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PROCEEDINGS
OF THE
SECOND INTERNATIONAL CONFERENCE
OF
AGRICULTURAL ECONOMISTS

HELD AT
CORNELL UNIVERSITY,
ITHACA, NEW YORK,
AUGUST 18 TO AUGUST 29, 1930

The Collegiate Press
GEORGE BANTA PUBLISHING COMPANY
MENASHA, WISCONSIN

1930

3 cards
Ranch organization
1, Ranching

RESEARCH INVESTIGATIONS ON THE LIVESTOCK RANCHES OF THE UNITED STATES

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THE western half of the United States, in which livestock ranching, rather than general farming, represents the major agricultural industry, has been somewhat behind the general farming regions of the eastern half of the United States in the development of their research methods in ranch organization and management studies. The investigational work in farm management started about 1910, whereas the ranch management investigations were not started until about 12 years later.

The term "ranch" has been most frequently thought of as a livestock enterprise in the open country where a man's wealth is measured in terms of the number of cattle, sheep, and horses which he possesses, and which are cared for very largely without the use of cultivated crops. Grazing and hay lands constitute the real estate holdings.

This lack of research seems to be due to the following reasons:

1. The ranches are in the western and newer states where little investigational work of any kind has been done, due to the short time that the stations have been in operation and the limited amount of state and federal funds available for such work.

2. The efforts of the agricultural experiment stations have heretofore been directed primarily toward the solution of the problems of the farms, rather than those of the ranches, even in those states where ranching has played, and will continue to play, the leading rôle. This policy of the stations in the past has no doubt been due to the fact that most of the research men doing work in our range states received their training in middle western and eastern universities, and they started the same lines of investigational work in the West that was being conducted in the schools from which they came. The first fifteen bulletins on cattle and sheep from the Wyoming Experiment Station were on the fattening of livestock, a practice that had little or no application in those early days.

3. It is easier to work with the small farmer for he is more dependent upon the agricultural colleges and his neighbors for help. The ranch operators feel that they can get along without any as-

sistance, and that the college recommendations are usually impractical (which has too often been the case). The present calf selling recommendation is an example.

4. Ranching has long been looked upon as an exploitative industry and has been curbed by both state and federal legislation. This has created in the ranchers the spirit of independence and resentment toward state and federal supervision. The above factors have retarded the progress of the research work along the lines of ranch organization and management.

The United States Department of Agriculture Report No. 110 by Barnes and Jardine in 1916, on the Meat Situation in the United States, gives the cost of production of certain outfits. Nothing of value however is given in the way of management.

One of the first careful studies to be made of ranching was that of Director Youngblood and Professor Cox of the Texas Station and appeared as bulletin No. 297. This study, made in 1920, dealt with the factors influencing size, tenure, carrying capacity, improvements, capital, credits, labor, products, and marketing. The study was undertaken to correct the impression that ranching is essentially an exploitative industry, and to aid in placing the industry on a sound economic and social basis, rather than to formulate a set of rules for the guidance of the ranchmen in the everyday problems of ranch management. No attempt was made to correlate certain practices with profitable returns.

In the fall of 1921 the Bureau of Agricultural Economics and the Bureau of Animal Industry of the United States Department of Agriculture began a study of the costs and methods of producing calves on ranches in Texas. Fifteen ranches with 38,511 cows were studied for the years 1920, 1921, 1922 and 40 ranches were studied in 1923. Preliminary reports of the work appeared in 1924, and again in 1925. The work was carried on by V. V. Parr and G. S. Klemmedson, and seemed to be the most complete study of its kind up to that time.

The costs in the above Texas study were divided into (1) net costs which included all cash expenditures, and death loss and depreciation on the breeding herd, (2) interest on owner's equity and value of the owner's labor. The total represented gross cost which was \$31.17 per cow and \$47.08 per calf on all ranches for the farm year period. The calves weighed 350 and sold for \$21.28. The calves sold for less than one-half their cost during the four-

year period. The net costs rather than the gross costs were used in the comparative studies.

The Bureau of Agricultural Economics of the United States Department of Agriculture in cooperation with the Colorado Agricultural College started, in 1922, a study of the costs and methods of cattle production on prairie and mountain valley ranches. These studies were carried on for four years, and the results published in 1928 as bulletins number 327 and 342 from the Colorado Experiment Station.

R. L. Adams of the California Experiment Station made a cost of production study of producing beef in California in 1923-24. He found that the cost of production decreased as the age of the animal increased, up to three years of age. Adams did not attempt to place a value on lands, but used instead the value of hay, pasture, and concentrates. For the above reason his costs were somewhat below the other studies made in the western range states. The cost per pound for calves on the California ranches was 8.8 cents compared to 13.4 cents per pound on the Texas ranches. The calf cost on Wyoming mountain valley ranches is approximately 10.9 cents per pound.

During the summer of 1925 the Bureau of Agricultural Economics and the Bureau of Animal Industry of the United States Department of Agriculture, in cooperation with the Agricultural Experiment Stations in Wyoming, Montana, North Dakota and South Dakota undertook the task of making a study of the cattle industry of the Northern Great Plains, and determining the factors and methods of management that would prove best for the stockmen in that area.

Sixty records were taken in Wyoming and about the same number in each of the other states. Wyoming Bulletin No. 147 on Range Cattle Management, published in 1926, gives the results secured in Wyoming. The other states have not published their findings. The United States Department of Agriculture published the findings for the entire area as Technical Bulletin No. 45.

We used the correlation method of study on the Wyoming records which I believe was the first time that it was used to analyze ranch management investigations. The comparative method of study was used in presenting the results of the investigations to the ranchers at the stock growers conventions.

The factors influencing profits which showed fairly good cor-

relation with the rate of return were (1) per cent of total investment which the operators had in cattle, (2) per cent of calf crop, and (3) the number of cattle handled per man. There was a noticeable correlation between calf crop and the number of cows per bull.

Rate of return on investment, rather than labor income, is used as a measure of successful management, as interest is a greater item of expense than labor on most livestock ranches.

The commonly recommended practice of selling calves and yearlings at prices prevailing at that time was found to be a poor practice, and the same condition holds on most of our northwestern ranches.

A study similar to the above was conducted in the Southwest, in 1926. United States Department of Agriculture Technical Bulletin No. 68 gives the results of this study. New Mexico Experiment Station Bulletin No. 169 also reports on the survey. Similar cooperative studies were made in Utah. The results are given in bulletins number 203 and 204 from the Utah Experiment Station.

A cooperative cost account route was started in the states of Montana, Wyoming, North Dakota and South Dakota, following the first survey. The results of this study are now being prepared for publication.

The states of Colorado and Wyoming in cooperation with the Bureau of Agricultural Economics and the Bureau of Animal Industry of the United States Department of Agriculture started a cost and management study route in southern Wyoming and northern Colorado in 1929. There are eighteen ranches in each of the states and the field man makes the rounds of the ranches each month. We secure, I believe, more detailed information on management practice than has been secured so far in ranch management studies.

We have made five detailed studies of range cattle and range sheep areas in Wyoming. The first range sheep study included 65 wool growers and approximately one-half million head of sheep. The records were taken in 1926 and covered the calendar year of 1925. About one million head of sheep and 100,000 head of cattle have been included in our studies during the last five years.

We do not select certain ranches for our investigational work in a given area. We take all the ranches of the area. When

studying range sheep production we do not include operators who have less than a band—1,200 head of ewes. Some operators run as many as 50,000 head. The average is about 6,000 head per ranch.

Our cost of production and management investigations have not been made for the purpose of determining the cost of production, but rather to determine the factors that influence the cost of production, and how those factors can be changed in such a way as to give better returns to the rancher. In order that we may know which ranchers are the best managers it is necessary to have a measuring stick. We have used, for this purpose, the rate of return on investment. Cost of production is determined in the studies, but it is of secondary importance.

A study or publication showing the average cost of production of wool, beef, or lambs, is of little or no value to the man producing these products. It may be of general interest to him and to the public, but it has no real value to the individual producer because it does not show him the weak points in his operations. In order that cost of production and management studies may be of real value they must show why one man's cost of producing wool is 24 cents per pound and why his neighbor's cost is 40 cents per pound.

In all of our studies on range cattle and range sheep investigations we have made a complete analysis of all factors that are influenced by different management practices, and prepared a detailed statement of all items of expense and receipts for each individual ranch, in order that we may determine just what factors are influencing the profits, and how those factors may be improved so as to give better returns. If after such a study we cannot make specific and valuable recommendations that will result in a more favorable return to the operator, then our studies are not worth while. We analyzed and tabulated the results of each individual ranch in such a way that the rancher can see his items of cost and compare them with those of his neighbors, and with the averages for all ranches included in the study. It enables him to see the weak places in his methods of management.

Our method of procedure has been to first secure the approval of the stockmen of the area in which we are to make the investigation. This is done by attending the county and state association meetings of the livestock men, and presenting the results of a

previous study. We attempt to show them the value of the study when applied to their own ranch business.

Figure 1, showing the purchasing power of beef cattle, sheep and wool over a long period of years, is used to show the stockmen the up and down movements in the prices of livestock and livestock products. The forty-year period from 1890 to 1929 equals 100. This forty-year period is used in order to give a better picture of normal prices. In the use of the 1910-14 period we may secure results that are misleading. For example, the price of wool during the period 1910-14 was lower than in any other five-year period during the last half century.

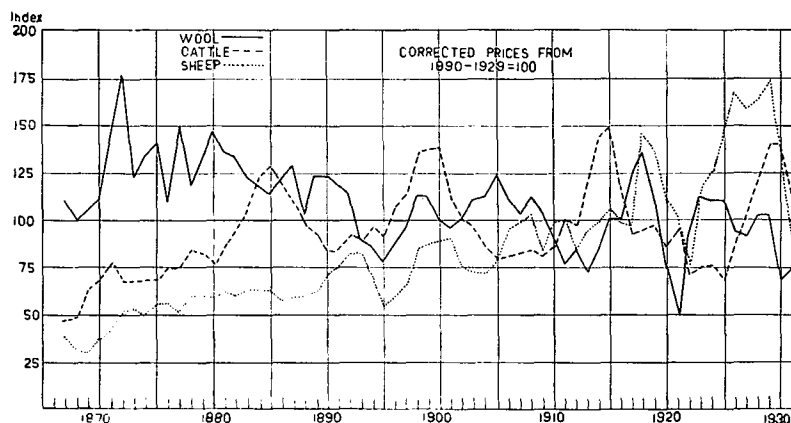


FIGURE 1. PURCHASING POWER OF BEEF CATTLE, SHEEP, AND WOOL, 1867-1931

A careful study of the corrected prices of his products over a long period of years gives the rancher a better idea of what to expect of the future as measured by what has happened in the past. It arouses his interest in economic work and assists us in securing his cooperation in the study of his particular ranch.

We also use a chart showing the numbers, prices, and death losses of range cattle and sheep during the last half century. A precipitation or drought chart is also shown to illustrate the effect of dry years on numbers, prices and death losses of cattle and sheep in the state. This chart brings out the need for better organization and management on the ranches in order to check to some extent these severe losses due to death, forced sales and low prices.

The average investment per ranch and the amount and percentage investment in each enterprise, is shown in table 1. The average investment per ranch was \$93,355 with 50 per cent of the total investment in land, 35 per cent of the total investment in cattle, and the remaining amount in sheep, horses, buildings and improvements, machinery and equipment, and feed and supplies.

The per cent of investment in the different enterprises is one of the most important factors in influencing the rate of return on

Table 1. Average Distribution of Investment, 47 Wyoming Mountain Valley Ranches

Item	Average investment per ranch	Per cent total
Land, 585 acres @ \$21.85.....	\$12,782	13.69
Pasture, 871 acres @ \$25.81.....	22,480	24.08
Grazing land, 1,120 acres @ \$10.05.....	11,256	12.06
Livestock:		
Cows, 305 head @ \$48.....	14,640	15.68
Heifers 1 year old, 102 head @ \$30.....	3,060	3.28
Heifers 2 years old, 79 head @ \$42.....	3,318	3.55
Bulls, 16 head @ \$96.....	1,536	1.65
Steers 1 year old, 118 head @ \$36.....	4,248	4.55
Steers 2 years old, 75 head @ \$50.....	3,750	4.02
Steers 3 years old, 30 head @ \$67.....	2,010	2.15
Sheep, 160 head @ \$10.90.....	1,750	1.87
Horses, 32 head @ \$56.....	1,792	1.92
Buildings and improvements.....	7,126	7.63
Machinery and equipment.....	2,450	2.63
Feed and supplies.....	1,154	1.24
Total.....	\$93,355	100.00

investment. The per cent of the total investment which a rancher should have in his producing livestock is about 40 per cent. The above table represents a study of 47 mountain valley ranches and the results from this survey will be used at this Conference to illustrate our methods. I presume that you are interested in methods rather than our findings. Any of our other studies would serve equally well.

Just what value to place on the lands is always a perplexing problem. We take the values that the ranchers give us as a preliminary start. From this we work out from all the records, the average value, and in most cases it has checked rather closely with

the assessed values. If there is any great variation in land values on the different ranches, as shown by the carrying capacity, we correct for those differences.

The values placed on the lands by the owners and by the assessor is somewhat higher than the actual value of those lands when

Table 2. Ranch Statement, Based on Averages for 47 Wyoming Mountain Valley Ranches

Item	Amount
Receipts:	
Cows.....	\$2,836
Heifers 2 years old.....	350
Heifers 1 year old.....	263
Bulls.....	276
Calves.....	210
Steers 1 year old.....	2,115
Steers 2 years old.....	3,152
Steers 3 years old.....	1,372
Sheep.....	1,062
Horses.....	12
Hay.....	284
Miscellaneous.....	67
Increase in inventory.....	1,440
Total receipts.....	\$13,439
Expenses:	
Livestock purchases.....	1,618
Current expenses.....	6,507
Unpaid family labor.....	500
Total expenses.....	8,625
Ranch income (receipts less expenses).....	4,814
Interest on borrowed capital (interest on \$14,000 @ 6.79 per cent).....	951
Net ranch income (ranch income less interest).....	3,863
Value of owner's supervision.....	1,538
Net return on owner's investment.....	2,325
Rate of return on owner's investment (\$79,352).....	2.93 %

measured by their productive power. This holds true in almost all parts of the United States.

The inventories and sales are worked out for the individual ranches, and the average for all the ranches is given in table 2. No increase in cattle inventory due to the upward trend in cattle prices is allowed in this table. If the cattle on hand at the end of the year are inventoried at a higher value due to market changes, the rate of return on the owner's investment would have been

8.4 instead of 2.93 per cent. It seems advisable to give both methods in figuring the rate of return.

Receipts less expenses represent what we call the ranch income and averaged \$4,814. From this ranch income we subtract the

Table 3. Cost of Producing Beef on 47 Wyoming Mountain Valley Ranches in 1926*

Item	Amount
Expenses per ranch:	
Labor.....	\$2,787
Supplies.....	978
Feed purchased.....	610
Leases and fees.....	365
Taxes.....	637
Automobile and truck.....	138
Repairs and buildings.....	150
Miscellaneous.....	425
Repairs on equipment.....	262
Unpaid labor.....	500
Value of supervision.....	1,538
Interest (interest on \$93,352 @ 6.79 per cent).....	6,339
Decrease in inventory of improvements and equipment.....	446
Total expenses.....	\$15,175
Receipts per ranch:	
Cattle.....	10,574
Sheep.....	884
Horses.....	12
Miscellaneous.....	67
Cattle increase.....	575
Total receipts.....	12,112
Loss per ranch.....	\$ 3,063
Per cent: increase in price necessary to cover costs.....	27.5
Price per hundredweight received for beef, 1926.....	\$6.31
Additional price necessary to pay costs of production.....	\$1.73
Annual pounds of beef produced per cattle unit.....	287
Annual cost of carrying a cattle unit.....	\$23.07
Cost per hundredweight produced.....	\$8.04

* Average investment per ranch, \$93,355. Beginning inventory, 596 cattle units. One cattle unit equals 1 cow, 1 bull, 1 two- or three-year-old, or two yearlings.

amount of interest paid, and we have the net ranch income of \$3,863 which is the amount the owner received for his supervision and capital. The net ranch income minus the value of the owner's supervision gives \$2,325 or the amount received as a return on

investment. The average operator lacked 3.86 per cent of making a return on his investment equal to the average rate of interest paid on borrowed money.

The expenses and receipts on the average mountain valley cattle ranch and the price that the cattle should have sold for in order to pay all costs of production including interest on investment at 6.79 per cent, and supervision at \$2.22 per cattle unit are shown in table 3.

The average price received for beef was \$6.31 per hundredweight which included all classes of animals. The price should have been 27.5 per cent more, or \$8.04 per hundredweight in order to pay all costs. The price of beef in the fall of 1926 was about normal when compared with the corrected prices for the period 1921-30, or for the forty-year period, 1890-1929.

The annual cost per cattle unit was \$23.07 and the pounds of beef produced per animal unit was 287 pounds. Cheaper gains were put on the one- and two-year-old animals than were produced by the cows in the form of a calf.

In order to show the ranchers the importance of the various factors in influencing profits we tabulated a complete business analysis of the 12 best ranches, with the average for the 12, and the same for the 12 ranches with the lowest returns (table 4). The average for all of the ranches in the survey is given on the bottom line.

The 12 best operators were making 5 per cent on their investment whereas the 12 poorest operators showed a loss of 5 per cent. The two groups showed a difference of 10 per cent on the rate of return being made on investment.

The men in the best group had in most cases 500 head or more of cattle whereas the men in the lower group had as a rule outfits that were too small for efficient management.

The labor cost on the better ranches was \$3.67 per cattle unit compared to \$5.93 on the poorer ranches. The interest charge was very much greater on the poorer than on the better ranches, due to the larger per cent of investment in things other than cattle. The total carrying cost per cow on the better ranches was \$21.10 compared to \$30.50 on the poorer ranches.

By means of such a chart it is possible to go through a ranch business and point out every strong and weak point in its organi-

Table 4. Factors Influencing Profits on Wyoming Mountain Valley Ranches

Rate of return	Number of cow units	Investment in cattle	Calf crop	Loss on calves	Cows per man	Per cent loss of cows	Cows per bull	Days on winter feed	Land per cow unit	Hay fed per cow unit	Operating expenses per cow unit												
											Labor	Supplies	Feed	Leases and forests	Taxes	Miscellaneous	Depreciation	Manager	Interest	Horse cost	Total cost	Total receipts	Pounds of beef produced per cow unit
Twelve ranches with highest rates of return																							
10.00	535	92.20	76	1.	114	1.9	18	100		1.27	6.40	.28	3.37	2.05	.65	1.41	.42	2.75	3.93	.61	21.9	25.8	285
10.00	716	54.03	73	1.9	215	2.	23	115	10.2	.77	.88	.29	.27	.47	.57	1.37	.80	2.42	6.34	1.21	14.6	24.4	309
8.71	936	47.28	73	2.	127	1.9	27	120	1.6	1.52	3.89	1.88		.19	.44	1.17	.98	1.83	6.85	1.55	18.8	31.9	315
5.61	2,180	52.43	66	4.2	142	5.	35	140	18.2	.73	5.45	1.33		.85	.53	.19	.70	1.08	5.56	.38	16.1	23.1	303
5.56	2,963	60.71	69	3.	200	4.	23	155	5.6	1.47	2.67	1.93	.31	.76	1.38	2.57	.45	1.16	6.14	1.37	18.7	24.3	296
5.32	414	35.94	74	3.6	244	1.8	44	90	6.4	1.44	1.69	.64		.23	1.50	.30	.46	3.53	10.26	.84	19.5	26.2	265
4.47	1,323	51.84	68	5.8	181	1.9	20	140	2.5	1.69	4.67	.44	1.17	2.30	.61	.56	1.00	1.74	7.28	1.20	30.0	34.3	330
3.74	1,143	50.18	71	2.5	147	2.8	19	120	12.6	1.34	3.28	3.21	1.27	1.14	.76	.05	.46	2.01	7.42	1.26	20.9	26.0	303
3.19	573	35.00	75	2.8	106	1.8	25	165	5.2	1.34	4.69	1.63	2.05	.43	.54	.05	1.18	2.45	9.69	1.88	24.6	26.7	307
2.96	332	44.48	83	3.8	144	1.9	22	100	5.9	1.80	4.02	.85	5.01	.76	1.04	.12	1.31	3.42	9.26	1.65	27.4	30.3	280
2.86	672	38.40	80	2.1	187	5.	23	155	7.1	1.33	3.08	1.06	.30	.25	.77	1.02	1.91	2.57	7.43	1.13	19.5	24.7	322
2.70	2,132	43.50	82	3.	189	4.	14	150	3.3	1.12	3.35	1.83	2.08		.46		1.39	1.64	8.99	.95	20.7	24.9	294
*5.43	1160	50.57	74	2.9	151	2.8	24	129	6.5	1.32	3.67	1.28	1.31	.79	.78	.73	.92	2.21	7.34	1.17	21.1	26.9	301

Table 4. (Continued)

Rate of return	Number of cow units	Investment in cattle	Calf crop	Loss on calves	Cows per man	Per cent loss of cows	Cows per bull	Days on winter feed	Land per cow unit	Hay fed per cow unit	Operating expenses per cow unit													
											Labor	Supplies	Feed	Leases and forests	Taxes	Miscellaneous	Depreciation	Manager	Interest	Horse cost	Total cost	Total receipts	Pounds of beef produced per cow unit	
Twelve ranches with lowest rates of return																								
- 2.49	1,327	42.08	52	1.6	141	2.	22	135	8.5	1.36	6.10	.78	1.49	3.13	.73	.03	.97	1.73	8.57	1.45	25.0	18.5	252	
- 2.61	263	23.70	72	4.2	69	3.3	22	135	3.8	1.50	8.38	1.48	.12	.71	.71	1.48	3.07	3.18	15.41	2.21	36.8	31.2	334	
- 2.77	714	17.70			115		20	150	4.3	1.43	7.46	1.99	.84	.18	.95	.05	3.73	2.42	15.87	1.21	34.7	22.0	285	
- 2.87	349	47.77	56	2.4	103	1.5	28	125	6.5	1.15	5.30	2.03	.44	.09	.64	.34	1.00	3.30	7.43	1.16	21.8	21.1	258	
- 3.84	337	31.24	77	4.2	125	4.	21	120	2.9	1.31	4.15	1.12		.47	2.04	1.33	1.34	3.45	11.49	.87	26.2	22.9	290	
- 4.05	449	30.25	52	3.5	103	1.8	31	135	2.6	1.13	4.04	1.37	.75	.16	.69		1.47	3.24	11.43	.90	24.1	16.3	185	
- 5.17	263	18.03	70	6.4	101	3.6	17	130	17.8	1.27	4.94	2.37	.19	.23	1.31	2.50	2.96	3.20	19.61	1.98	39.3	25.2	325	
- 6.30	549	22.03	77	3.7	106	1.2	30	105	10.5	1.93	11.10	.60	3.28	.34	1.49	.86	2.40	2.59	16.40	1.55	40.6	25.4	259	
- 7.29	113	27.04	59		75	4.	25	135	3.2	.90	3.81	1.81	.42	.17	1.25	.73	2.58	6.00	12.82	1.80	31.4	15.4	240	
- 7.51	163	35.05	50		74	3.	25	120	4.9	1.75	5.95	.36	.22	.27	1.37	.12	2.73	3.93	9.81	3.58	28.3	18.2	240	
- 8.31	1,484	49.26	53	4.7	175	1.4	27	145	10.3	1.12	3.36	1.46	2.20	.40	.69	1.02	.76	1.59	7.68	.58	19.7	10.0	231	
- 10.84	336	31.96	62	3.1	86	3.	24	110	8.4	2.11	7.24	1.36	7.14	1.45	.61	2.86	1.44	3.28	10.26	2.58	38.2	20.4	279	
** - 5.34	529	31.34	61	3.1	106	2.6	24	129	7.0	1.41	5.93	1.40	1.42	.64	1.04	.94	2.04	3.16	12.23	1.65	30.5	20.6	265	
***.74	678	37.98	69	3.9	131	2.2	22	130	6.3	1.28	4.74	1.41	.69	.53	.92	.81	1.24	2.22	9.33	1.18	23.1	23.5	287	

* Average for twelve ranches with highest rates of return.

** Average for twelve ranches with lowest rates of return.

*** Average for all ranches included in the survey.

zation. One must know the conditions on the ranch, as well as have the figures, in order to give sound recommendations for better organization.

The correlation method used in determining the relative importance of certain factors on the rate of return, is shown in figure 2. There was a correlation of $+.545 \pm .070$ between the rate of return and the per cent of the total investment in cattle.

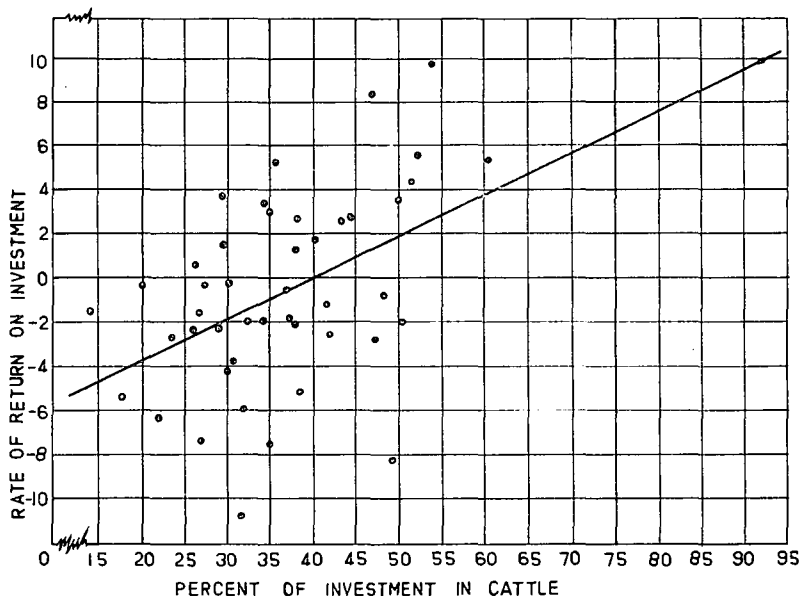


FIGURE 2. RELATION OF PER CENT INVESTMENT IN CATTLE TO RATE OF RETURN ON INVESTMENT

$$r_{xb} = +.545 \pm .070$$

$$\bar{X} = -7.499 + .192B$$

In presenting these charts to the stockmen we place these results on a chance basis. In order to have a fair chance for success the operator should have 40 per cent or more of his investment in cattle. Of those who had 40 per cent or more of their investment in cattle, 9 were making a favorable return while 8 were not. Of those who had less than 40 per cent of their investment in cattle, 6 were making a success and 22 were not. The chances were approximately 3 to 1 in favor of the operators who had 40 per cent or more of their investment in cattle.

Rate of return and cows handled per man showed a correlation of $+.430 \pm .081$. The chances of the men who were handling more than 132 head of cattle per man were 2 to 1 that they would succeed, whereas the chances for the men who were handling less than 132 head of cattle were 3 to 1 that they would not succeed.

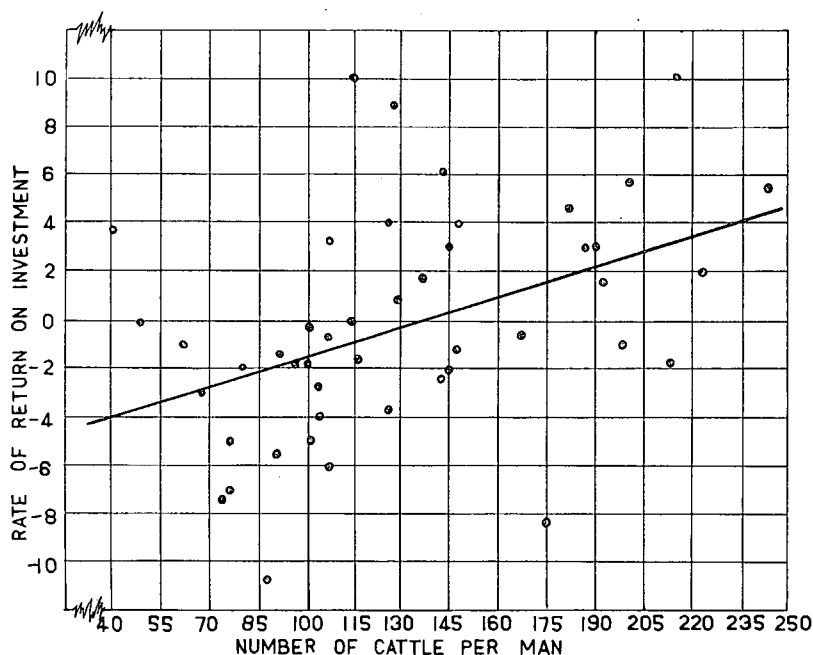


FIGURE 3. RELATION OF THE NUMBER OF CATTLE PER MAN TO RATE OF RETURN ON INVESTMENT

$$r_{xc} = +.430 \pm .081$$

$$\bar{X} = -5.483 + .402E$$

The calf crop was another important factor influencing returns. The correlation between rate of return and calf crop was $+.335$. An 80 per cent calf crop seemed to be a fair goal toward which to strive. A curvilinear correlation fits the chart somewhat better, and shows the point beyond which it is not advisable for the average rancher to attempt to increase his calf crop.

The rate of return and number of cattle per ranch showed a noticeable correlation; 600 to 700 head per ranch seems to be a

Table 5. Coefficients of Gross Correlation Between Various Factors Influencing the Rate of Return on Wyoming Mountain Valley Ranches

[illegible]

Table 6. Coefficients of Net Correlation Between Various Factors Influencing the Rate of Return on Wyoming Mountain Valley Ranches

[illegible]

favorable sized unit. This permits of keeping two men the year around, and extra labor at haying, and during other rush periods. In our coefficient of net correlation we find that the number of cattle is not an important factor, due to the removal of the effect of the number of cows handled per man.

Total expenses per cattle unit and rate of return showed a correlation of $+ .520 \pm .071$. The lower the expense the better the rate of return. The receipts per cattle unit were not as important in influencing profits as the expenses per cattle unit. The calf

Table 7. Annual Carrying Costs on Wyoming Mountain Valley Ranches

Items	Cows	Calves	Steers			Heifers	
			Yearlings	Two-year-olds	Three-year-olds	Yearlings	Two-year-olds
Feed, grain.....	\$0.32	\$0.46					
Feed, hay.....	8.76	12.50	\$5.38	\$7.45	\$10.61	\$5.45	\$6.89
Grazing.....	4.60	6.57	2.41	3.20	4.55	2.28	2.88
Labor, man.....	4.64	6.63	2.74	3.78	4.32	2.46	3.88
Labor, horse.....	.60	.86	.36	.50	.71	.32	.51
Equipment.....	.68	.97	.41	.57	.81	.37	.58
General expenses..	1.31	1.87	.75	1.14	1.29	.74	1.05
Interest on investment.....	3.34	4.77	2.55	3.37	4.41	1.89	2.71
Death loss.....	.97	1.30	.90	.66	.60	.89	1.08
Depreciation.....	1.55	2.22					
Bull service.....	1.86	2.66					1.89
Total.....	\$28.63	\$40.90	\$15.50	\$20.67	\$27.30	\$14.40	\$ 21.47

crop is one of the most important factors in increasing the receipts per cattle unit.

The coefficients of gross correlation are given in table 5 and show the correlation between the different variables. Death loss showed almost no correlation during this particular year. During severe winters there is a noticeable correlation.

In order to determine the degree of association that exists between two variables when we eliminate the effects of their common association with the other variables, we have worked out the coefficients of net correlation which are given in table 6. It is interesting to note that there is practically no net correlation be-

tween certain variables that may show a fairly good gross correlation. Rate of return and number of cattle units is a good example of the effect of their common association with other variables. When the influence of the cattle handled per man is taken from the size, as measured by the number of cattle, there is practically no correlation between size and rate of return. The ranches running 600 or more cattle are able to make better use of their labor and thereby increase the rate of return. Size itself is of little value except as it influences the ranch organization.

The items of cost in carrying the different classes of animals for one year, are shown in table 7. The annual gains and cost

Table 8. Total Carrying Costs and Gains on Wyoming Mountain Valley Ranches

	Steers				Heifers		
	Calves	Yearlings	Two-year-olds	Three-year-olds	Calves	Yearlings	Two-year-olds
Weight.....	400	565	892	1,150	384	630	847
Total cost.....	\$46.90	\$62.39	\$83.05	\$110.35	\$34.90	\$49.31	\$70.78
Cost per hundred-weight.....	12.73	9.66	9.33	9.60	9.09	7.83	8.36
Annual gain.....	400	256	236	258	384	239	217
Annual cost.....	46.90	15.49	20.66	27.30	34.90	14.41	21.47
Cost per hundred-weight gain....	12.73	6.05	8.76	10.54	9.09	5.86	9.90

per hundredweight gain are given in table 8. The cost per breeding cow was \$28.63 and the cost per calf was \$40.90. The high cost per calf was due to the low calf crop of 70 per cent. Yearling steers cost \$15.50 and yearling heifers cost \$14.40. The interest charge is greater and the feed bill is a few cents more on the steers than on the heifers.

The two-year-old steers cost \$20.67 and the two-year-old heifers \$21.47. The death loss is greater on the heifers and they also have a bull charge. The three-year-old steers cost \$27.30. This last group usually receives a little extra feed and care, and many of them go direct to the packing plants.

The total carrying cost for the different classes of animals and the annual gains and weight of the animals are shown in table 8.

The steer calves are given a value of \$12 more than the heifer calves. If this differential is not made on the calves, the she-stuff will show a loss, and the steers a gain, later on. The feedlot buyer makes this distinction when he is buying calves.

The steer calves cost \$12.73 per hundredweight. The gains can be put on the yearling steers at a cost of \$6.05 per hundred and on the two-year-olds at \$8.76 per hundredweight. The cost of the gains put on the steers the third year is \$10.54 per hundredweight. The yearlings make the cheapest gains. This has led some people to recommend selling calves and yearlings from our western ranches, which is, under average conditions, a poor recommendation.

The cost per hundredweight of the animal up to a certain age, and the selling price of the different classes of animals should be the correct method of arriving at the proper age to sell. The lowest cost of production per pound, total weight, is on the two-year-old steers and the yearling heifers. If prices are as good for those classes as for the younger and older animals, then that is the time to sell.

Our recommendation regarding the age at which to sell cattle on any ranch is to sell at the age at which the cost of production is most nearly reached by the selling price. This explains why the general farmer finds it more profitable to sell calves and why the rancher finds it more profitable to sell older animals. High calf crops and limited pasture favor calves, while low calf crops and abundant range favor older steers.

We have attempted to carry our analysis a little further, and show by the account method whether it is better to follow the practice of selling dry fat cows as well as culled cows each year, or whether the cows should all be kept for breeding purposes as long as they are serviceable. Based on conditions as they exist on Wyoming's mountain valley ranches, there is an advantage in selling dry cows.

The account method has been used to answer the question of breeding heifers to calf as two-year-olds. Recognizing the fact that calving at the age of two years will in many cases check their growth, I have given them the same value at the end of the year as they had in the beginning. I have also allowed for a 5.7 per cent death loss of heifers. Under the above conditions the calves

Table 9. Items of Cost, Necessary Feeding Margin, and Sliding Scale Spread for Lamb Feeding in Wyoming*

Price per hundredweight for feeder lambs	\$5.00	\$6.00	\$7.00	\$8.00	\$9.00	\$10.00	\$11.00	\$12.00	\$13.00	\$14.00	\$15.00
Value of 60-pound lambs.....	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20	7.80	8.40	9.00
Feed cost per lamb.....	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34
Interest on lamb.....	.08	.09	.11	.13	.14	.16	.18	.19	.21	.22	.24
Interest on feed.....	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
Death loss @ 3 per cent.....	.09	.11	.13	.14	.16	.18	.20	.22	.23	.25	.27
Man labor.....	.21	.21	.21	.21	.21	.21	.21	.21	.21	.21	.21
Horse labor or truck charge.....	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09
Building and equipment charge.....	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
General farm expenses and miscellaneous charges.....	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
Marketing.....	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83
Total charge per head.....	6.78	7.41	8.05	8.68	9.31	9.95	10.59	11.22	11.85	12.48	13.12
Less credit for manure.....	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33
Cost per head.....	6.45	7.08	7.72	8.35	8.98	9.62	10.26	10.89	11.52	12.15	12.79
Pounds gain per head.....	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Weight of lambs.....	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5
Cost per hundredweight.....	7.82	8.58	9.36	10.12	10.88	11.66	12.44	13.20	13.96	14.73	15.50
Necessary spread or margin per hundredweight.....	2.82	2.58	2.36	2.12	1.88	1.66	1.44	1.20	.96	.73	.50
Feed cost per 100 pounds gain.....	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Other costs per 100 pounds gain.....	2.71	2.84	3.02	3.16	3.29	3.47	3.64	3.78	3.91	4.04	4.22
Total cost per 100 pounds gain.....	13.11	13.24	13.42	13.56	13.69	13.87	14.04	14.17	14.31	14.44	14.62
Less credit for manure per 100 pounds gain...	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
Total cost less credit for manure per 100 pounds gain.....	11.64	11.77	11.95	12.09	12.22	12.40	12.57	12.71	12.84	12.97	13.15
Marketing costs per 100 pounds gain.....	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69
Total charges less credits per 100 pounds gain....	15.33	15.46	15.64	15.78	15.91	16.09	16.26	16.40	16.53	16.66	16.84
Cost per 100 pounds gain, when feeder supplies feed, labor, and equipment, and receives fertilizer.....	11.29	11.33	11.47	11.51	11.60	11.69	11.78	11.87	11.91	12.00	12.09
Sliding scale spread when starting with 5-cent lambs...	7.82	8.70	9.59	10.47	11.35	12.24	13.13	14.01	14.89	15.78	16.66

* Based on studies of feeding operations in Goshen County, Wyoming, and on experiment station results from sub-stations.

would cost \$6 less per head than the calves from the general cow herd. Just how much less the calf is worth from a two-year-old heifer than the calf from an older animal, depends on many factors. It looks at the present time as if it is largely a matter of the amount of available winter feed, and the ranch practices.

In table 9 I have attempted to work out a sliding scale for the lamb producers and lamb feeders. The items of cost, feeding practices, and gains are based on the economic studies of feeding operations in Goshen County, Wyoming, and on the experiment station results from our sub-stations.

The price of feeder lambs ranges from \$5 to \$15 per hundredweight. The costs of fattening the above priced lambs are given

Table 10. Ration on Which Feed Cost Used in Table 9 is Based

Feed	Daily amount (pounds)	Daily cost	Price per unit
Cottonseed cake.....	.20	\$0.480	\$48.00 per ton
Grain.....	.70	0.889	1.27 per hundredweight
Wet pulp.....	4.00	0.364	1.82 per ton
Alfalfa hay.....	1.50	0.862	11.50 per ton

in the table. A charge is made for all items of cost and a credit is given for the fertilizer. The lambs are on feed 90 days, and average one-fourth of a pound of gain per day.

The lambs are to be marketed at an average weight of 82.5 pounds, or before they become too heavy, for choice lambs. It is doubtful whether the lamb feeder is the one to feed the lambs to the market in an orderly manner. The packing plants may be a better place than the feedlots to hold fat lambs. The packing plants can at least check the production of more lamb on any one carcass. The lambs should perhaps be sent to the market as early as possible in order to hold down the present abundant supply of lamb meat.

The spread necessary for feeding the different priced feeder lambs ranges from \$2.82 per hundredweight on 5-cent lambs to 50 cents on 15-cent lambs, when marketing is included. The cost per hundred pounds gain, including marketing, is \$15.33 on the

5-cent lambs and \$16.84 on the 15-cent lambs. Marketing charges are figured at 83 cents per lamb.

The feed cost is \$2.34 per lamb for 90 days, and is based on the ration given in table 10.

The feed prices will vary in the different regions and for the different seasons. The above prices are those prevailing over a period of years in the better sheep feeding areas.