average, smaller operations would require higher premiums than larger operations, (10.7% compared with 9.3%). Those ranchers producing heavier yearlings, which resulted when converting from a cow-calf or cow-spring yearling to the yearling operation, required high premiums. They did not have a potential for high gains on the 2-year-olds. The large cow-yearling operation did not require such a high premium, as it had potential for adding more gains on 2-year-olds. It must be noted that individual situations must be considered before decisions to change operations could be made.

Table 3. Reductions in Returns to Fixed Capital Occurring with Conversions From the Cow-Yearling to Cow-2-Year-Old Operations and Resulting From Conversions.

Operations Compared	Loss in Converting		Price Premiums Required	
	Total	Per Steer	Dols/Cwt	Percent
Small				
Cow-calf converted to cow-2-year-old [a/]	6,203	88.61	8.28	13.6
Cow-spring yearling converted to cow-2-year-old [a/]	2,913	52.96	5.04	8.3
Cow-yearling converted to cow-2-year-old	4,142	65.75	6.26	10.3
Simple Average-Small	4,419	69.10	6.53	10.7
Large				
Cow-calf converted to cow-2-year-old [a/]	18,131	115.48	10.79	17.6
Cow-spring yearling converted to cow-2-year-old [a/]	9,242	60.40	5.64	9.2
Cow-yearling converted to cow-2-year-old	1,148	6.91	.67	1.1
Simple Average-Large	9,507	60.93	5.70	9.3

[a/] The basic ranch type, cow-calf or cow-spring yearling is indicated. The premium are calculated after converting them to cow-yearling for comparison with the 2-year-old.

INTRODUCTION

This study examines economic comparisons of production alternatives, which may have the potential to produce cattle suitable for slaughter directly off rangeland.

Cattle ranching occurs throughout Wyoming under many different conditions. This study focuses on the high mountain valley type represented by the southwest triangular portion of the state from Albany to Uinta and Teton counties, and the basin-mountain valley type of the northwest. In the latter, crop production can occur at either higher elevations or in a more intense and more diversified fashion at lower elevations in the basins.

Because all ranching types could not be studied immediately or simultaneously, a decision was made to focus on the High Mountain and Basin-Valley types.

REASONS FOR UNDERTAKING PROJECT

Livestock ranching is, by far, the leading agricultural activity in Wyoming. The cattle ranching industry produced an average of $438 million in cash receipts and $307 million value of production annually during 1979-1984. Value of production differs from cash receipts by allowing for resale of purchased livestock and changes in inventories.

Livestock provides the means for marketing about $138 million or 77% of the value of crop production during 1979-1984. Resources used by the livestock industry amount to more than 20 million animal-unit-month (AUM) equivalents of range, pasture and harvested forages and feeds. That includes over 2 million AUMs of grazing from public lands, more than 2 million tons of hay providing about 6 million AUM equivalents, over 2 million AUM equivalents from other harvested feeds, about 1 million AUMs from crop

aftermath and about 9 million AUMs from state and privately owned ranges and pastures. Of the total resources used by livestock, about 90% is used by cattle and about 10% by sheep.

The range livestock industry continues to face a number of problems. Input costs in 1984 were averaging 50% above 1978 levels. Cattle prices reached historical highs in 1979 and declined somewhat in 1980. They have nearly returned to 1978 levels for cull cows, steers and heifers and below 1978 levels for calves.

REVIEW OF PREVIOUS WORK

Research in ranch economics in Wyoming began with studies by Vass and co-workers from 1930 into the 1950s.

Stevens and Agee (1961, 1962) reported data from the 1959 year for a study of cattle ranching in the mountain valley areas of Wyoming. Follow-up studies were reported by Stevens (1968, 1975). These were cost and return studies using cross tabulation techniques to examine factors affecting profitability in cattle ranching in those areas and provided good baseline data. Ranch management practices studied were adoption of artificial insemination (Stevens and Mohr, 1969) and pre-conditioning of calves (Stevens and Teichert, 1970), a topic which was previously explored by Kearl (1968a).

During the same period, studies of cattle ranching in the plains area were made by Kearl (1961, 1965) and additional data were collected for 1964-1966. Those studies assembled baseline data for plains cattle ranching. Eikenberry (1966) studied stocker operations in Wyoming. Data from these studies were pooled with earlier studies to make analyses of cow-calf, cow-yearling, and various purchased stocker systems of operations simulated through 1946-1965 (Kearl, 1969, 1972). Given reasonable opportunities for

procurement of stocker cattle without excessive transportation or shrinkage costs, the different systems ranked from most to least profitable were: (1) spring purchased stockers; (2) fall purchased stockers: (3) combinations of 1 and 2; (4) combinations of 1 and 2 with a cow-yearling system; (5) a straight cow-yearling system; and (6) a cow-calf system was least profitable.

Comparisons among livestock systems or cow-calf vs. cow-yearling systems have since been made by researchers in other states. Results for the Wyoming northern plains area were confirmed by work in southwest North Dakota (Qualey and Leistritz, 1975). Linear programming was used to select optimum livestock systems. With minor modifications in the cropping program, a cow-yearling system produced a 42% increase in operator labor and management return compared with a typical cow-calf system. Variations in pasture management or prices did not change the optimum solution from the cow-yearling systems.

Linear programming was used to determine optimum systems in Colorado under various assumptions (Gee and Skold, 1970). The cow-yearling system was optimal for ranches using combinations of private and public range land and native hay meadows. A mixed operation selling some calves was optimum if improved meadow hay replaced the native meadow hay. However, total weight of yearlings sold exceeded total weight of calves sold by a ratio of more than three to one in that program. A cow-calf system was optimum for one ranch organization that allowed for sale of 469 tons of hay.

The superiority of the cow-yearling system has also been confirmed by work in Utah which used linear programming to develop optimum marketing schemes for ranches in Utah with 250-300 mother cows (Hewlett and Workman, 1978). At 1970-75 average prices net ranch income was maximized by reducing the cow herd and retaining all steer calves for sale as yearlings. Advantages of retaining heifers to yearling age for possible improvement of replacement selection was not considered.

Baseline data obtained in the Northern Plains studies of 1959 and 1964-66 were subsequently used in development of "model ranch" budgets for use in conjunction with experimental data from various sources for evaluation of crossbreeding among English breeds (Kearl, 1976). Advantages of crossbreeding include greater calf survival and consequently higher calf crops, greater calf and yearling gains and consequently heavier weights, somewhat higher gross receipts, little change in costs, and greatly increased returns to residual income claimants. Heavier weights attainable through crossbreeding may be an important element in production of grass-fed cattle suitable for slaughter.

Price discrimination against cross-bred cattle was rampant and serious in the 1950s and early 1960s. It diminished in the later 1960s, and was essentially non-existent by the early 1970s. Discrimination may have been replaced by a premium price for cross-breds, which will further enhance the economic advantages of cross-breeding (Menkhaus and Kearl, 1976; Kearl, 1982).

Base data from the plains studies and reseeding cost data and experimental data from other sources were used to evaluate economic feasibility of range reseeding (Cordingly and Kearl, 1976; Kearl, 1981). Spring use of ranges reseeded with cool-season grasses such as crested wheatgrass or Russian Wildrye can produce increased gains on cows, provide a flushing effect and result in greater conception rates and earlier calving. They also produce increased gains on calves and yearlings and thus may also be important to the Wyoming Lean concept by providing some increase in calf and yearling weights.

CATTLE INVENTORIES IN WYOMING

Average inventories of cattle in Wyoming on January 1, 1975, the year of highest recorded numbers, 1985 and the 1975-84 average, are summarized in Table 4. "Cows and heifers that have calved" do not all calve each year, or in

the immediate preceding year; but they have calved at some time in the past. Replacement heifers are mostly yearling heifers coming 2-years-old, but some of them may be past 2-years-old, without yet calving. Most, but not all, of the replacement heifers enter the cow-herd and will be part of the calving inventory during the spring.

Table 4. Cattle Inventories, Calves Born, and Animal-Unit-Months in Wyoming, January 1, 1975-85 (thousands).

Item	1975	1975-1984 Averages	1985
All cattle and calves	1,690	1,456	1,365
Cows and heifers that have calved[a/]	819	697	630
Replacement heifers	163	133	122
Potential calving herd	982	830	752
Other cattle over 500 lbs.[b/]			
Heifers	41	59	78
Steers	79	113	169
Sub-total other cattle	120	172	247
Calves under 500 lbs.	540	410	330
Bulls	48	42	36
Calves born in the year	760	660	[d/]
Calf death loss	75	47	[d/]
Animal-unit-months (AUMs)[c/]	20,280	17,472	16,380

Source: Statistical Reporting Service, 1983. "Wyoming Agricultural Statistics, 1983." Division of Agricultural Economics, University of Wyoming and the Wyoming Dept. of Agriculture in Cooperation with Economics, Statistics and Cooperative Services of the U.S. Dept. of Agriculture.

a/ About 1.5% are dairy cows and 98.5% are beef cattle.

b/ Typically includes 35,000-45,000 cattle on feed. The increase from 1975-1985 probably results from a larger number of calves more than 500 lb., not more feeding or retention of more yearlings.

c/ Based on AUM coefficients of 1.0 for all cattle and calves in inventories, multiplied by 12 months. Calves born in the year are not entered into the calculation until they enter the "calves under 500 lb." class.

d/ Final estimates not available.

Other "cattle 500 lb. or more" include steers and heifers. They are mostly yearlings but can include some calves born in the year. Typically 35,000-45,000 are in feedlots being fattened on January 1. Others are held for sale as 2-year-olds.

"Calves under 500 lb." on January 1 are weaned calves from the previous year calf crop that haven't been sold. They provide the heifer replacements to be retained and steers and heifers to be sold as yearlings during the next year.

Calves born in the year averaged 660,000 head for 1975-1984 and provide 410,000 calves under 500 lb. to be carried over. Calf death loss, much but perhaps not all occurring between birth and weaning, amounts to about 47,000 head, which allows for about 200,000 head of calves to be marketed. It is difficult to arrive at a precise "cattle balance sheet" or reconciliation because of some inshipment and outshipment occurring during the year.

Animal-unit-months (AUMs) required for cattle on a year-long basis are also shown in Table 4. For these purposes an AUM was defined as the monthly forage requirement for cattle in the January 1 inventories without regard to size. The historical peak requirement was in 1975.

SEASONALITY OF GAINS

Seasonality and total gain is important in managing any type of cattle ranching operation. It is particularly important in producing cattle for slaughter off range or pasture. The importance relates to: (1) the size and condition of "grass-fed" cattle available for slaughter during different months; and, (2) extending the marketing period when grass-fed cattle may be available at size and condition suitable for slaughter.

Livestock Gains at the Northern Plains Experimental Range

Woodward provided information on summer gains of yearling and 2-year-old steers (Table 5) and described the data as follows:

> "The yearling and 2-year-old steers have made about the same average daily gains. Since the periods covered are not exactly the same for the two age groups, a more exact comparison is impossible. These steers were all run in the same pasture most of the summer.
>
> "Seasonal rainfall had little or no effect upon gains for these three years, although it varied from 7-13 inches." (Woodward, undated.)

The yearling steers grazed about 40 days longer than the 2-year-olds, and on the average gained 35 lb. more. This suggests a significant slowing in rate of gain or perhaps even some loss of weight late in the grazing season. The total gain of yearlings, 292 lb., is consistent with data from the Central Plains Experimental Range and other locations in Colorado which will be shown subsequently.

Table 5. Summer Gains of Steers -- 1953-55 (Northern Plains Experimental Range, Miles City, Mont.).

Year	Spring		Fall		Total Gain	Daily Gain
	Date	Weight	Date	Weight		
	Yearling Steers (175 Days Average)					
1953	4-8	495	9-30	771	276	1.58
1954	4-7	475	9-29	753	277	1.59
1955	4-6	481	9-27	801	322	1.85
Average	4-7	484	9-29	775	292	1.67
	2-Year-Old Steers (141 Days Average)					
1953	4-8	743	8-19	1,001	258	1.86
1954	3-23	757	8-17	1,012	255	1.79
1955	3-29	826	8-18	1,082	256	1.80
Average	3-30	775	8-18	1,032	257	1.82
	Yearling Heifers (197 Days Average)					
1953		503		787	284	1.44
1954		525		803	278	1.46
1955		522		810	288	1.52
Average		517		800	283	1.47
1946-1955		477		753	276	1.40

Data on heifer gains for 1946-1955 were also available and shown for comparison with steers (Table 5). Regarding heifers, Woodward said:

> "Heifers at the Miles City Station are bred to calve at three years of age. The heifer calves are wintered on hay with a mineral supplement. Heifer calves to be bred as yearlings are often fed on a higher plane of nutrition. Anyone following this practice may have heavier spring weights and probable lower summer gains than those recorded here.

The average daily gain of heifers is reduced by the long grazing season, 197 days average, compared with about 175 days for yearling steers and 135-145 days for 2-year-olds. The total gain of heifers, 276 lb. is also consistent with performance of heifers at the Central Plains Experimental Range in Colorado. The additional days of grazing do little to enhance total gain of these heifers.

Livestock Gains-Central Plains and Rocky Mountains

G.E. Klipple, formerly range conservationist at the Rocky Mountain Forest and Range Experiment Station, also provided some information from that station.

> "Frequent requests have been received by the Rocky Mountain Forest and Range Experiment Station for data on weight gains made by cattle grazing summer range. The average weight gains listed below have been compiled from the cattle-weight data gathered by this station during the past 13 years. The monthly figures are weighted averages of all of the available data for the indicated class of cattle, rounded to the nearest pound. The bunchgrass data are from Manitou Experimental Forest, and the data for shortgrass ranges are from the Central Plains Experimental Range (Table 6).
>
> "Monthly average weight gains made by yearling steers, yearling heifers, and 2-year-old heifers, follow a similar pattern. During the first half of the summer season, 60 to 90 percent of the total summer gains are made.
>
> "Low October weight gains by yearling and 2-year-old cattle indicate the desirability of moving all cattle intended for fall sale by early October." (Klipple, 1953.)

Yearling Heifers and Steers

Data are available from the Rocky Mountain Forest and Range Experiment

Table 6. Average Monthly Gains for Yearling Heifers Grazing at Varying Intensities 1940-49, Steers and Heifers at Moderate Intensities of Grazing 1943-1952, Central Plains Experimental Range (Nunn, Colo., about 25 miles southeast of Cheyenne, Wyo.) and Yearling and 2-Year-Old Heifers, Shortgrass Ranges.

Item	Unit	Heifers - 1940-49 Intensity of Grazing[a]		1943-1952 Moderate Intensity[b]		Shortgrass Ranges[c]			
		Heavy (60% Use)	Moderate (40% Use)	Heifers	Steers	Yearling Steers	2-year old Heifers	Yearling Heifers	Pond. Pine Bunchgrass Heifers[c]
Month									
May	lb.	66	69	65	61	61	66	67	--
June	lb.	56	61	57	60	65	60	64	72
July	lb.	52	58	56	56	63	56	46	54
Aug.	lb.	41	49	45	53	57	47	38	46
Sept.	lb.	20	32	36	44	39	28	32	42
Oct.	lb.	-14	1	4	12	10	-2	5	-2
Total Gain									
May-Sept.	lb.	235	269	260	274	285	257	247	214
May-Oct.	lb.	221	270	264	287	295	255	252	212
Ave. Daily Gain									
May-Sept.	lb.	1.53	1.77	1.70	1.79	1.86	1.68	1.61	1.75
May-Oct.	lb.	1.20	1.47	1.43	1.56	1.60	1.39	1.39	1.39
Average Numbers									
Animals	no.	91	92	37	27				
Acres	acres	852	1,456	552	280				
Acres/Animal	acres	9.4	15.9	14.9	10.4				

[a] Klipple, G.E. and David F. Costello. "Vegetation and Cattle Responses to Different Intensities of Grazing on Short-Grass Ranges on the Central Great Plains, Technical Bulletin No. 1216, U.S. Department of Agriculture, (Washington: 1960), p. 65, 66.

[b] Klipple, G.E. "Early-and-Late Season Grazing Versus Season-Long Grazing of Shortgrass Vegetation on the Central Great Plains." U.S. Forest and Range Experiment Station, Forest Service, U.S. Dept. of Agriculture, Fort Collins, Colorado, December 1964.

[c] Long-term gains, various years and time periods prior to 1953.

Station to show effects of intensities of grazing on seasonal gains of yearling heifers (Table 6). Although results for light intensities of grazing are not shown, gains are similar for moderate and light intensities of grazing through May, June and July. Gains are slightly less for the heavy intensities of grazing through those months, and noticeably less in September and October compared with the moderate or light intensities.

Losses occur on the heaviest intensity in October and gains tend to be very small for the moderate intensity. The decline in gains is due primarily to deterioration in quality of feed available. With moderate grazing, 40% utilization, approximately 60% of the total forage produced during the year is still available in October, so quantity of feed is not limiting. Actively growing grass has digestible nutrients, protein and mineral contents more than adequate for rapid animal growth. When the grass reaches maturity and after seed has set, nutritional values decline. That affects and is reflected in performance of the animals. There is year-to-year variation in quality of late season forage. However, examination of data for each year, and including years 1950-1966, shows a high repeatability of the results represented by these averages (Klipple, 1966).

In order to achieve the desired percentage utilization each year, stocking rates in these experiments were varied from year to year. That contrasts with a ranching situation where the forage production and utilization will vary from year to year as stocking remains relatively constant. The percentage of range forage utilization may be 40% or less in favorable years, or 60% or more in unfavorable years on a typical ranch. That will cause late season gains to vary somewhat, mostly in the direction of reductions in September and October gains because of variations in feed supply and percent utilization.

This was a relatively large experiment using an average of 183 animals

each year for 10 years, and with eight pastures aggregating 2,308 acres, for the heavy and moderate intensities of grazing. The data can be evaluated accordingly.

Comparisons have also been made between steer and heifer gains at moderate rates of grazing. Steers maintain a slightly higher rate of gain than heifers later in the season. That may be due to earlier maturity and onset of estrous among heifers.

The information presented has relevance for timing of marketing decisions, or shifting to alternative feed supplies. Use of crop aftermath, particularly on irrigated lands, might sustain a higher rate of gain through September and October than is shown for native ranges.

The 10-year averages of monthly gains shown from the Central Plains Experimental Range are quite representative of the individual year data and also for individual years 1953-1966 (Klipple, 1966). Gains were consistently high through August, except 1954 when an extreme drought occurred. Even then, gains were quite good through May and June before cattle were removed from the ranges. Gains were consistently decreasing in September and quite low in October for all grazing intensities. Significant exceptions to the pattern shown by the averages were rare.

Hereford steer gains reported by Shoop (1984) in the Central Plains range area from 1976-1983 were similar to those shown in Table 6. Gains averaged approximately 270 lb. in 145 days, which included most of May and September, or 1.86 lb. per day compared with 1.79 lb. per day for steers at moderate intensities of grazing and the full May-September period, for 1943-1952.

Klipple also reported on gains of yearling steers and heifers and 2-year-old heifers for other locations and time periods in Colorado (Table 6). Gains of 2-year-old heifers were very similar to those of yearlings. One could infer the same could be true of steers in the Central Plains, as was

shown previously for the Northern Plains (Table 5).

Cattle Weight Gains on a National Forest

Cattle weight gains have also been studied on the Diamond Mountain cattle allotment, Ashley National Forest, at the eastern end of the Uinta Mountains in Utah (Laycock and Conrad, 1981). Elevation of the area is about 8,000 feet. Data were obtained each year from 1961-1965 (Table 7). About 40 cows with calves and 30 yearlings were weighed each year. Cattle weighed were all of one ownership through the five years of the experiment, but not all the same cows were weighed each year. At first weighing cows averaged 865 lb. Yearlings, presumably heifers wintered at relatively high rates of gain to grow them for replacements, averaged 624 lb. while calves averaged 191 lb. at the start. Seeded pastures of smooth brome and crested wheatgrass were used in the first grazing period each year. Gains through the season were quite similar to those reported from the plains areas or the mountains of Colorado, allowing for the June-September grazing period and the heavy weights of the yearling at the start.

Table 7. Average Gain in Pounds Per Day by Time Periods on Diamond Mountain Cattle Allotment 1961-65 (Uinta Mountains, Utah).

Time Period	Cows	Yearlings	Calves
June 2 - July 4	2.4	1.8	1.8
July 5 - August 11	2.2	1.8	2.0
August 12 - October 5	.5	1.2	1.8
June 2 - October 5	1.5	1.6	1.9
Total (125 days)	187.5	200.00	237.5

Source: Laycock, William A. and Paul W. Conrad, 1981. "Responses of Vegetation and Cattle to Various Systems of Grazing on Seeded and Native Mountain Rangelands in Eastern Utah." Journal of Range Management, Vol. 34, No. 1, January 1981.

Other Experiments

Data from experiments in the Divide area, southwest of Baggs, Wyo., in a sagebrush bunch grass range type of area at about 6,500-7,000 feet reported steer gains of 243 lb. on different treatments from May 10 to September 7, 1955. Summer gain trends with high gains in May-July and lower gains in August-September were very much like those in the plains or mountains. (Hervey and Kochenderfer, 1956).

Suitability of cattle for slaughter directly off ranges or pastures is largely dependent on the rate of gain. They likely will not be suitable for slaughter when gains slow or stop, as would be expected in late September, October or later.

Attempts to market cattle earlier than the September-October period will result in cattle too small for slaughter and in revenue sacrifice because of lower weights. Attempts to carry animals longer results in increased interest and feed expenses, with little or no increase in weight, unless it is done by a feeding program or on some type of special pasture or crop aftermath where rapid gains can be continued.

SEASONALITY OF CATTLE MOVEMENTS FROM WYOMING

Seasonality of livestock gains is a primary determinant of seasonality of livestock marketings and movements. That data gives further indication of the seasonal availability of livestock in Wyoming. Shipments of Wyoming cattle to other states can be used to illustrate the seasonal movement of Wyoming cattle to markets (Table 8). About 60% of total cattle movement is in three months, September-November. October is the peak month of marketing, with about 26% of the movement.

Peak movement months vary by class of livestock. Movement is greater in

September and October for steers and heifers, October and November for calves and cull bulls, and October-December for cull cows.

Table 8. Seasonal Variation in Interstate Shipments of Wyoming Cattle, by Classes, 1960-81 Average.

Month	Steers	Heifers	Cows	Calves	Bulls	Unclassified	Total All Classes[a]
				(000 Head)			
Jan.	9.9	8.8	9.4	9.3	1.0	0.1	38.6
Feb.	8.5	8.2	7.2	5.7	1.0	0.1	30.8
Mar.	12.1	10.2	6.7	5.1	1.1	0.1	35.0
Apr.	16.6	13.7	6.2	5.3	1.1	0.6	43.6
May	17.5	12.2	8.0	5.8	1.3	0.8	44.8
June	10.8	8.4	10.4	4.5	1.4	0.5	35.4
July	8.9	7.3	9.5	1.8	1.2	0.3	29.0
Aug.	19.7	13.2	8.3	1.8	1.1	0.3	43.8
Sept.	76.9	40.3	9.8	7.0	1.2	1.2	136.4
Oct.	94.7	42.5	19.4	70.1	1.9	1.1	229.6
Nov.	33.9	24.1	31.0	72.4	2.1	0.4	163.8
Dec.	11.3	10.9	17.9	18.3	1.4	0.2	60.0
Total	319.0	199.3	143.9	207.1	15.9	5.6	890.9
				(Percent)			
Jan.	3.1	4.4	6.6	4.5	6.5	2.4	4.3
Feb.	2.7	4.1	5.0	2.8	6.2	1.5	3.5
Mar.	3.8	5.1	4.7	2.5	7.1	1.9	3.9
Apr.	5.2	6.9	4.3	2.6	6.9	11.3	4.9
May	5.5	6.1	5.6	2.8	8.1	14.0	5.0
June	3.4	4.2	7.2	2.2	8.9	8.8	4.0
July	2.8	3.7	6.6	0.9	7.7	4.9	3.3
Aug.	6.2	6.6	5.8	0.9	6.8	4.9	4.9
Sept.	24.1	20.2	6.8	3.4	7.7	21.0	15.3
Oct.	29.7	21.3	13.5	33.9	11.8	18.6	25.8
Nov.	10.6	12.1	21.5	35.0	13.5	7.5	18.4
Dec.	3.6	5.5	12.5	8.8	8.6	3.3	6.7
Total[a]	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: James S. St. Clair and Joseph E. Vercimak, 1984. "Marketing Alternatives and Costs for Wyoming Cattle." Division of Agricultural Economics, Agricultural Experiment Station, University of Wyoming, Laramie. Research Journal forthcoming.

[a] Totals may not add to 100.0 due to rounding.

From 1960-1981, steers and heifers accounted for about 58% of total movement and calves for about 23%. The calf movement, 207,000 head, corresponds well with the calves born, death loss and retention data shown in Table 1, though the time period is not the same. There is some possibility of misclassification of "calves" as steers and heifers, and consequent understatement of calf movement. Some of the steer and heifer movement during winter and early spring may be "short yearlings", or calves under one year. Most of the steer and heifer movement, and virtually all from spring through fall would be of animals over one year of age. The steer and heifer shipments, 518,000 head, includes many cattle brought to Wyoming in the spring of the year and shipped out in the fall, as well as calves retained.

Only about 1,000 cattle are slaughtered in Wyoming each month, or 12,000 annually; so the interstate movements give a good indication of both seasonality and proportions of cattle marketed. There are also intra-state sales that transfer ownership from ranchers to farmer-feeders, and a limited amount of intra-state sales for slaughter.

PROCEDURES

Sampling

During June-August 1985, a ranch survey was conducted throughout Wyoming. Names from county extension agents and Forest Service and Bureau of Land Management permittee lists were used to identify ranch operators to be contacted. A large portion of those ranchers were contacted and interviews arranged with those willing and with time to cooperate. Detailed data were obtained on resource bases, cattle inventories, sales, winter feeding, pasture requirements, costs of operation, machinery, equipment and improvement inventories, labor use and management practices.

Several criteria were used to screen participants at the initial contact list level. They were:

1) Ranches which were full-time commercial producers were selected;
2) Ranches which were part-time, strictly purebred or ranches with a mix of other livestock or cash crop enterprises were screened out;
3) At least 100 head of cows and heifers to calve was considered a lower limit to help screen out part-time operations;
4) A good mix of size and type of operations was sought to properly meet the purpose of this study;
5) Unusual or special types of cattle operations were to be avoided so that the data would be more homogeneous; and,
6) Only operations which grazed entirely within Wyoming or near its borders were selected.

A random sample approach to data collection is theoretically a more desirable method for data collection. However, given the number of variables and degree of variation among them, a very large sample would be required to achieve a high degree of statistical validity. A large random sample in a survey of this type is difficult to obtain because of the requirements for cooperation and because of the time and costs involved. The need to complete this work in the busiest time of the year, when dawn-to-dusk ranch work is the norm, compounded data collection problems. The sample obtained is thought to represent a range of particular cases and better-than-average operators. It cannot be presented as a statistically sound estimate of state-wide or regional averages.

Location, Size and Type of Ranch Observation

Data were obtained from 67 ranches including 17 in the northern plains which were not used in this analysis and seven in the mountain valley areas

which were not fully usable. Responses from 43 ranches were used in this analysis (Table 9).

Table 9. Location of Sample Mountain Valley Ranches Used in Final Analysis.

Drainage (D) or Basin (B)	Cow-Calf		Cow-Spring Yearling		Cow-Yearling		Total
	Small	Large	Small	Large	Small	Large	
Blacks Fork (D)	3					3	6
Bear River (D)			1	2			3
Green River (D)	1				2	2	5
Wind River (B)	2	2	1	1	1	1	8
Big Horn (B)	3	1	1	4		3	12
Snake River (D)		1			2		3
Platte-Laramie R. (D)	3	1	1	—	—	1	6
Totals	12	5	4	7	5	10	43

Sample ranches were drawn from seven separate mountain valley areas based on the major river basins or drainages within Wyoming. Drainages in the southwestern part of Wyoming include: (1) the Bear River area, in western Uinta and southwestern Lincoln County; (2) the Blacks Fork and Henry's Fork drainage area, located in Uinta County; and (3) the upper reaches of the Green River and its tributaries located mainly in Sublette County. In the northwestern part of the state sampled ranches included: (1) ranches along the Wind River and its tributaries in western Fremont County; and (2) ranches located around the periphery of the Big Horn Basin in Hot Springs, Washakie, Big Horn and Park counties. Ranches were also sampled in the Snake River drainage in Teton and northern Lincoln counties and in the Upper Platte and the Laramie River area in Carbon and Albany counties. The sample size is relatively small in four of the six groupings.

Ranch Summarization, Classification and Conversion

Data from each ranch was summarized and analyzed by a computerized procedure which calculated an inventory reconciliation, animal unit equivalents, feed requirements, etc. Calculations were made on a per-animal unit, per cow, and total basis. Each resulting ranch report was examined and seven of the original 50 ranches were considered outliers or atypical operations and screened out. The observations were classified as cow-calf, cow-spring yearling, or cow-yearling types. Most ranch operations could easily be classified but some had a mix of these enterprises and/or included custom feeding to slaughter weights before sale. These conflicts were resolved using the following criteria:

(1) Cattle entering into finish feeding programs were considered to be at the point of final sale when delivered to the feed lot. Sales were calculated on that basis and custom feeding costs deleted.

(2) The number and total sale weights of calf, short yearling and yearling animals were considered on operations marketing more than one age class. Usually one age class was most emphasized on the ranch and the operation classified accordingly.

Classification by Size of Breeding Herd

Examination of data ranked by size suggested two sizes for the analysis, a small size of 100-375 cows and a large size of more than 375 cows. Data from each sample ranch was placed into the above classified groupings and new data sets were developed to represent each of the six size/type groups.

Conversion of Operations to Constant Size

Within the size groupings there was some variation among the cow-calf, cow-spring yearling and cow-yearling types of operation. In order to improve comparability among types, all were adjusted to a common size of 355

animal-units (AUs) for the small size and 865 AUs for the large size. This adjustment amounted to not more than a 5-10% change from the unadjusted size of the different groups toward the central value.

Basic Ranch Livestock Inventories and Conversions

If a program to produce grass fed cattle suitable for slaughter off ranges or pastures is to be viable it will likely depend upon: (1) the ability of Wyoming producers to produce unusually heavy yearling cattle; or, (2) upon the economic feasibility of carrying yearling cattle through a winter and the next summer to sell as "2-year-olds" at about 28-32 months old, depending on calving and marketing dates. The possibilities are tested by considering the effect of converting a cow-calf or cow-spring-yearling basic ranch to the cow-yearling type and subsequently from the cow-yearling to cow-2-year-old type of operation.

When considering such conversions it is necessary to recognize that the resource base for a given ranch and for Wyoming as a whole is relatively fixed or constant in the short run and will support a given number of animal-units (AUs). In order for any operation using a constant animal-unit base to convert to marketing the next older age class of production, a sacrifice must be made in the number of cows in the breeding herd. A weaned calf carried over to be sold as a yearling the next fall will require a certain amount of forage and feed which can only be supplied by reducing the requirement of the cow-calf stage. That, in turn, can only be done by reducing the size of the breeding herd.

The economic feasibility of converting each basic cow-calf, cow-spring-yearling and cow-yearling ranch to the older age class stage of production was tested holding the number of grazing AUMs, the most fixed resource, constant.

Changing requirements for winter feed can be accommodated by purchase of hay or grain.

The conversions were as follows:

Basic ranch	Convert to	Convert to
Cow-calf	Cow-yearling	Cow-2-year-old
Cow-spring yearling	Cow-yearling	Cow-2-year-old
Cow-yearling	----	Cow-2-year-old

Three basic operations and five conversions result in 8 scenarios for each size of operation, or 16 scenarios in total.

Animal-Unit-Month (AUM) Standards for Conversions

Kilocalories (Kcal) of basal metabolism for adult animals is predicted by Kcal of basal metabolism = 70 ($W_{kg}^{.75}$), where W is the average weight of the animal for some time period. This relationship has been accepted by nutritionists generally as a biologic constant representing maintenance requirements of animals at rest (Crampton and Harris).

Lewis, et al. derived coefficients ($COEF_{au}$) indicating requirements for animals at specific weights in relation to a base weight as follows:

$$COEF_{au} = \frac{W^{.75}}{1{,}000^{.75}}$$

The denominator represents the weight of a mature cow in pounds, and thus sets the mature cow coefficient at 1.0 and coefficients for other classes in relation to that. The constant 70 occurs in both numerator and denominator and cancels out. The exponent .75, whether for kg. or lb., remains the same. AUM coefficients for maintenance requirements for different weights of livestock on different types and sizes of operation were calculated using the above formula. Requirements for both maintenance and gains based on the net energy system of calculation seem well correlated with the AUM requirements for maintenance only (Kearl, 1970).

AUM Requirements

Calculation of AUM requirements is accomplished by a simple multiplication of number of animals in the inventory, the appropriate AUM coefficient, and number of months in inventory. The animal-unit-years (AUYs), or more commonly just animal-units (AUs), represent the requirements of a mature cow for 12 months, or the equivalent. Thus, AUs are calculated as AUMs ÷ 12. The conversion of different types of operations to constant sizes of 355 or 865 AUs was mentioned previously. The conversion of one type to a different type of the same size was done by similar means except that total grazing AUMs are held constant.

Yearling animals and calves have requirements according to the AUM coefficients shown, if grazing on private land. If either U.S. National Forest or Bureau of Land Management (BLM) lands are used, as in this study, different coefficients may apply. In the more distant past, a cow with a calf, a yearling or a bull were all counted as one AUM each. Some national forests allowed use by three yearlings in place of two cow-calf pairs. Currently regulations and standards seem to be changing and the conversions may become 1.0 for a cow with or without a calf, .3 to .33 for a nursing calf, and .6 to .7 for a yearling. Those conversion factors would match up well with the conversion calculations made based on the AUM coefficients. In any case, the conversions as made represent a "best case" scenario from the standpoint of developing a feasible grass-fat program. If conversions were on the older basis then even more cow-calf units would be sacrificed to carry calves to yearling age and yearlings to 2-year-olds, and development of a grass-fat program would be feasible.

RESULTS

Land Resources

Tables 10 and 11 show the land resource base for each type and size of operation. Base inventories are an average of resources reported by all producers in that class. These inventories are highly variable among producers and may be the predominant factor causing the variability among types of operation.

Hay production often shows a surplus over the amount of hay fed. The surpluses may be due to unreported additional enterprises on the ranch or unreported hay selling, or perhaps due to unusually favorable conditions locally, high yields and high production in 1984.

Waste includes unharvestable acres such as canals, ditches, low swampy areas, areas with willow or weed problems, etc. A factor of 10% was used to account for these waste areas.

Production Coefficients

Production coefficients computed from the survey data are summarized in Table 12. The data shown represent simple averages of data reported. Coefficients for cow replacement rate, number of cows per bull, average number of years the bulls are used, and death loss percentages are consistent among the types and sizes, except for death loss on bulls. Because of the small number of bulls used on the small ranches, the relatively few that die reflect a major difference on death losses.

The cow replacement rate is about 16.7% of cows and heifers to calve or about 20% of cows in the fall-winter inventory that have calved. That is consistent with the data in Table 4 showing 697,000 cows that have calved and 133,000 replacement heifers, or 19.8% of cows that have calved.

Table 10. Irrigated Lands and Crop Production by Size and Type of Operation

Size and Type of Operation and Kind of Land	Acres			Production		
	Owned	Rented	Total	Unit	Per Acre	Total
Small Operations						
Cow-calf						
Hayland						
Alfalfa	67	0	67	Tons	3.3	221
Grass hay	192	0	192	Tons	1.3	250
Waste	29		29			
Sub-Total	288	0	288	Tons		471
Small Grains	17	0	17	Bu.	81	1,377
Pasture	82	0	82			
Total	387	0	387			
Cow-spring yearling						
Hayland						
Alfalfa	140	27	167	Tons	2.2	367
Grass Hay	166	0	166	Tons	1.9	315
Waste	35	3	38			
Sub-Total	341	30	371	Tons		682
Small Grains	16	6	22	Bu.	73	1,606
Pasture	141	35	176			
Total	498	71	569			
Cow-yearling						
Hayland						
Alfalfa	40	0	40	Tons	2.6	104
Grass Hay	336	11	347	Tons	1.5	521
Waste	43	1	44			
Sub-Total	419	12	431	Tons		625
Small Grains	9	0	9	Bu.	80	720
Pasture	138	0	138			
Total	566	12	578			
Large Operations						
Cow-calf						
Hayland						
Alfalfa	153	36	189	Tons	3.0	567
Grass Hay	360	132	492	Tons	1.6	787
Waste	57	19	76			
Sub-Total	570	187	757	Tons		1,354
Small Grains	0	9	9			
Pasture	26	0	26			
Total	596	196	792			

(Continued)

Table 10. (Continued) Irrigated Lands and Crop Production by Size and Type of Operation

Size and Type of Operation and Kind of Land	Acres			Production		
	Owned	Rented	Total	Unit	Per Acre	Total
Cow-spring yearling						
Hayland						
Alfalfa	288	7	295	Tons	3.5	1,033
Grass Hay	174	66	240	Tons	1.8	430
Waste	51	8	59			
Sub-Total	513	81	594	Tons		1,463
Small Grains	70	13	83	Bu.	83	6,889
Pasture	223	68	291			
Total	806	162	968			
Cow-yearlings						
Hayland						
Alfalfa	182	0	182	Tons	3.0	546
Grass Hay	451	94	545	Tons	1.7	927
Waste	71	10	81			
Sub-Total	704	104	808	Tons		1,473
Small Grains	28	0	28	Bu.	80	2,240
Pasture	300	97	397			
Total	1,032	201	1,233			

Calf crop weaned, 86-91% for four of the six groups, is higher than the current state average, but reasonable for better-than average operators. The 77-82% calf crop reported by two groups is nearer the state average. It is likely that calf crop born and calf death loss are both understated. Cooperating ranchers are able to give good data on calf crop weaned.

Weights of steer and heifer calves on the small cow-calf operation, 464 and 430 lb., are higher than expected, but plausible. That group included the largest number of operations interviewed and can be considered the best sample. Increased uses of cross-breeding and hormone implants may be helpful in explaining the calf weaning weights. Given those calf weaning weights for the small cow-yearling operation, yearling sale weights of 790 and 733 lb. represent weaning to yearling gains of 326 lb. for steers and 303 lb. for

heifers. These are also plausible and consistent with previous studies (Kearl, 1969; 1980).

Table 11. Summary of All Land Resources Used by Size and Type of Operation. (Acres or AUMs)

Type of Resource	Size and Type of Operation					
	Small-Sized			Large-Sized		
	Cow-Calf	Cow-Spring Yrlng.	Cow-Yearling	Cow-Calf	Cow-Spring Yrlng.	Cow-Yearling
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Irrigated						
Deeded	387	498	566	596	806	1,032
Leased	0	71	12	196	162	201
Sub-Total	387	569	578	792	968	1,233
Rangelands						
Owned	2,414	2,274	2,804	7,010	4,040	5,762
Private Lease	183	374	0	4,114	1,423	2,036
State Lease	677	270	1,329	945	619	998
Total	3,274	2,918	4,133	12,069	6,082	8,796
Total Land	3,661	3,487	4,711	12,861	7,050	10,029
Grazing Permits	(AUMs)	(AUMs)	(AUMs)	(AUMs)	(AUMs)	(AUMs)
BLM	639	465	166	1,227	1,610	1,879
Forest Service	241	210	280	805	1,375	1,198
Total	880	675	446	2,032	2,985	3,077

The large cow-calf class, with calf weights of 525 and 510 lb., included three exceptional managers using cross-breeding programs involving some large-breed influence. The sale weight of cull cows reflect that. Because of this, the large cow-calf class represents to some extent an "outlier." That will also show up in connection with costs and returns.

The weight of yearling steers from the large cow-yearling operation indicates gains of about 300 lb. from a calf weight of 464 lb. Gains are probably a little more than 300 lb. from a calf weaning weight less than 464 lb. The number of observations in the large cow-yearling group represents a fairly good sample size.

Table 12. Production Coefficients for Small and Large Sized Cow-Calf, Cow-Spring Yearling and Cow-Yearling Ranches, Mountain Valley Areas of Wyoming.

Item	Types of Operation					
	Small Sized - 355 AUs [a]			Large Sized - 855 AUs [b]		
	Cow-Calf	Cow-Spring Yearling	Cow-Yearling	Cow-Calf	Cow-Spring Yearling	Cow-Yearling
No. of cows to calve	259	228	188	593	544	475
Cow replacement rate	15.2%	17.3%	16.7%	16.8%	17.2%	17.0%
No. of cows per bull	21	18	17	19	18	18
No. of years bulls used	3.9	3.25	3.8	3.6	3.75	4.05
No. of horses on ranch	9	12	14	14	12	18
Percent calf crop born	91.7%	79.5%	85.6%	88.1%	93.8%	91.8%
Percent calf crop weaned	88.1%	77.4%	82.3%	85.6%	91.0%	89.4%
Percent death loss:						
Cows	1.7%	2.8%	1.7%	1.4%	1.1%	1.9%
Calves	3.6%	2.1%	3.3%	2.5%	2.8%	2.4%
Yearlings	1.7%	4.4%	2.0%	0.5%	0.9%	2.4%
Bulls	7.0%	8.3%	0.0%	0.7%	0.9%	2.8%
Average sale weights (lb.)						
Cull cows [c]	985	1,027	1,075	1,073	1,041	995
Steer calves	464	-	-	525	-	-
Heifer calves	430	-	-	510	-	-
Yearling steers	-	539	790	-	606	763
Yearling heifers	-	508	733	-	529	644

[a] The small-sized operations represent 100-375 cows to calve.

[b] The large-sized operations represent more than 375 cows to calve.

[c] Cull cow sales are the same for operations after conversion as for the basic ranches.

[d] Yearling heifer sale weights are shown for the cow-yearling system.

Because it is possible to feed for a wide range of winter gain, the sale weights for the spring yearling operations could result from many combinations of weaning weights, average daily gain, number of days fed and total winter gains. Certainly the indicated sale weights are easily attainable starting with 464 or 430 lb. calves, as indicated by the small cow-calf sale weights, or from weights as low as 400 lb.

A frequency distribution of different weights of animals offered is shown in Table 13.

Table 13. Distribution of Weights of Steers, Heifers and Cows Sold

Weight Interval (lb.)	Steers Number	Steers Average Weight (lb.)	Heifers Number	Heifers Average Weight (lb.)	Cows & Replacemts. Number	Cows & Replacemts. Average Weight (lb.)
Fall Sales						
Less than 326	29	306	62	302		
326-425	579	403	611	388		
426-525	1,737	481	660	471		
526-625	785	588	710	595		
626-725	223	698	660	675		
726-825	2,595	772 [a]	453	761	126	817
826-925 [b]	1,077	832 [a]	19 [b]	874 [b]	367	872
926-1025 [b]	45	940	800 [b]	1,025 [b]	1,372	981
1026-1125 [b]	420	1,069	211	1,054	669	1,079
1126-1225 [b]	1,595	1,204	--	--	410	1,191
Sub-Total	9,085		4,186		2,944	
Spring Sales						
426-525	194	484	392	489		
526-625	459	565	659	589		
626-725	802	662	--			
Over 725	140	765	--			
Sub-Total	1,595		1,051			
Total	10,680		5,237		2,944	

[a] About 97% of these cattle were sold in lots that averaged under 830 lb.

[b] 926-1,025 lb. heifers and steers and heifers more than 1,026 lb. were all custom feedlot finished and sold for slaughter.

There is a distinct tri-modal distribution of steer weights. The steers under 625 lb., amounting to 29% of the total, are calves. About 37% of the steers are in the yearling feeder cattle range with very few of them weighing 900 lb. or more. About 19% of the steers were custom fed and about 15% were of the spring-yearling group. Heaviest weights reported for the yearling feeder steers were in the 926-1025 lb. range where only 45 yearlings averaging 940 lb. are shown. In fact, only about 80 head were sold in lots averaging more than 830 lb. All the steers more than 1026 lb. were fed on a custom basis and sold for slaughter sometime in the early to mid-winter period.

The weights in the various classes are group averages, so individual calves within the groups weigh over 625 lb., just as some yearlings weigh less than that and some steers will weigh more than 900 lb. However, the numbers of steers more than 900 lb. would still be small.

There is not the pronounced tri-modal distribution in heifers as occurred in steers. There was a tendency for both heifer calves and yearling heifers to be distributed through the 526-625 lb. weight range. Suffice to say that few yearling heifers weighed more than 825 lb. About 20% of the heifers were put through the custom feedlot to be sold for slaughter and about 18% were in the spring-yearling sales category and may have gone into feedlots or back onto ranges on some other ranch.

Compensatory Gains

The problem of providing animals that weight 150-300 lb. more than those commonly being marketed is a key issue for a program of marketing grass fed slaughter cattle. More intensive winter-feeding programs in carrying calves from weaning to yearling age would, on the surface, appear to be one alternative. However, the effect of compensatory gain must be considered in this regard. Compensatory gain refers to the tendency for animals to make

faster gains after a period of retarded gains than after periods of normal or greater than normal gains. Conversely, those gaining at high rates in one period make noticeably lower gains in the succeeding period.

Lawrence and Pearce (1964) reported on a study using Shorthorn and Sussex cross steers. Results are shown in Table 14. Summer period gains are high after winter gains of 0.0 and 0.75 lb. per day. The compensatory effect is non-linear and the entire effect of increased winter gain sacrificed during the following summer in going from 0.75 to 1.50 lb. per day gain. About 59% of the winter gain is sacrificed in summer going from 0.0-.75 lb. winter gain.

Table 14. Winter and Summer Gains and Effect of Compensatory Gain, Two Studies. (Lb.)

Average Daily Gain		Total Gains			Differences		
Winter 168 days [a]	Summer 153 days [a]	Winter	Summer	Total	Winter	Summer	Total
Lawrence and Pierce Study							
0.00	2.64	0	404	404			
					+126	-74	+52
0.75	2.16	126	330	456			
					+126	-139	-13
1.50	1.25	252	191	443			
Elliott Study							
0.46	1.48	77	226	303			
					+76	-21	+45
0.85	1.34	143	205	348			
					+102	-43	+59
1.46	1.06	245	162	407			

Sources: Derived from Lawrence and Pierce, 1964 and Elliott, 1967.

[a] The days on test in Lawrence and Pierce. For convenience and comparison these same numbers were used to calculate total gains applied to Elliott's study.

A three-year study by Elliot (1967) in Wyoming also found that summer gains on range were inversely related to previous winter gains. Approximately 105 Hereford steer calves were wintered each year to gain at three different

levels. In the spring, half of each group was finished in a feedlot and the other half summered on a short grass range. The compensatory gain effect was less pronounced than in the study by Lawrence and Pierce. Only about 28% of the winter gain advantage of the higher gaining groups was lost in going from 0.46-0.85 lb. winter gains and 42% of the advantage was lost in going from 0.85-1.46 lb. winter gains.

Compensatory growth responses are highly variable due to the previous winter treatment and the quality and quantity of the summer forage available. Compensatory effects from 30-70% have been reported. It is reasonable to expect animals wintered at low rates of gain to recover about 50% of the difference in gain acquired during the winter period when compared to higher gaining groups (Kercher, 1982). Thus, for instance, a spring weight difference of 100 lb. between two groups of animals would be reduced to 50 lb. by fall.

Ross (1983) used an assumption of 50% compensatory gain together with experimental data which was reviewed here earlier and data from prior survey work in Wyoming to establish the relationships shown in Table 15. The gains are consistent with or conservative in relation to experimental data indicating gains of steers in the 275-295 lb. range, and heifers in the 250-270 lb. range, presumably after being wintered at near-maintenance levels.

Table 15. Winter Gains and Subsequent Summer Gains for Steers and Heifers Starting at 400 and 380 lb., Respectively.

Steers			Heifers		
Winter Gains	Summer Gains	Total Gains	Winter Gains	Summer Gains	Total Gains
(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
0	288	288	0	265	265
55	260	315	55	235	290
105	235	340	105	210	315
165	205	370	165	180	345
205	185	390	205	160	365
250	165	415	250	140	390

Source: Based on relationships used by Ross, 1983.

The work on compensatory gains was used to guide assumptions about attainable gains for conversions from one type of operation to another which are given in Table 16. The assumptions are a little more optimistic than used by Ross (1983), allowing for about 15-20 lb. more summer gain in any situation. That, in fact, may be conservative with allowances for better performance that might be achieved by crossbred cattle, or with the use of growth stimulating implants. The projected winter gains of 150 and 165 lb. for heifers and steers, respectively, should be attainable in 165-180 days

Table 16. Gain and Sale Weight Assumptions for Various Livestock Systems

Size and Type	Sale Weight	Convert to Cow-Yearling			Convert to 2-Year-Old	
		Winter Gain	Summer Gain	Sale Weight	Gain	Sale Weight
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Small						
Cow-Calf						
Steers	464	165	220	850	220	1,070
Heifers	430	150	200	780	-	-
Cow-Spring Yearling						
Steers	539	(75) [a/]	265	805	245	1,050
Heifers	508	(78) [a/]	235	745		
Cow-Yearling						
Steers	790	-	-	-	250	1,040
Heifers	733	-	-	-	-	-
Large						
Cow-Calf						
Steers	525	165	220	900		1,070
Heifers	510	150	200	850		
Cow-Spring Yearling						
Steers	606	(142) [a/]	235	840	230	1,070
Heifers	529	(99) [a/]	220	750	-	-
Cow-Yearling						
Heifers	763	-	-	-	262	1,025
Steers	644	-	-	-	-	-

[a/] Sale weight is the spring weight. Gains are those required to achieve the spring weights if the fall weights were 464 and 430 lb. for steers and heifers, as shown for the cow-calf operation.

feeding period using only mid- to early-bloom alfalfa hay or a combination of some grass hay with alfalfa. The winter gains are not so high as to negate the 50% compensatory gain assumption.

Higher winter gains, 1.1-1.25 lb. per day may be attainable using higher quality alfalfa hay. Gains of 1.5 lb. per day are attainable using alfalfa and corn silage or alfalfa and a modest amount of concentrates (Ross, 1983.) However, even with those high rates of gain it is difficult to produce very many steers weighing more than 900 lb. Some ranch operators express a goal of doubling the weight of calves between weaning and sale as yearlings 11 months later. That is an attainable goal with calves weaned at around 400 lb. It becomes progressively more difficult as calf weaning weights increase to 450 lb. or more.

Crossbreeding can produce weight increases of around 10% in yearlings using English Breed cross cows producing second cross calves. (Kearl, 1976.) Use of larger "exotic" breeds might increase weights of yearlings by around 20%. However, depending on the calf and cow replacement programs, four to six years of systematic crossbreeding are required to achieve a significant change in the basic cow herd and seven to 11 years are required for relatively complete conversion.

Inventories and Sales

Cattle inventories and sales for the various scenarios are summarized in Table 17. It should be noted that as the conversions are made, fall inventories of cows and heifers to calve in the spring change from 261 (222+39) for the small cow-calf to 205 (174+31) for the small cow-calf basic ranch converted to cow-yearlings, and then to 166 (141+25) when converted to two-year-old steer sales. Sales change from 114 steer and 71 heifer calves allowing for death losses, to 57 yearling heifers and 87 yearling steers,

thence to 46 yearling heifers and 70 two-year-old steers. Carrying heifers to 2-year-olds was not considered because of the difficulty of carrying heifers through the yearling and 2-year-old breeding seasons. Similar changes occur for the other type and sizes of operations (Table 17).

Table 17. Livestock Inventories and Number of Cattle Sold for Various Basic Livestock Systems and Conversions.

Size and Kind of Basic Ranch and Class of Stock in the Fall Inventories	Basic Ranch Fall Inventory	Basic Ranch Sales	Converted to Cow-Yearling Fall Inventory	Converted to Cow-Yearling Sales	Converted to Cow-2-Yr-Old Fall Inventory	Converted to Cow-2-Yr-Old Sales
Small cow-calf						
Cows [a]	222	35	174	27	141	22
Heifers to calve [a]	39	--	31	--	25	--
Weaned heifer calves [b]	44	3 [c]	90	57 [c]	72	46 [c]
Heifer calves born [b]	119	71	93	--	75	--
Steer calves born [b]	119	114	93	--	75	--
Weaned steer calves	--	--	90	87 [c]	72	--
Yearling steers	--	--	--	--	71	70 [d]
Bulls	10	2	8	2	6	1
Total animal units (AUs)	355		380		371	
Small cow-spring yearling						
Cows [a]	193	32	155	26	131	22
Heifers to calve [a]	39	--	32	--	27	--
Weaned heifer calves [b]	89	45 [c]	71	36 [c]	60	31 [c]
Heifer calves born [b]	91	--	73	--	62	--
Steer calves born [b]	91	--	73	--	62	--
Weaned steer calves	89	87 [c]	71	68 [c]	60	--
Yearling steers	--	--	--	--	58	55 [d]
Bulls	9	3	7	2	6	2
Total animal units (AUs)	355		329		328	
Small cow-yearling						
Cows [a]	159	28	--	--	132	23
Heifers to calve [a]	31	--	--	--	26	--
Weaned heifer calves [b]	78	45 [c]	--	--	64	36 [c]
Heifer calves born [b]	80	--	--	--	66	--
Steer calves born [b]	80	--	--	--	66	--
Weaned steer calves	78	76 [c]	--	--	64	--
Yearling steers	--	--	--	--	63	62 [d]
Bulls	8	3	--	--	7	2
Total animal units (AUs)	355				351	

(Continued)

Table 17. (Continued) Livestock Inventories and Number of Cattle Sold for Various Basic Livestock Systems and Conversions.

Size and Kind of Basic Ranch and Class of Stock in the Fall Inventories	Basic Ranch		Converted to Cow-Yearling		Converted to Cow-2-Yr-Old	
	Fall Inventory	Sales	Fall Inventory	Sales	Fall Inventory	Sales
Large cow-calf						
Cows [a]	498	91	377	69	316	58
Heifers to calve [a]	100	--	75	--	63	--
Weaned heifer calves	103	2 [c]	193	116 [c]	162	97 [c]
Heifer calves born [b]	261	152	198	--	166	--
Steer calves born [b]	261	255	198	--	166	--
Weaned steer calves	--	--	193	192 [c]	162	--
Yearling steers	--	--	--	--	161	157 [d]
Bulls	23	8	17	6	14	5
Total animal units (AUs)	865		879		884	
Large cow-spring yearling						
Cows [a]	454	87	348	67	286	55
Heifers to calve [a]	94	--	72	--	59	--
Weaned heifer calves	248	153 [c]	190	117 [c]	156	96 [c]
Heifer calves born [b]	255	--	196	--	161	--
Steer calves born [b]	255	--	196	--	161	--
Weaned steer calves	248	247 [c]	190	188 [c]	156	--
Yearling steers	--	--	--	--	155	153 [d]
Bulls	22	8	17	6	14	5
Total animal units (AUs)	865		785		784	
Large cow-yearling						
Cows [a]	400	71	--	--	327	58
Heifers to calve [a]	81	--	--	--	66	--
Weaned heifer calves	213	127 [c]	--	--	174	114 [c]
Heifer calves born [b]	218	--	--	--	178	--
Steer calves born [b]	218	--	--	--	178	--
Weaned steer calves	213	208 [c]	--	--	174	--
Yearling steers	--	--	--	--	170	166 [d]
Bulls	20	6	--	--	17	5
Total animal units (AUs)	866				853	

[a] The calving inventory in the spring includes cows plus heifers to calve, minus death loss.
[b] Calves born to the calving inventory in the spring.
[c] Yearlings when sold.
[d] Two-year-olds when sold.

The value of sales for the six basic ranch operations and conversions are summarized in Table 18. Numbers sold are as explained and presented previously in Table 10. Weights for the basic operations and after adjustment are as explained in the immediate foregoing section and shown in Table 16. Appendix Tables B-1 through B-6 show the sales for basic operations in income statement form.

The predominant month of sale for various types of livestock is important in the selection of price data. Weaned calves were sold between October and early December. The predominant month of sale for these calves was November at an average of seven months of age. Spring yearling sales were evenly spread during the months of March and April when animals were 11-13 months of age. Yearling sales occurred predominantly in October but were spread from September through November. These cattle were between 17 and 19 months of age.

Two-year-old steer sales were assumed to be in September when the steers have reached market weights. This would put them at an approximate age of 29 months old. Sales may actually vary over a two- to four-month period depending on gains and market weights.

Conversion of cow-calf operations to cow-yearling resulted in significant increases in gross receipts. Conversion to the cow-2-year-old stage then reduced the receipts. Conversion of the cow-spring yearling operations to fall-yearling operations tended to reduce receipts because of the reduction of the cow-herd required to accommodate the yearlings on range. There were further reductions in converting to the 2-year-old operations. The cow-yearling types converted to 2-year-olds also reduced the value of sales slightly.

Table 18. Summary of Cattle Sales from Various Types and Sizes of Mountain Valley Cattle Ranching Operations, and Conversions to Other Types.

Ranch Size, Type and Class of Stock	Number Sold	Average Weight (lb.)	Price per Cwt.	Price per Head	Total Value
Small cow-calf, basic ranch [a]					
Cows	35	985	$36.16	$356.	$12,466.
Yearling heifers	3	780	57.80	451.	1,353.
Heifer calves	71	430	61.85	266.	18,883.
Steer calves	114	464	71.05	330.	37,583.
Total Sales	223				$70,285.
Bulls sold	2	1547	45.30	701.	1,402.
Bulls purchased	3	Cost per bull		1324.	3,972.
Net bull replacement cost					2,570.
Small cow-calf converted to cow-yearling [a]					
Cows	27	985	$36.16	$356.	$9,617.
Yearling heifers	57	780	57.80	451.	25,698.
Yearling steers	87	850	62.60	532.	46,293.
Total Sales	171				$81,608.
Bulls sold	2	1547	45.30	701.	1,402.
Bulls purchased	2			1324.	2,648.
Net bull replacement cost					1,346.
Small cow-calf converted to cow-2-year-old [a]					
Cows	22	985	$36.16	$356.	$7,836.
Yearling heifers	46	780	57.80	451.	20,739.
2-year-old steers	70	1070	61.00	653.	45,689.
Total Sales	138				$74,264.
Bulls sold	2	1547	45.30	701.	1,402.
Bulls purchased	2			1324.	2,648.
Net bull replacement cost					1,346.
Small cow-spring yearling basic ranch [a]					
Cows	32	1027	$36.16	$371.	$11,884.
Yearling heifers	3	740	58.20	431.	1,292.
Spring yearling heifers	42	508	66.40	337.	14,167.
Spring yearling steers	87	539	74.50	402.	34,935.
Total Sales	164				$62,278.
Bulls sold	3	1562	45.30	708.	2,123.
Bulls purchased	4			900.	3,600.
Net bull replacement cost					1,477.

Table 18. (Continued) Summary of Cattle Sales from Various Types and Sizes of Mountain Valley Cattle Ranching Operations, and Conversions to Other Types.

Ranch Size, Type and Class of Stock	Number Sold	Average Weight (lb.)	Price per Cwt.	Price per Head	Total Value
Small cow-spring yearling converted to cow-yearling [a]					
Cows	26	1027	$36.16	$371.	$9,655.
Yearling heifers	36	745	58.15	433.	15,596.
Yearling steers	68	805	63.25	509.	34,623.
Total Sales	130				$59,874.
Bulls sold	2	1562	45.30	708.	1,415.
Bull purchased	3			900.	2,700.
Net bull replacement cost					1,285.
Small cow-spring yearling converted to cow-2-year-old [a]					
Cows	22	1027	$36.16	$371.	$8,170.
Yearling heifers	31	745	58.15	433.	13,430.
2-year-old steers	55	1050	61.00	641.	35,228.
Total Sales	108				$56,828.
Bulls sold	2	1562	45.30	708.	1,415.
Bulls purchased	3			900.	2,700.
Net bull replacement cost					1,285.
Small cow-yearling, basic ranch [a]					
Cows	28	1075	$36.16	$389.	$10,884.
Yearling heifers	45	733	58.25	427.	19,214.
Yearling steers	76	790	63.45	501.	38,095.
Total Sales	149				$68,193.
Bulls sold	3	1488	43.93	654.	1,961.
Bulls purchased	3			984.	2,952.
Net bull replacement cost					991.
Small cow-yearling converted to cow-2-year-old [a]					
Cows	23	1075	$36.16	$389.	$8,940.
Yearling heifers	36	733	58.25	427.	15,371.
2-year-old steers	62	1050	61.00	641.	39,711.
Total Sales	129				$64,022.
Bulls sold	2	1488	43.93	654.	1,307.
Bulls purchased	2			984.	1,968.
Net bull replacement cost					661.

Table 18. (Continued) Summary of Cattle Sales from Various Types and Sizes of Mountain Valley Cattle Ranching Operations, and Conversions to Other Types.

Ranch Size, Type and Class of Stock	Number Sold	Average Weight (lb.)	Price per Cwt.	Price per Head	Total Value
Large cow-calf, basic ranch [c]					
Cows	91	1073	$36.16	$388.	$35,308.
Yearling heifers	2	850	57.50	489.	978.
Heifer calves	152	510	60.65	309.	47,016.
Steer calves	255	525	69.35	364.	92,842.
Total Sales	500				$176,144.
Bulls sold	8	1600	45.30	725.	5,798.
Bulls purchased	9			1320.	11,880.
Net bull replacement cost					$6,082.
Large cow-calf converted to cow-yearling [a]					
Cows	69	1073	$36.16	$388.	$26,772.
Yearling heifers	116	850	57.50	489.	56,695.
Yearling steers	192	900	61.89	557.	$106,946.
Total Sales	377				$190,413.
Bulls sold	6	1600	45.30	725.	4,349.
Bulls purchased	7			1320.	9,240.
Net bull replacement cost					4,891.
Large cow-calf converted to cow-2-year-old [b]					
Cows	58	1073	$36.16	$388.	$22,504.
Yearling heifers	97	850	57.50	489.	47,409.
2-year-old steers	157	1070	61.00	653.	102,474.
Total Sales	312				$172,387.
Bulls sold	5	1600	$45.30	725.	3,624.
Bulls purchased	6			1320.	7,290.
Net bull replacement cost					4,296.
Large cow-spring yearlings, basic ranch [b]					
Cows	87	1041	$36.16	$376.	$32,749.
Yearling heifers-Fall	2	750	58.09	436.	871.
Yearling heifers-Spring	151	529	65.80	348.	52,560.
Yearling steers-Spring	247	606	70.95	430.	106,199.
Total Sales	487				$192,379.
Bulls sold	8	1545	45.30	690.	5,599.
Bulls purchased	8			1424.	11,392.
Net bull replacement cost					5,793.

Table 18. (Continued) Summary of Cattle Sales from Various Types and Sizes of Mountain Valley Cattle Ranching Operations, and Conversions to Other Types.

Ranch Size, Type and Class of Stock	Number Sold	Average Weight (lb.)	Price per Cwt.	Price per Head	Total Value
Large cow-spring yearlings converted to cow-yearling					
Cows	67	1041	$36.16	$376.	$25,221.
Yearling heifers	117	750	58.09	436.	50,974.
Yearling steers	188	840	62.75	527.	99,095.
Total Sales	372				$175,290.
Bulls sold	6	1545	45.30	700.	4,199.
Bulls purchased	6			1424.	8,544.
Net bull replacement cost					4,345.
Large cow-spring yearling converted to cow-2-year-old steers					
Cows	55	1041	$36.16	$376.	$20,703.
Yearling heifers	96	750	58.09	436.	41,825.
2-year-old steers	153	1070	61.00	653.	$99,863.
Total Sale	304				$162,391.
Bulls sold	5	1545	45.30	700.	3,499.
Bulls purchased	5			1424.	7,120.
Net bull replacement cost					3,621.
Large cow-yearling, basic ranch [b]					
Cows	71	995	$36.16	$360.	$25,545.
Yearling heifers	127	644	59.20	381.	48,418.
Yearling steers	208	763	63.85	487.	101,332.
Total Sales	406				$175,295.
Bulls sold	6	1600	45.30	725.	4,349.
Bulls purchased	7			1208.	8,456.
Net bull replacement cost					4,107.
Large cow-yearling converted to cow-2-year-olds [b]					
Cows	58	995	$36.16	$360.	$20,868.
Yearling heifers	114	644	59.20	381.	43,462.
2-year-old steers	166	1025	61.00	625.	103,792.
Total Sales	338				$168,122.
Bulls sold	5	1600	45.30	725.	3,624.
Bulls purchased	5			1208.	6,040.
Net bull replacement cost					2,416.

[a] The small ranches, regardless of type, have all been converted to 355 animal-units (AUs) and represent operations of 100-375 cows.

[b] Bull purchases and sales information is the same for the following systems, until different data are shown.

[c] All large sizes, regardless of type, have been adjusted to 865 animal-units (AUs) and represent 375 cows or more.

Cattle Prices

Cattle prices for the Eastern Wyoming - Western Nebraska (Torrington) area were used in this analysis. That market is a logical alternative for producers in Western Wyoming and the Wind River Basin. Cattle from northern Wyoming are sometimes marketed at Billings. Prices at Billings tend to be about 1% lower in the spring and 2% lower in fall than at Torrington (Kearl, 1985). The 1980-84 average prices were used for utility and cutter cows and for medium and large frame number one muscle thickness feeder steers and heifers at the appropriate weight and month of marketing (Table 19). Prices were interpolated to be as accurate and consistent as possible for different weights sold.

Programs to increase weights of feeder or grass fed animals were mentioned previously. Marketing at different times of year, i.e., August or September instead of October, may also be a possibility to extend the seasonal availability of grass-fed beef. Seasonal price changes are important, as are seasonal gains and effects on sale weight. Based on data presented earlier, mid-August sales could entail sacrificing of 75 lbs. in weight compared with mid-October sale. Such earlier sale could allow carrying more breeding cow-units, and perhaps selling at a slightly higher price, but evaluating for the net benefits is a much more complicated consideration.

Cross-breeding can significantly increase weights of animals coming off grass. Some evidence also suggests that certain crosses may command premium prices as feeder animals. Where that is true of feeder cattle prices, then the price premium needed to bid cattle away from feedlots and implement a grass-fed slaughter program will be increased.

Table 19. Summary of 1980-84 Average Prices for Various Classes, Grades and Weights of Cattle, Eastern Wyoming - Western Nebraska Auction Markets (dollars per cwt).

Description	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Feeder Cattle (Medium Frame, No. 1 Muscle Thickness)												
Steers												
300-400	81.25	82.23	81.60	80.04	79.69	77.12	75.42	74.44	73.93	73.80	73.37	73.59
400-500	78.39	77.82	79.12	77.84	77.24	75.78	73.75	72.39	71.67	71.86	71.45	71.80
500-600	73.60	73.15	73.94	73.19	72.44	72.76	70.54	69.41	68.80	68.63	68.64	68.59
600-700	69.76	69.58	68.58	68.07	67.31	67.60	66.91	67.01	66.42	65.64	65.99	66.00
700-800	67.00	67.39	67.10	65.66	64.60	64.14	64.02	64.89	64.45	64.01	64.51	64.31
800-1,000	64.09	64.23	65.07	64.39	63.13	62.70	62.80	63.23	62.87	61.89	62.69	62.56
Heifers												
300-400	70.13	71.73	70.49	68.76	67.41	67.47	66.54	66.24	66.41	64.11	62.82	63.03
400-500	67.71	69.18	68.09	67.15	66.01	66.12	65.19	64.88	63.75	62.65	61.58	61.76
500-600	64.79	66.41	65.21	63.92	63.60	63.89	63.34	63.08	62.05	60.45	59.99	60.42
600-700	62.37	64.15	62.94	61.93	60.62	61.39	60.68	61.37	60.96	59.11	59.21	59.15
700-800	60.27	62.53	--	60.78	59.49	59.88	59.59	60.22	59.85	58.09	58.50	58.37
Slaughter Cattle												
Choice Steers												
900-1,100	63.30	63.99	65.55	67.15	68.08	67.54	66.84	65.54	64.38	62.12	62.16	63.07
1,100-1,300	63.65	64.35	65.81	67.62	68.47	67.83	67.22	65.98	64.75	62.47	62.53	63.45
Choice Heifers												
900-1100	62.34	62.79	64.11	65.58	66.46	65.80	64.91	63.46	62.35	60.71	61.14	62.00
Cows												
Utility	40.61	42.96	44.03	43.52	42.79	43.58	43.32	43.84	42.06	40.13	37.66	37.92
Cutter	37.59	40.28	40.85	40.60	39.55	40.39	40.69	40.74	39.31	37.35	34.65	34.65
Bulls												
Yield Grade 1												
1,000-1,500	49.96	52.52	52.83	52.87	52.32	52.10	52.19	51.73	50.96	49.04	46.30	45.93
1,500-2,100	51.09	53.58	53.98	54.04	53.35	53.30	53.52	53.09	52.35	50.14	--	46.85
Yield Grade 2												
1,000-1,500	48.56	50.87	51.00	50.98	50.49	49.91	50.34	49.72	49.10	47.14		44.24
1,500-2,100	49.52	51.82	52.05	52.13	51.43	50.90	51.59	50.96	50.40	48.13		45.14

Costs of Operation

Costs of operation per animal unit are summarized in Table 20. Individual cost items tend to vary somewhat among different types of small operations, and between large cow-spring-yearling and cow-yearling operations. However, the total cash costs per animal unit for the small operations are remarkably similar. The total cash costs for the large cow-spring yearling and cow-yearling operations are also quite similar and only about 5% different from the small operations. Slightly higher cash costs for large operations is expected, compared to smaller operations. Averages have been calculated for the small operations, weighted by number of observations in each type and for the cow-spring yearling and cow-yearling large operations again weighted by number of observations in each type.

The depreciation per animal unit is also shown in Table 20. It includes depreciation on improvements, machinery and livestock subject to depreciation. This item was calculated to be the same for the three types of small operations and for the three types of large operations. There was some variation in depreciation reported among the different types. But depreciation should not vary significantly among the three types based on the same size.

The large cow-calf operation deserves some special note. It was mentioned previously that this operation as a group included several outstanding managers. Those outstanding managers and their influence on the group average in effect makes this entire group appear to be an outlier. That was true of the performance in terms of calf crop produced and use of a little earlier calving, cross-breeding and perhaps other practices to produce heavy weaning weights on calves. It is also reflected in

the performance in maintaining relatively low costs of operation. That is achieved through production of an abundance of feed on the ranch with relatively small feed purchases and lower costs in other categories.

Table 20. Costs per Animal Unit by Size and Type of Operation (Dollars)

	Small Operations				Large Operations			
Cost Item	Cow-Calf	Cow-Spring Yrlng.	Cow Yrlng.	Weighted Avg.	Cow-Calf	Cow-Spring Yrlng.	Cow-Yrlng.	Weighted Avg.
Hired Labor	13.52	10.37	19.73	14.40	24.72	26.07	28.04	27.23
Feed Purchased	19.82	9.14	13.11	16.19	8.26	24.33	19.58	21.54
Land Rent	5.45	10.57	15.46	8.81	13.88	9.09	12.20	10.92
Supplies	5.30	12.57	11.11	8.07	5.34	5.49	10.18	8.25
Repairs	16.26	16.55	13.64	15.69	9.19	10.91	9.96	10.35
Taxes	13.25	12.37	12.19	12.83	10.53	9.38	8.21	8.69
Insurance	9.05	5.93	6.45	7.84	4.40	3.93	11.64	8.47
Fertilizers	5.35	10.32	1.21	5.31	6.97	6.60	7.40	7.07
Vet Expense	4.11	3.15	5.16	4.18	4.06	4.03	4.25	4.16
Seeds	1.10	2.28	1.21	1.35	0.58	3.10	0.63	1.65
Fuel and Lube	20.22	16.10	17.07	18.69	9.21	12.86	12.90	12.88
Water and Drainage	0.00	4.78	0.00	0.91	1.22	1.98	2.52	2.30
Utilities	9.27	8.21	9.49	9.12	6.63	5.87	4.72	5.19
Freight & Yardage	1.36	0.31	2.97	1.54	0.17	1.53	4.42	3.23
Miscellaneous	10.21	9.26	5.42	8.89	1.63	12.70	6.02	8.46
Interest on Oper. Capital [a/]	8.73	8.57	8.72	8.70	6.94	8.96	9.27	9.15
TOTAL CASH COST	143.00	140.48	142.94	142.51	113.73	146.83	151.94	149.84
Non-cash Costs								
Depreciation	47.89	47.89	47.89	47.89	28.44	28.44	28.44	28.44
Total	190.89	188.37	190.83	190.40	142.17	175.27	180.38	178.28

[a/] Interest on operating capital charged to all cash costs for six months @ 13% annual interest rate.

[b/] Excluding the cow-calf operation.

Interest on operating capital has been charged on all cash costs at a 13% annual rate for six months. That is an imputed charge to account for the use

of the cash operating capital as a resource on a debt-free operation. The logic is that the cash costs are distributed through the year. As they accumulate it is as though half of the cash costs are obligated for the full year, or conversely, the full amount of cash is required for one-half year. Hence, the interest charge on cash costs are as stated above.

Table 21 summarizes the average hay surpluses or deficits as reported by producers. Hay production data are based on those in Table 10, while winter feeding requirements are shown in Appendix Table A-1 and A-2. Large surpluses may be the result of unreported enterprises on the ranches, hay selling activities, unreported or unrecognized waste, an unusually good local crop production year in 1984, or inaccurate reporting of data on feed production. Ranchers may report total yields based on yields from some of the better fields, or based on the "good years" rather than a longer-term average. Alfalfa hay yields for 1984 were not significantly different from average yields; but grass hay yields are up somewhat compared to Wyoming Agricultural Statistics, 1984 (Wyoming Crop and Livestock Reporting Service, 1985).

Feed costs are affected by the amount of hay and other feed producers must purchase. Hay purchases by small cow-calf producers to offset deficits increased feed costs for the group. Other variables, especially weather, will increase or decrease hay and supplemental feeding, which affects feed costs.

The total tons of hay fed tends to increase for those producers converting from cow-calf to yearling and 2-year-old operations. Conversions from spring-yearling operations tend to feed the same or lesser amounts of hay. Cow-yearling and cow-2-year-old systems feed about the same hay tonnages. All conversions were calculated based on feeding enough hay to

attain about .93 lb. average daily gain on steers, and about .85 average daily gain on heifers.

Table 21. Hay Production and Use by Size and Type of Operation

	Hay Produced	Hay Fed	Surplus (Deficit)	Value of Surplus [a]
	(Tons)	(Tons)	(Tons)	(Dollars)
Small Operations				
Cow-calf	471	538	(67) [b]	($4,154) [b]
Convert to cow-yearling		654	(183) [b]	$12,261) [b]
Convert to cow-2-year-old		622	(151) [b]	($10,117) [b]
Cow-spring-yearling	682	542	140	$8,712
Convert to cow-yearling		508	174	$10,796
Convert to cow-2-year-old		501	181	$11,225
Cow-yearling	625	575	50	$3,109
Convert to Cow-2-year-old		575	52	$3,102
Large Operations				
Cow-calf	1,354	1,084	270	$16,764
Convert to cow-yearling		1,260	94	$5,958
Convert to cow-2-year-old		1,237	117	$7,234
Cow-spring-yearling	1,463	1,410	53	$3,299
Convert to cow-yearling		1,185	278	$17,231
Convert to cow-2-year-old		1,145	318	$19,746
Cow-yearling	1,473	1,314	159	$9,841
Convert to cow-2-year-old		1,269	204	$12,675

[a] Priced at $62 per ton.

[b] Deficit.

All costs for basic ranches are also shown in Appendix Tables B-1 through B-6. These costs are shown in the income statements on a total, per AU and per cow basis.

Summary of Net Returns

Net Cash Income or Return Above Cash Costs

Net cash income is calculated by subtracting cash expenses from cash receipts (Tables 22 and 23). It is cash actually available for family living, debt retirement and reinvestment including purchase of new equipment and improvements, etc. In research, extension or planning applications, calculations are usually made as though the operation is free of debt, and that is done in this case. That allows for comparisons among different ranches, types or systems of operation on a standardized debt-free basis without the confounding factor of differing amounts of debt. It will also allow one to see the amount that could be available for interest and principal payments on debt. An imputed cost for interest on operating capital (cash expenses) is used for research, extension or planning applications. That was explained previously and included in cash costs.

Because of the limited sample size and variations in some production coefficients and costs, one must be careful in making comparisons among the six basic ranch budgets. Comparisons between a particular basic ranch budget and the conversion to a different type of operation should be valid if assumptions are correct and principles of logical consistency are carefully observed.

Because the converted operations are based on the same set of resources as the basic ranch unit, many operating costs will remain the same. The principal exceptions are the feed cost, veterinary expenses and breeding costs. Those changes are reflected in changes in cash costs and hay sales where surplus hay existed. A number of costs such as land rent, seed, fertilizer, taxes, insurance, utilities and water and drainage remain stable as cattle inventories change. Others such as supplies, repairs, fuel and

Table 22. Summary-Net Income on Small Operations

	Cow-Calf			Cow-Spring Yearling			Cow-Yearling	
	Basic Ranch	Convert to Cow-Yrlng.	Convert to Cow-2-Yr-Old	Basic Ranch	Convert to Cow-Yrlng.	Convert to Cow-2-Yr-Old	Basic Ranch	Convert to Cow-2 Year-Old
	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)
Sales								
Cull Cows	12,466	9,617	7,836	11,884	9,655	8,170	10,884	8,940
Young Cattle	57,819	71,991	66,428	50,394	50,219	48,658	57,309	55,082
Total Livestock Sales	70,285	81,608	74,264	62,278	59,874	56,828	68,193	64,022
Hay Sales [a/]	-0-	-0-	-0-	8,712	10,796	11,225	3,109	3,102
Total Sales	70,285	81,608	74,264	70,990	70,670	68,053	71,302	67,124
Cash Costs [b/]	50,765	57,241	55,048	49,870	49,075	48,481	50,744	49,549
Ret. Above Cash Costs	19,520	24,367	19,216	21,120	21,595	19,572	20,558	17,575
Allowance for Labor and Management	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200
Ret. Above Cash Costs Labor and Mgt.	12,320	17,167	12,016	13,920	14,395	12,372	13,358	10,375
Depreciation	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
Ret. to Total Cap.	-4,680	167	-4,984	-3,080	-2,605	-4,628	-3,642	-6,625
Int. on Working Cap.								
Livestock	13,602	14,435	15,487	13,847	14,610	15,500	14,528	15,687
Mach. and Equip.	11,036	11,036	11,036	11,036	11,036	11,036	11,036	11,036
Ret. to Fixed Cap.	-29,318	-25,304	-31,507	-27,603	-28,251	-31,164	-29,206	-33,348

[a/] Hay sales vary due to changing requirments of systems.

[b/] Cash costs vary due to changes in purchased feed, breeding fees and veterinary expenses. All other costs are expected to remain constant.

Table 23. Summary-Net Income On Large Operations

	Cow-Calf			Cow-Spring Yearling			Cow-Yearling	
	Basic Ranch	Convert to Cow-Yrlng.	Convert to Cow-2-Yr-Old	Basic Ranch	Convert to Cow-Yrlng.	Convert to Cow-2-Yr-Old	Basic Ranch	Convert to Cow-2 Year-Old
	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)
Sales								
Cull Cows	35,308	26,772	22,504	32,749	25,221	20,703	25,545	20,868
Young Cattle	140,836	163,641	149,883	159,630	150,069	141,688	149,750	147,254
Total Livestock Sales	176,144	190,413	172,387	192,379	175,290	162,391	175,295	168,122
Hay Sales	16,764	5,958	7,234	3,299	17,231	19,746	9,841	12,675
Total Sales	192,908	196,371	179,621	195,678	192,521	182,137	185,136	180,795
Cash Costs	98,376	96,314	94,876	127,008	121,234	117,851	131,428	127,522
Ret. Above Cash Costs	94,532	100,057	84,745	68,670	71,287	64,286	53,708	53,275
Allowance for Labor and Management	19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200
Ret. Above Cash Costs Labor and Mgt.	75,332	80,857	65,545	49,470	52,087	45,086	34,508	34,075
Depreciation	24,600	24,600	24,600	24,600	24,600	24,600	24,600	24,600
Ret. to Total Capital	50,732	56,247	40,945	24,870	27,487	20,486	9,908	9,475
Int. on Working Cap.								
Livestock	33,825	35,959	38,778	35,783	37,850	40,091	38,605	39,320
Mach. and Equip.	23,772	23,772	23,772	23,772	23,772	23,772	23,772	23,772
Ret. to Fixed Cap.	-6,865	-3,474	-21,605	-34,685	-34,135	-43,377	-52,469	-53,617

lubrication, freight and yardage, hired labor and miscellaneous may change slightly; but those costs have not been adjusted.

Return above cash costs is increased by conversion to cow-yearling operations for both sizes of cow-calf operation. Cow-spring yearling operations returns from conversion are also positive, but not as large as the cow-calf conversion. Return over cash costs generally decreases with the change to the 2-year-old operation.

Return Above Cash Costs and Operators Labor and Management

On owner-operated ranches there are requirements for funds to meet family living expenses. That item is not included in expenses, unless the operation is incorporated and corporation officers' salaries cover it.

Rural appraisers frequently use 10% of gross income as an allowance for the operators labor and management. Extension economists in the western states also use that amount. Allowance of about 10% of cash receipts of the basic ranch units is made in Tables 22 and 23. It is below the poverty level for the smaller operation, but adequate for the larger operation. Some non-cash items such as housing, meat, and perhaps milk, eggs and garden produce, supplement the cash income of many ranchers.

The return above cash costs and allowance for operators' labor and management represents the funds available for debt repayment, and investment in new equipment to replace the old. Depreciation allowances have not been deducted, but over time cash expenditures on new equipment or improvements will equal or exceed the depreciation.

Return to Total Capital

In the procedures used here, return to capital is calculated by deducting depreciation, a non-cash item. Depreciation is that reported for 1984, not the depreciation which might be calculated for the longer term on a typical

complement of machinery and equipment.

The allowance for operators labor and management and the depreciation allowances were both fixed over all operations within a size. Consequently, the returns over cash costs and operators' labor and management and returns to total capital vary as the return over cash costs vary.

Return to total capital is negative for all basic ranches and conversions in the small-sized operation. It is positive for all basic ranches and conversions in the large-sized operation.

Return to Fixed Capital

Return to fixed capital (land and improvements) is calculated and used by rural appraisers and in some research and extension applications. Interest on the investment in working assets is calculated and deducted from the return to total capital to find the return to fixed capital. In these calculations an interest rate of 10% has been charged on the investment in cattle, horses, machinery and equipment. Machinery and equipment investments are derived from a study by Gee and Gleason (1985). Interest is not charged on the investment in ranch-raised feeds. Interest has already been charged on cash costs to produce the feeds. Inclusion of interest on the inventory of ranch-raised feeds may result in a slight over-statement of interest costs because of double counting. Excluding them results in a slight under-statement. Charging interest on the investment in cattle accounts for interest cost increases for holding calves to yearling or 2-year-old age. Those increases are partially offset by the reduced interest on the reduced investment in cows and bulls. The interest rate used here, 10%, is set arbitrarily; but it may approximate recent rate of return in safe investments.

Return to fixed capital is negative for all basic ranches and conversions

in both sizes. Returns are shown increasing (the size of loss or negative return is reduced) in going from cow-calf or cow-spring yearling to cow-yearling in both sizes of operation. Returns decrease (the size of loss or negative returns increase) then in converting to 2-year-old operations.

The cow-spring yearling operations have returns about equal to the cow-fall yearling conversions. It might be noted that spring prices were considerably above fall prices through 1980-84 used.

APPENDIX A

WINTER FEED REQUIREMENTS BY SIZE AND TYPE OF OPERATION

Table A-1. Winter Feed Requirements for Small Basic Ranch Type of Operation.

Class of Stock	Number of Animals	Feeding Season (Days)	Pounds per Day			Total Tons for Season		
			Hay	Grain	Other	Hay	Grain	Other
Cow-calf basic ranch								
Cows	222	157	20.5		0.3	357.3	0.0	5.2
Replacement heifers	39	160	19.0		0.5	59.3	0.0	1.6
Weaned heifer calves	44	173	16.5			62.8	0.0	0.0
Weaned steer calves	0	173	17.8			0.0	0.0	0.0
Bulls	10	155	25.0			19.4	0.0	0.0
Horses	9	143	21.0			13.5	0.0	0.0
Waste (+5%)						25.6	0.0	0.3
Total tons						537.8	0.0	7.1
Cow-calf to cow-yearling								
Cows	174	157	20.5		0.3	280.0	0.0	4.1
Replacement heifers	31	160	19.0		0.5	47.1	0.0	1.2
Weaned heifer calves	90	173	16.5			128.5	0.0	0.0
Weaned steer calves	90	173	17.8			138.2	0.0	0.0
Bulls	8	155	25.0			15.5	0.0	0.0
Horses	9	143	21.0			13.5	0.0	0.0
Waste (+5%)						31.1	0.0	0.3
Total tons						653.9	0.0	5.6
Cow-calf to cow-2-year-old								
Cows	141	157	20.5		0.3	226.9	0.0	3.3
Replacement heifers	25	160	19.0		0.5	38.0	0.0	1.0
Weaned heifer calves	72	173	16.5			102.8	0.0	0.0
Weaned steer calves	72	173	17.8			110.5	0.0	0.0
Yearling steers	71	157	16.0			89.2	0.0	0.0
Bulls	6	155	25.0			11.6	0.0	0.0
Horses	9	143	21.0			13.5	0.0	0.0
Waste (+5%)						29.6	0.0	0.2
Total tons						622.2	0.0	4.5
Cow-spring yearling basic ranch								
Cows	193	145	23.0		0.4	321.8	0.0	5.6
Replacement heifers	39	145	19.0		0.4	53.7	0.0	1.1
Weaned heifer calves	89	134	11.5	3.0		68.6	17.9	0.0
Weaned steer calves	89	99	11.3	3.0		49.8	13.2	0.0
Bulls	9	145	24.0	4.5		15.7	2.9	0.0
Horses	12	70	14.6	0.5		6.1	0.2	0.0
Waste (+5%)						25.8	1.7	0.3
Total tons						541.5	36.0	7.1

(Continued)

Table A-1. (Continued) Winter Feed Requirements for Small Basic Ranch Type of Operation.

Class of Stock	Number of Animals	Feeding Season (Days)	Pounds per Day			Total Tons for Season		
			Hay	Grain	Other	Hay	Grain	Other
Cow-spring yearling to cow-yearling								
Cows	155	145	23.0		0.4	258.5	0.0	4.5
Replacement heifers	32	145	19.0		0.4	44.1	0.0	0.9
Weaned heifer calves	71	165	13.3	1.0		77.9	5.9	0.0
Weaned steer calves	71	165	14.5	1.0		84.9	5.9	0.0
Bulls	7	145	24.0	4.5		12.2	2.3	0.0
Horses	12	70	14.6	0.5		6.1	0.2	0.0
Waste (+5%)						24.2	0.7	0.3
Total tons						507.9	14.9	5.7
Cow-spring yearling to cow-2-year-old								
Cows	131	145	23.0		0.4	218.4	0.0	3.8
Replacement heifers	27	145	19.0		0.4	37.2	0.0	0.8
Weaned heifer calves	60	165	13.3	1.0		65.8	5.0	0.0
Weaned steer calves	60	165	14.5	1.0		71.8	5.0	0.0
Yearling steers	58	145	16.0			67.3	0.0	0.0
Bulls	6	145	24.0	4.5		10.4	2.0	0.0
Horses	12	70	14.6	0.5		6.1	0.2	0.0
Waste (+5%)						23.9	0.6	0.2
Total tons						501.0	12.7	4.8
Cow-yearling basic ranch								
Cows	159	149	22.0			260.6	0.0	0.0
Replacement heifers	31	164	20.0			50.8	0.0	0.0
Weaned heifer calves	78	183	12.9	1.0		92.1	7.1	0.0
Weaned steer calves	78	183	14.0	1.0		99.9	7.1	0.0
Bulls	8	149	26.0			15.5	0.0	0.0
Horses	14	170	24.0	0.3		28.6	0.4	0.0
Waste (+5%)						27.4	0.7	0.0
Total tons						574.9	15.4	0.0
Cow-yearling to cow-2-year-old								
Cows	135	149	22.0			221.3	0.0	0.0
Replacement heifers	27	164	20.0			44.3	0.0	0.0
Weaned heifer calves	66	183	12.9	1.0		77.9	6.0	0.0
Weaned steer calves	66	183	14.0	1.0		84.5	6.0	0.0
Yearling steers	65	149	16.0			77.5	0.0	0.0
Bulls	7	149	26.0			13.6	0.0	0.0
Horses	14	170	24.0	0.3		28.6	0.4	0.0
Waste (+5%)						27.4	0.6	0.0
Total tons						575.0	13.1	0.0

Table A-2. Winter Feed Requirements for Large Basic Ranch Type of Operation.

Class of Stock	Number of Animals	Feeding Season (Days)	Pounds per Day			Total Tons for Season		
			Hay	Grain	Other	Hay	Grain	Other
Cow-calf basic ranch								
Cows	498	132	21.0		0.7	690.2	0.0	23.0
Replacement heifers	100	141	20.0		0.8	141.0	0.0	5.6
Weaned heifer calves	103	165	15.8	0.5	0.5	134.3	4.2	4.2
Weaned steer calves	0	165	16.5	0.5	0.5	0.0	0.0	0.0
Bulls	23	132	28.0		0.6	42.5	0.0	0.9
Horses	14	132	26.0	1.0	0.4	24.0	0.9	0.4
Waste (+5%)						51.6	0.3	1.7
Total tons						1083.6	5.4	35.9
Cow-calf to cow-yearling								
Cows	377	132	21.0		0.7	522.5	0.0	17.4
Replacement heifers	75	141	20.0		0.8	105.8	0.0	4.2
Weaned heifer calves	193	165	15.8	0.5	0.5	251.6	8.0	8.0
Weaned steer calves	193	165	16.5	0.5	0.5	262.7	8.0	8.0
Bulls	17	132	28.0		0.6	31.4	0.0	0.7
Horses	14	132	26.0	1.0	0.4	24.0	0.9	0.4
Waste (+5%)						59.9	0.8	1.9
Total tons						1257.9	17.7	40.5
Cow-calf to cow-2-year-old								
Cows	316	132	21.0		0.7	438.0	0.0	14.6
Replacement heifers	63	141	20.0		0.8	88.8	0.0	3.6
Weaned heifer calves	162	165	15.8	0.5	0.5	211.2	6.7	6.7
Weaned steer calves	162	165	16.5	0.5	0.5	220.5	6.7	6.7
Yearling steers	161	132	16.0			170.0	0.0	0.0
Bulls	14	132	28.0		0.6	25.9	0.0	0.6
Horses	14	132	26.0	1.0	0.4	24.0	0.9	0.7
Waste (+5%)						58.9	0.7	1.6
Total tons						1237.3	15.0	34.4
Cow-spring yearling basic ranch								
Cows	454	129	23.5			688.2	0.0	0.0
Replacement heifers	94	154	22.0			159.2	0.0	0.0
Weaned heifers calves	248	150	13.0	2.0	2.5	241.8	37.2	46.5
Weaned steer calves	248	123	13.0	2.0	2.5	198.3	30.5	38.1
Bulls	22	115	30.0			38.0	0.0	0.0
Horses	12	125	23.0	0.5		17.3	0.4	0.0
Waste (+5%)						67.1	3.4	4.2
Total tons						1409.8	71.5	88.9

(Continued)

Table A-2. (Continued) Winter Feed Requirements for Large Basic Ranch Type of Operation.

Class of Stock	Number of Animals	Feeding Season (Days)	Pounds per Day			Total Tons for Season		
			Hay	Grain	Other	Hay	Grain	Other
Cow-spring yearling to cow-yearling								
Cows	348	129	23.5			527.5	0.0	0.0
Replacement heifers	72	154	22.0			122.0	0.0	0.0
Weaned heifer calves	190	165	13.0	0.5	0.5	203.8	7.8	7.8
Weaned steer calves	190	165	14.6	0.5	0.5	228.9	7.8	7.8
Bulls	17	115	30.0			29.3	0.0	0.0
Horses	12	125	23.0	0.5		17.3	0.4	0.0
Waste (+5%)						56.4	0.8	0.8
Total tons						1185.1	16.9	16.5
Cow-spring yearling to cow-2-year-old								
Cows	286	129	23.5			433.5	0.0	0.0
Replacement heifers	59	154	22.0			99.9	0.0	0.0
Weaned heifer calves	156	165	13.0	0.5	0.5	167.3	6.4	6.4
Weaned steer calves	156	165	14.6	0.5	0.5	187.9	6.4	6.4
Yearling steers	155	129	16.0			160.0	0.0	0.0
Bulls	14	115	30.0			24.2	0.0	0.0
Horses	12	125	23.0	0.5		17.3	0.4	0.0
Waste (+5%)						54.5	0.7	0.6
Total tons						1144.5	13.9	13.5
Cow-yearling basic ranch								
Cows	400	132	22.0		0.3	580.8	0.0	7.9
Replacement heifers	81	150	21.3		0.6	129.4	0.0	3.6
Weaned heifer calves	213	165	13.5	1.1	0.5	237.2	19.3	8.8
Weaned steer calves	213	165	13.5	1.1	0.5	237.2	19.3	8.8
Bulls	20	147	28.2	0.4		41.5	0.6	0.0
Horses	18	136	20.9			25.6	0.0	0.0
Waste (+5%)						62.6	2.0	1.5
Total tons						1314.3	41.2	30.6
Cow-yearling to cow-2-year-old								
Cows	327	132	22.0		0.3	474.8	0.0	6.5
Replacement heifers	66	150	21.3		0.6	105.4	0.0	3.0
Weaned heifer calves	174	165	13.5	1.1	0.5	193.8	15.8	7.2
Weaned steer calves	174	165	13.5	1.1	0.5	193.8	15.8	7.2
Yearling steers	170	132	16.0			179.5	0.0	0.0
Bulls	17	147	28.2	0.4		35.2	0.5	0.0
Horses	18	136	20.9			25.6	0.0	0.0
Waste (+5%)						60.4	1.6	1.2
Total tons						1268.6	33.7	25.0

APPENDIX B

COSTS AND RETURNS FOR CATTLE OPERATIONS IN WYOMING MOUNTAIN VALLEYS, 1984

Table B-1. Costs and Returns for Small Cow-Calf Operations in Wyoming Mountain Valleys, 1984. Average Herd 259 Cows (355 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Steer Calves	114	464	$71.45	$331.53	$37,794
Heifer Calves	71	430	61.58	264.79	18,800
Yearling Heifers	3	780	58.09	453.10	1,359
Cull Cows	35	985	36.16	356.18	12,466
Total Sales					$70,420
Total Sales/Animal Unit					$198.37
Total Sales/Cow					$271.89

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$4,800	$13.52	$18.53
Feed Purchased	7,036	19.82	27.17
Land Rent	1,935	5.45	7.47
Supplies	1,882	5.30	7.26
Repairs	5,772	16.26	22.29
Taxes	4,704	13.25	18.16
Insurance	3,213	9.05	12.40
Fertilizers	1,899	5.35	7.33
Vet Expense	1,459	4.11	5.63
Seeds	391	1.10	1.51
Fuel and Lube	7,178	20.22	27.71
Water and Drainage	0	0.00	0.00
Utilities	3,291	9.27	12.71
Freight and Yardage	483	1.36	1.86
Miscellaneous	3,625	10.21	13.99
Int. on Oper. Capital	3,099	8.73	11.97
Total Cash Costs	$50,765	$143.00	$196.00
Other Costs			
Family Labor and Mgmt.	$6,703	$18.88	$25.88
Depreciation	17,000	47.89	65.64
Int. on Working Capital			
Livestock	13,602	38.32	52.52
Machinery and Equip.	11,036	31.09	42.61
Interest on Land	63,880	179.94	246.64
Total Other Costs	$112,221	$316.12	$433.29
Total All Costs	$162,986	$459.12	$629.29
Return Above Cash Costs	$19,655	$55.37	$75.89
Return Above Cash Costs, Family Labor and Mgmt.	$12,952	$36.48	$50.01
Return to Total Capital	-$4,048	-$11.40	-$15.63
Return to Fixed Capital	-$28,686	-$80.81	-$110.76

[a/] Production coefficients: 91.7% calf crop born alive, 3.6% calf loss birth to weaning, 1.7% annual cow loss, 7% bull loss, 15.2% replacement rate, 21 cows per bull, bulls used 3.9 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, 12 producer sample.

Table B-2. Costs and Returns for Small Cow-Spring Yearling Operations in Wyoming Mountain Valleys, 1984. Average Herd 228 Cows (355 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Yearling Steers	87	539	$73.94	$398.54	$34,673
Yearling Heifers	42	508	65.21	331.27	13,913
Yearling Heifers	3	745	58.50	435.83	1,307
Cull Cows	32	1027	36.16	371.36	11,884
Total Sales					$61,777
Total Sales/Animal Unit					$174.02
Total Sales/Cow					$270.95

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$3,681	$10.37	$16.15
Feed Purchased	3,245	9.14	14.23
Land Rent	3,752	10.57	16.46
Supplies	4,462	12.57	19.57
Repairs	5,875	16.55	25.77
Taxes	4,391	12.37	19.26
Insurance	2,105	5.93	9.23
Fertilizers	3,664	10.32	16.07
Vet Expense	1,118	3.15	4.90
Seeds	809	2.28	3.55
Fuel and Lube	5,716	16.10	25.07
Water and Drainage	1,697	4.78	7.44
Utilities	2,915	8.21	12.78
Freight and Yardage	110	0.31	0.48
Miscellaneous	3,287	9.26	14.42
Int. on Oper. Capital	3,042	8.57	13.34
Total Cash Cost	$49,870	$140.48	$218.73
Other Costs			
Family Labor and Mgmt.	$6,703	$18.88	$29.40
Depreciation	17,000	47.89	74.56
Int. on Working Capital			
Livestock	13,847	39.01	60.73
Machinery and Equip.	11,036	31.09	48.40
Interest on Land	63,948	180.14	280.47
Total Other Costs	$112,534	$317.00	$493.57
Total All Costs	$162,404	$457.48	$712.30
Return Above Cash Costs	$11,907	$33.54	$52.22
Return Above Cash Costs/ Family Labor and Mgmt.	$5,204	$14.66	$22.82
Return to Total Capital	-$11,796	-$33.23	-$51.74
Return to Fixed Capital	-$36,679	-$103.32	-$160.87

[a/] Production coefficients: 79.5% calf crop born alive, 2.1% calf loss birth to weaning, 4.4% annual yearling loss, 2.8% cow loss, 8.3% bull loss, 17.3% replacement rate, 18 cows per bull, bulls used 3.25 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, four producers in sample.

Table B-3. Costs and Returns for Small Cow-Yearling Operations in Wyoming Mountain Valleys, 1984. Average Herd 188 Cows (355 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Yearling Steers	76	790	$64.01	$505.68	$38,432
Yearling Heifers	45	733	58.09	425.80	19,161
Cull Cows	28	1075	36.16	388.72	10,884
Total Sales					$68,477
Total Sales/Animal Unit					$192.89
Total Sales/Cow					$364.24

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$7,004	$19.73	$37.26
Feed Purchased	4,654	13.11	24.76
Land Rent	5,488	15.46	29.19
Supplies	3,944	11.11	20.98
Repairs	4,842	13.64	25.76
Taxes	4,327	12.19	23.02
Insurance	2,290	6.45	12.18
Fertilizers	430	1.21	2.28
Vet Expense	1,832	5.16	9.74
Seeds	430	1.21	2.28
Fuel and Lube	6,060	17.07	32.23
Water and Drainage	0	0.00	0.00
Utilities	3,369	9.49	17.92
Freight and Yardage	1,054	2.97	5.61
Miscellaneous	1,924	5.42	10.23
Int. on Oper. Capital	3,097	8.72	16.47
Total Cash Costs	$50,745	$142.94	$269.92
Other Costs			
Family Labor and Mgmt.	$6,703	$18.88	$35.65
Depreciation	17,000	47.89	90.43
Int. on Working Capital			
Livestock	14,528	40.92	77.28
Machinery and Equip.	11,036	31.09	58.70
Interest on Land	63,932	180.09	340.06
Total Other Costs	$113,199	$318.87	$602.12
Total All Costs	$163,944	$461.81	$872.04
Return Above Cash Costs	$17,732	$49.95	$94.32
Return Above Cash Costs/ Family Labor and Mgmt.	$11,029	$31.07	$58.66
Return to Total Capital	-$5,971	-$16.82	-$31.76
Return to Fixed Capital	-$31,535	-$88.83	-$167.74

[a/] Production coefficients: 85.6% calf crop born alive, 3.3% calf loss birth to weaning, 2% annual yearling loss, 1.7% cow loss, 0% bull loss, 16.7% replacement rate, 17 cows per bull, bulls used 3.8 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, five producers in sample.

Table B-4. Costs and Returns for Large Cow-Calf Operations in Wyoming Mountain Valleys, 1984. Average Herd 593 Cows (865 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Steer Calves	255	525	$68.64	$360.36	$91,892
Heifer Calves	152	510	59.99	305.95	46,504
Yearling Heifers	2	850	58.09	493.77	988
Cull Cows	91	1073	36.16	388.00	35,308
Total Sales					$174,691
Total Sales/Animal Unit					$201.96
Total Sales/Cow					$294.59

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$21,383	$24.72	$36.06
Feed Purchased	7,145	8.26	12.05
Land Rent	12,006	13.88	20.25
Supplies	4,619	5.34	7.79
Repairs	7,949	9.19	13.41
Taxes	9,108	10.53	15.36
Insurance	3,806	4.40	6.42
Fertilizers	6,029	6.97	10.17
Vet Expense	3,512	4.06	5.92
Seeds	502	0.58	0.85
Fuel and Lube	7,967	9.21	13.43
Water and Drainage	1,055	1.22	1.78
Utilities	5,735	6.63	9.67
Freight and Yardage	147	0.17	0.25
Miscellaneous	1,410	1.63	2.38
Int. on Oper. Capital	6,003	6.94	10.12
Total Cash Costs	$98,376	$113.73	$165.90
Other Costs			
Family Labor and Mgmt.	$17,972	$20.78	$30.31
Depreciation	24,600	28.44	41.48
Int. on Working Capital			
Livestock	33,825	39.10	57.04
Machinery and Equip.	23,772	27.48	40.09
Interest on Land	155,944	180.28	262.97
Total Other Cost	$256,113	$296.08	$431.89
Total All Costs	$354,489	$409.81	$597.79
Return Above Cash Costs	$76,315	$88.23	$128.69
Return Above Cash Costs/ Family Labor and Mgmt.	$58,343	$67.45	$98.39
Return to Total Capital	$33,743	$39.01	$56.90
Return to Fixed Capital	-$23,854	-$27.58	-$40.23

[a/] Production coefficients: 88.1% calf crop born alive, 2.5% calf loss birth to weaning, 1.4% annual cow loss, .7% bull loss, 16.8% replacement rate, 19 cows per bull, bulls used 3.6 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, five producer sample.

Table B-5. Costs and Returns for Large Cow-Spring Yearling Operations in Wyoming Mountain Valleys, 1984. Average Herd 544 Cows (865 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Yearling Steers	247	606	$68.58	$415.59	$102,652
Yearling Heifers	151	529	65.21	344.96	52,089
Yearling Heifers	2	750	58.50	438.75	878
Cull Cows	87	1041	36.16	376.43	32,749
Total Sales					$188,368
Total Sales/Animal Unit					$217.77
Total Sales/Cow					$346.26

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$22,551	$26.07	$41.45
Feed Purchased	21,045	24.33	38.69
Land Rent	7,863	9.09	14.45
Supplies	4,749	5.49	8.73
Repairs	9,437	10.91	17.35
Taxes	8,114	9.38	14.91
Insurance	3,399	3.93	6.25
Fertilizers	5,709	6.60	10.49
Vet Expense	3,486	4.03	6.41
Seeds	2,682	3.10	4.93
Fuel and Lube	11,124	12.86	20.45
Water and Drainage	1,713	1.98	3.15
Utilities	5,078	5.87	9.33
Freight and Yardage	1,323	1.53	2.43
Miscellaneous	10,986	12.70	20.19
Int. on Oper. Capital	9,463	10.94	17.40
Total Cash Costs	$128,721	$148.81	$236.62
Other Costs			
Family Labor and Mgmt.	$17,972	$20.78	$33.04
Depreciation	24,600	28.44	45.22
Int. on Working Capital			
Livestock	35,783	41.37	65.78
Machinery and Equip.	23,772	27.48	43.70
Interest on Land	155,736	180.04	286.28
Total Other Costs	$257,863	$298.11	$474.01
Total All Costs	$386,584	$446.92	$710.63
Return Above Cash Costs	$59,647	$68.96	$109.65
Return Above Cash Costs/ Family Labor and Mgmt.	$41,675	$48.18	$76.61
Return to Total Capital	$17,075	$19.74	$31.39
Return to Fixed Capital	-$42,480	-$49.11	-$78.09

[a/] Production coefficients: 93.8% calf crop born alive, 2.8% calf loss birth to weaning, 0.9% annual yearling loss, 1.1% cow loss, 0.9% bull loss, 17.2% replacement rate, 18 cows per bull, bulls used 3.75 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, seven producers in sample.

Table B-6. Costs and Returns for Large Cow-Yearling Operations in Wyoming Mountain Valleys, 1984. Average Herd 475 Cows (865 Animal Units). [a/]

Item	Number Sold	Average Weight	Price per cwt.	Price per head	Total Value
Sales					
Yearling Steers	208	763	$64.01	$488.40	$101,586
Yearling Heifers	127	644	59.11	380.67	48,345
Cull Cows	71	995	36.16	359.79	25,545
Total Sales					$175,477
Total Sales/Animal Unit					$202.86
Total Sales/Cow					$370.20

Item	Total Cost	Cost per AU	Cost per Cow
Cash Costs			
Hired Labor	$24,255	$28.04	$51.17
Feed Purchased	16,937	19.58	35.73
Land Rent	10,553	12.20	22.26
Supplies	8,806	10.18	18.58
Repairs	8,615	9.96	18.18
Taxes	7,102	8.21	14.98
Insurance	10,069	11.64	21.24
Fertilizers	6,401	7.40	13.50
Vet Expense	3,676	4.25	7.76
Seeds	545	0.63	1.15
Fuel and Lube	11,159	12.90	23.54
Water and Drainage	2,180	2.52	4.60
Utilities	4,083	4.72	8.61
Freight and Yardage	3,823	4.42	8.07
Miscellaneous	5,207	6.02	10.99
Int. on Oper. Capital	8,019	9.27	16.92
Total Cash Costs	$131,428	$151.94	$277.27
Other Costs			
Family Labor and Mgmt.	$17,972	$20.78	$37.92
Depreciation	24,600	28.44	51.90
Int. on Working Capital			
Livestock	38,605	44.63	81.45
Machinery and Equip.	23,772	27.48	50.15
Interest on Land	155,743	180.05	328.57
Total Other Costs	$260,692	$301.38	$549.98
Total All Costs	$392,120	$453.32	$827.26
Return Above Cash Costs	$44,048	$50.92	$92.93
Return Above Cash Costs/ Family Labor and Mgmt.	$26,076	$30.15	$55.01
Return to Total Capital	$1,476	$1.71	$3.11
Return to Fixed Capital	-$60,901	-$70.41	-$128.48

[a/] Production coefficients: 91.8% calf crop born alive, 2.4% calf loss birth to weaning, 2.4% annual yearling loss, 1.9% cow loss, 2.8% bull loss, 17.0% replacement rate, 18 cows per bull, bulls used 4.05 years, all costs are for 1984, cattle prices are 1980-1984 average, real estate is valued on an AU basis, 10 producers in sample.

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