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North Park Cattle Production

An Economic Study

R. T. Burdick and Martin Reinholt

Hereford Cattle Grazing in Roosevelt National Forest, Just Below Cameron Pass and Immediately Adjacent to the Road Leading to Walden, Colo.

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North Park Cattle Production

An Economic Study*

R. T. Burdick and Martin Reinholt

IN 1929 COLORADO joined with Wyoming and the United States Department of Agriculture in a joint cooperative study of the cattle industry in the mountain areas of the two states. The North Park area of Colorado and the Saratoga Valley of Wyoming were selected as the location for the study. This report deals with the Colorado phase of the study.

These areas are in the upper drainage basin of the North Platte Valley. They are quite similar in their general range conditions. Each is surrounded by high national-forest grazing areas used for summer pasture. Each has a long winter season. The Saratoga Valley produces some alfalfa and grains, owing to its lower altitude.

Soil

No soil studies have been made in the region. Any reference to the soils will be from general observations. The bottom lands along the creeks show a great variation. All such bottoms seem to be underlaid by cobblestone, gravel, and sand. The soil depth varies from several feet to a few inches or none at all. The benchlands are generally more uniform in soil texture, being somewhat more porous and, therefore, retaining moisture better. As a rule the benchlands require less irrigation water to produce a hay crop than do the creek bottoms. The ability to produce hay depends more upon the available water supply than upon the soil in this valley.

Climate

The annual rainfall is less than 10 inches in the center of the North Park area, making irrigation necessary for successful hay or crop production. Near the mountains where there is more rain, or along sub-irrigated stream valleys, it is possible to grow crops without irrigation.

The normal season between killing frosts is less than 90 days throughout the entire mountain area, according to the weather bureau. Actually, there is a risk of frost during every month of the summer. This restricts crop production to the hardy, short-season crops.

The supply of irrigation water for the production of hay and also to irrigate certain pasture lands is obtained almost

*In cooperation with the Division of Farm Management and Costs, Bureau of Agricultural Economics, and Bureau of Animal Industry, U. S. Department of Agriculture.

exclusively by direct diversion from many streams. Practically no storage of irrigation water is practiced, as the cost of such facilities would be prohibitive when it is considered that the water is used for the production of such low-value crops as hay and pasture. Most of the ranches have their own private main ditches. There are a few "company" ditches where the shares are divided between two or three ranches, but these are exceptions. The building of storage reservoirs to catch flood waters would permit considerable extension of the irrigated area. Some expansion is possible through greater economy in the use of existing water rights.

The native vegetation is sagebrush, scantily interspersed with the wheatgrasses and needlegrass, on the benchlands and ridges where no irrigation water is applied. When water is applied or where the ground is naturally moist the native sedges and rushes, commonly called nutgrass *(Carex)* and wiregrass *(Juncus balticus)*, predominate. Most of the meadows, and particularly the upland benches, have been seeded to tame varieties of grass and forage plants, such as timothy, redtop, and alsike clover.

Early Development of Cattle Industry in North Park

Development of the range-cattle industry in North Park dates from 1879. In the summer of that year a herd of 3,500 big Texas steers was driven in from the Laramie Plains. About this time the plains around Laramie, Wyo., were beginning to become overcrowded, and cattlemen began seeking new ranges. A number of rather large operators were established by 1882, but up to this time only steers were run, and for the most part these were grazed only during the summer. The cattle that had been wintered in the park up to 1884 were grazed through without any hay. The winter of 1883-84 was one of exceptionally heavy snowfall, and thousands of cattle perished. The next summer marks the beginning of the practice of providing hay for wintering range cattle. At first only ¼ ton of hay per head was considered ample. Hay had been put up prior to this time, of course, but only for milk cows and saddle and work horses.

Land Ownership

Jackson County illustrates the problems of mixed ownership of land. There are 1,044,480 acres in the entire county. The 1930 census reports 321,277 acres in farms. The remainder of the county is in national forest, public domain, state lands, and a small area of unpatented land. Only 30.8 percent of the land area of Jackson County was in private hands in 1930. The men who operate the 321,277 acres of land in farms are directly affected by the method of control of the remaining area. Ranch

management in the North Park area is influenced by national-forest grazing policies, changes in the public domain and unclassified areas, state leasing policies, and finally, public-domain policies.

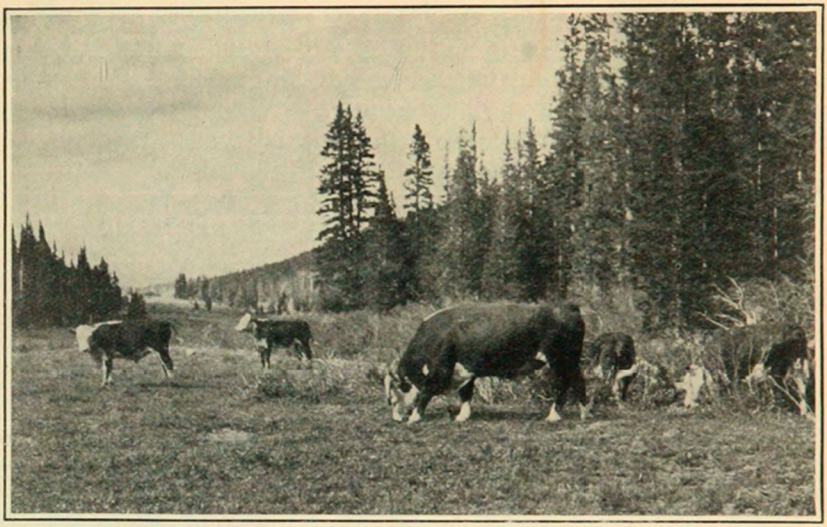

Figure 1.—Hereford cattle pasturing on outskirts of timbered area near Cameron Pass, on Poudre Canyon Highway.

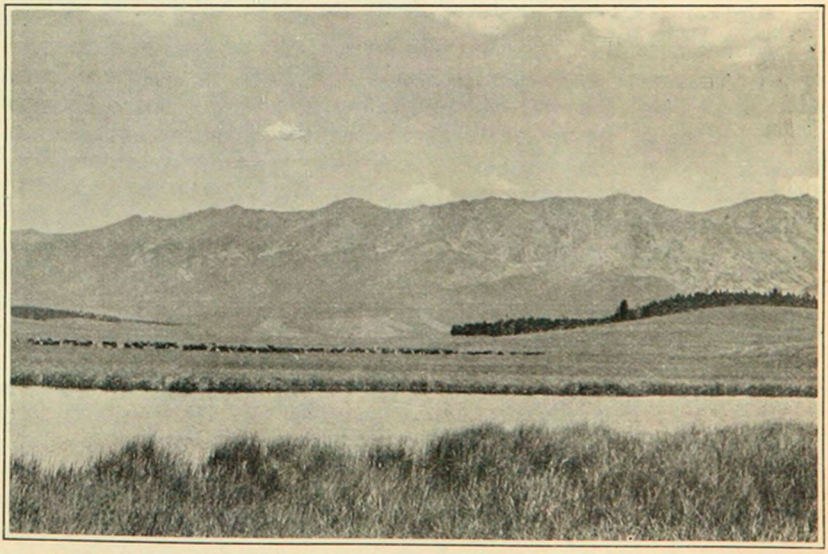

Figure 2.—Typical hay land, with small reservoir in foreground. A herd of cattle may be seen in the background, also mountain range, North Park area.

Nature and Scope of Study

THE MOUNTAIN-PARK areas of the Rocky Mountain region are important sources of cattle production. Conditions within these parks vary somewhat because of their north and south locations, but the situation disclosed in this study obtains generally from approximately the central part of Colorado north and west in the mountain parks of the state. Similar winter feeding conditions obtain in northwestern Wyoming. In the south-central part of Colorado the winter season is more open, and considerable winter grazing is practiced, as is the case in the Red Desert and the Laramie Plains to the north.*

In general, then, the conditions in the areas included in this study are those of the mountain parks which have considerable snowfall and a long winter feeding season. From a Colorado point of view, one important advantage in the selection of North Park as a location for the study was the opportunity which it offered to compare results for the years 1929 to 1931 with the study made in 1922 to 1925. In the earlier surveys 12 ranches were studied in North Park.

So far as possible, the ranches from the 1922-25 analysis were included in this study. Some ranches had changed ownership, so that 8 of the original 12 were finally secured. Twelve other ranches were added in 1929 to make a total of 20 ranches, of which 18 furnished complete records.

Methods of Securing Data

The cattlemen were supplied with record books. Personal visits were made each month to assist in keeping the records up to date and to check on the month's transactions. All purchase and sale records were secured from commission-house statements. During the haying season labor records were secured showing the work done by each man in haying. While it was necessary to obtain some estimates from ranch operators, the information secured is believed to be accurate and to give a reliable picture of conditions in this area during the 3 years.

Census Data for North Park

The 1930 census was taken 1 year after this study began. Its results were available at the time the study ended. The type-of-farming analysis made by the 1930 census disclosed some interesting data which need to be studied in connection with these records in order to give a better picture of the cattle business. According to the census, there were 106 "stock ranches" in Jackson County. The stock ranches reporting cattle had 337

*See map, p. 48, "Land Classification of Western Colorado," U. S. Dept. of Int., 1933.

head per ranch. There were 513 head as a 3-year average per ranch on the 18 ranches in the study.*

Of all farms, according to the census, 52 percent were stock ranches, 29 percent were crop-specialty ranches selling native hay, 3 percent were dairy ranches, and the remainder were listed as resorts or unclassified.

Of all income received by farmers in Jackson County in 1930, according to the census, 73 percent came from livestock sales, 7.3 percent from livestock products, 16.2 percent from hay sales, and 3.4 percent from family living or board. This indicates the predominence of the livestock business in Jackson County. Few ranches produce hay exclusively for sale. Practically all have cattle or sheep as their major enterprise. Hay production is in excess of winter-feed requirements in normal years. There is an active demand for North Park hay in the adjacent areas. When hay production is below normal, little hay is sold outside the valley. It is a rare experience for an acute hay shortage to develop. One reason for this is the limitation upon cattle production due to grazing rather than to hay production.

The ranches included in this study were representative of the medium- to large-sized ranch with part of its area owned and part leased. Over half of the ranches in the county were in this class.

Comparisons With Other Ranch Studies

In the past 10 years the western ranch business has received considerable attention from an economic standpoint.

Colorado Experiment Station bulletin 327, covering the years 1922 to 1925, showed that the 22 plains ranches of Colorado included in the study had the following averages per ranch: 1,016 head of cattle, 6,279 acres of owned land, 19,071 acres total area, 187 acres hay land, $98,002 total investment, $33,200 total indebtedness, $10,942 total receipts, and $7,953 total expenses; the ranches earned 2.39 percent on their investment.

Colorado Experiment Station bulletin 342, covering the years 1922 to 1925, showed that the 32 mountain ranches of Colorado which were included in that study had the following averages per ranch: 800 head of cattle, 3,932 acres of owned land, 5,728 acres total area, 998 acres hay land, $104,567 total investment, $32,446 total indebtedness, $14,244 total receipts, and $10,781 total expenses; the ranches earned a return of 2.74 percent on their investment.

U. S. D. A. bulletin 45 reviews a study of 304 cattle ranches in the northern Great Plains area. Nebraska bulletin 231 dis-

*The most common number per ranch during the years 1929-31, however, was from 300 to 400 head; 32 percent of the records came within this range.

cusses cattle ranches in the Nebraska sandhill region. Texas bulletin 413 reports on cattle ranches on the Edwards Plateau. Wyoming bulletin 197 discusses cattle ranches in southwestern Wyoming. Utah, Arizona, New Mexico, North Dakota, and South Dakota have other studies of the cattle business. These reports indicate that a comparatively large investment is required in the cattle business.

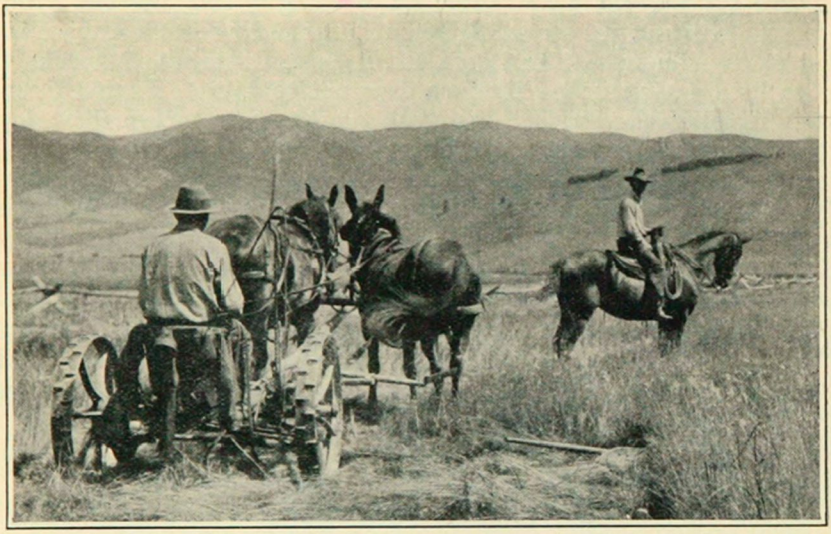

Figure 3.—Mower following horse and rider in breaking trail in a North Park hayfield.

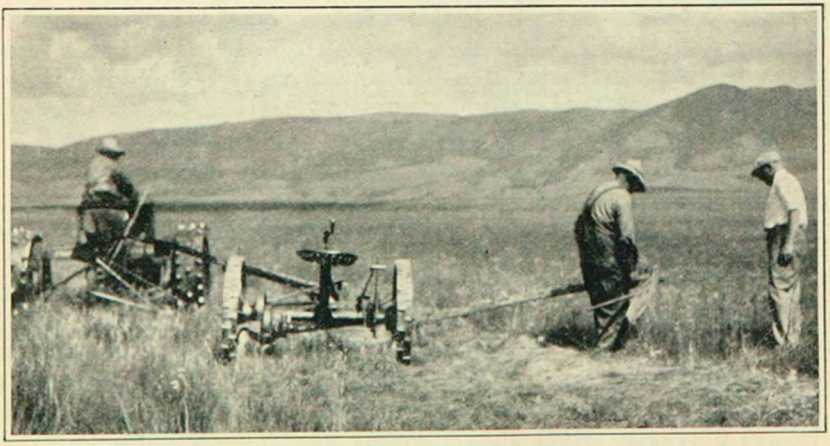

Figure 4.—Two mowers being operated by a tractor, North Park area; one mower is undergoing repairs.

Ranch Organization

Ownership and Size of Ranch

TABLE 1 SHOWS the various forms of control over land and the uses thereof. As previously stated, the tendency was to increase the deeded-land holdings, while at the same time there occurred a slight decrease in the leased land. The average for the 3-year period showed that 64 percent of all land under direct control was owned land. The other 36 percent was leased state and privately owned lands. These percentages do not include the national-forest grazing allotments, nor any public domain or free range. In 1929 there were only three of these ranches that did not lease any additional land. In 1930 there were four, and in 1931 six, that did not use any leased land. There were three ranches with no leased land during the study. The decrease in leased lands occurred in the lands leased from private individuals, while lands leased from the state remained practically unchanged.

Cost of Leased Land

Leased state land consists almost entirely of grazing land. Less than 1 percent of the total was classed as irrigated. The average rent paid for state-owned pasture land was 10.8 cents per acre. The land leased from private individuals consisted of 14 percent hay land, 7 percent irrigated pasture, and 79 percent dry pasture. The average rent per acre on privately owned land

TABLE 1.—*Distribution of North Park ranch land.*

Item	1929	1930	1931	3-year average weighted	Percentage of all land
Number of ranches	17	18	18	53	
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Total ranch area	4,044	3,966	3,998	4,002	100.00
Owned	2,414	2,608	2,670	2,567	64.2
Rented	1,630	1,358	1,328	1,435	35.8
Distribution of owned land:					
Hay land	906	1,008	1,008	976	38.0
Pasture, irrigated	376	396	396	389	15.2
Pasture, range	1,132	1,204	1,266	1,202	46.8
Distribution of rented land:					
Hay land	166	67	78	103	7.2
Pasture, irrigated	36	67	36	46	3.2
Pasture, range	1,428	1,224	1,214	1,286	89.6
Average value per acre, owned land:*					
Hay land	$19.28	$18.55	$18.55	$18.77	
Pasture land, irrigated	9.96	9.62	9.62	9.72	
Pasture land, range	3.66	3.55	3.43	3.54	

*The changes in values per acre from year to year reflect the purchase of new lands. Old lands were kept in the inventory without any change in value per acre during the 3 years.

was $1.33 for the hay land, 34.2 cents for the irrigated pasture, and 16.4 cents per acre for the dry pasture. While these show a somewhat higher cost for privately owned land than for state-owned, there can be no question as to the greater value of the former. The privately owned land has all been homesteaded or purchased, or in other words, "selected." It also has considerable improvements in the form of buildings, fences, and water rights and development. State land has none of these, and the renter must make or purchase all the improvements he will need.

The tax valuation on deeded grazing land was $1.62 in 1931. The mill levy was 15.52, which makes the tax 2.5 cents per acre. If the lease cost of private lands, minus the taxes, were capitalized at 6 percent, it would have a value of $2.32 per acre. The average valuation placed by the cooperating ranchmen on their deeded grazing land was $3.54, exclusive of improvements. Most ranchmen would rather own land than lease it, provided they could own it at a fair value.

The valuations shown in table 1 are exclusive of improvements but include the irrigation-water rights. The hay land was valued at an average price of $18.77 per acre. For individual ranches this varied from $10.35 to $29.80 per acre, with nine of the ranches between $15 and $25.

The irrigated pasture land of many grades or degrees of irrigation averaged $9.72 per acre. The variation here was from $3.05 to $16.40, with seven of the ranches between $7 and $14. The remainder of the land, classified mostly as sagebrush grazing land, with some quaking aspen and other timber in spots, was valued at $3.54. This varied from $1.34 an acre to $11.23, with 13 of the ranches between $2 and $5.

These variations in value per acre are not justified by any special soil quality in the land itself but are caused by other factors. Water rights and availability of irrigation water vary a great deal. So does nearness to railroad, and this factor has considerable weight as regards hay land because of the possibility of baling and shipping hay. Hay land differs a great deal in smoothness or workability, ease of applying water, drainage, and natural shelter for winter feeding. The grazing-land values are governed mostly by vegetative cover and stock water, and these do vary to a great extent. It is very difficult to draw the line between dry pasture and irrigated pasture. Sometimes the same field is one and sometimes the other. The fact that a piece of land is "under ditch," and so classed as irrigated, is no guarantee that it ever has much water applied.

The data relating to land purchases during this study give some clues as to market values of land. During 1929 five ranches purchased a total of 6,400 acres. The average purchase price was $14.30, with the value of the improvements placed at $4.30,

leaving the land at $10.00. The classification of this land was 49 percent hay meadow, 16 percent irrigated pasture, and 35 percent dry grazing land.

In 1930 four of these ranches purchased a total of 3,610 acres at $9.31 per acre but with improvements valued at only 31 cents per acre. The classification of this land was 37 percent hay land, 15 percent irrigated pasture, and 48 percent dry grazing land. In 1931 only two of the ranches acquired more land. A total of 1,120 acres was bought at an average cost of $1.53 per acre, and the improvements consisted of some fence valued at 32 cents per acre. This was all dry grazing land.

Ten of the eighteen ranches changed the amount of leased land from year to year. The other eight kept their leased areas constant or else leased no land. Eight of the ranches studied increased the area of land owned during the 3 years 1929 to 1931. Seven of these reduced the area rented, which indicates a decided tendency to substitute ownership for the uncertainties of renting.

Trend of Size of Ranch

The general trend in North Park is to increase the size of business, rent more land, buy if possible, and build up to a larger size of ranch and a more efficient enterprise. The eight ranches included in both the 1922-25 and 1929-31 studies reflect these tendencies. These eight ranches show increases in total area of 39.5 percent, or from 3,985 to 5,560 acres. In owned land the increase was 46 percent, or from 2,175 to 3,174 acres. In 1925 owners of these ranches owned an average of 2,175 acres per ranch and rented 1,705 acres. By the beginning of 1929 the same ranches averaged 2,551 acres of owned land and 2,575 acres leased. This is an increase of 17.3 percent in land owned and 51 percent in the leased area during the intervening 3 years. At the end of 1931 these eight ranches averaged 3,331 acres of owned land and were leasing 2,363 acres. This is an increase of 30.6 percent in owned land and a decrease of 9 percent in the leased land during the 3 years covered by this study. Only two of these eight ranches remained the same size in owned land throughout the two studies and the intervening time.

Other Comparisons Between Studies

Some other comparisons of these eight ranches in the two separate studies may be significant. The average indebtedness had been reduced 20.8 percent, or from $35,033 in 1922-25 to $27,762 per ranch in 1929-31. This indicates that the increase in owned land had been paid for out of current earnings, besides reducing the original indebtedness. The current cash operating expenses had increased 25 percent, or from $5,856 to

$7,320 per ranch. Purchases of livestock had increased from $718 to $2,313 per year, new buildings and improvements from $58 to $441, and new machinery and automobiles from $206 to $572 per ranch. Interest payments were reduced from $2,616 to $1,896 per ranch. The average cash income had increased from $11,995 to $13,681 per ranch, or 14 percent. The years 1922 to 1925, which were included in the first study, were considered years of hard times for the cattlemen. In 1929, when the second study began, the cattle business was fairly prosperous. But, in view of the previously stated increased ranch expenditures, the average net cash income available for personal living or for the payment of debts had decreased from $2,540 during 1922-25 to $1,139 for the years 1929-31, or 55.2 percent.

Cattle on Hand

It will be noted from table 2 that, with the exception of ranch 267, all ranches were building up their herds. The net gain on all ranches amounted to about 33 percent during the 3-year period. If we leave out ranch 281, which was not in the study at the start, and ranch 267, which sold its cattle in 1931, the increase in cattle numbers on the remaining 16 ranches is over 40 percent.

The 17 ranches with complete records for 1929 averaged 464 head of cattle per ranch at the beginning of 1929. Of this number, 247 were cows, the remainder consisting of 46 coming 2-year-old heifers, 69 coming yearling heifers, 65 coming yearling steers, 18 coming 2-year-old steers, 6 coming 3-year-old steers, and 13 bulls, 11 of which were in the breeding herd.

TABLE 2.—*Number of cattle on hand and wintered.*

Ranch number	Cattle on hand beginning of year			End of 1931	Averages of 1929, 1930, and 1931
	1929	1930	1931		
225	1757	2174	2415	2762	2115
214	948	941	1047	1098	979
201	703	804	898	1076	802
266	654	566	820	899	680
202	512	501	462	595	492
273	421	437	439	571	432
274	411	422	441	513	431
281	.....	352	410	431	381
277	309	355	389	436	351
267	309	312	381	28	334
276	253	335	379	414	322
280	292	290	344	373	309
271	274	301	309	329	295
275	222	287	351	389	287
279	208	304	334	380	282
263	259	302	272	318	278
278	197	237	301	277	245
265	153	185	193	232	177
Average	464	507	566	618	513

At the end of 1931 the 18 ranches with complete records for 1931 had 618 head of cattle per ranch, of which 298 were cows, 83 long-yearling heifers, 114 heifer calves, 87 steer calves, 17 long-yearling steers, 4 long 2-year-old steers, and 15 bulls.

The size of the herd at the beginning of 1929 varied from 153 to 1,757 head. It varied from 28 to 2,762 head at the end of 1931. The small herd of 28 on one ranch was due to the fact that this ranchman in 1929 disposed of his entire breeding herd. In the following years he purchased young stock in the fall of the year and sold them out at the end of the following grazing season.

Cattle Investment

At the beginning of 1929 there was an average investment in cattle of $32,636. This varied from $9,835 to $133,945. Ten out of the 17 ranches each had a cattle investment of between $20,000 and $50,000. Valuations per head at that time averaged about $79 for breeding cows coming 3 years old and over, $60 for coming 2-year-old heifers, $43 for coming yearling heifers, $47 for coming yearling steers, $70 for coming 2-year-old steers, $107 for coming 3-year-old steers, $184 for breeding bulls, and $115 for young bulls not in service.

By the end of 1931 or opening inventory for 1932 the average investment in range cattle was $22,558. It varied from $8,120 to $94,860. Five of the ranches had investments of between $20,000 and $45,000 each, and only one was over the last-named amount. At this time the average valuation for cows was approximately $42, for coming 2-year-old heifers $32, for coming yearling heifers $21, for coming yearling steers $26, for coming 2-year-old steers $39, for coming 3-year-old steers $55, for breeding bulls $134, and for young bulls $81.

The changes in number of cattle may be shown by table 3, which gives the total number of cattle on all ranches studied.

TABLE 3.—*Changes in cattle during 1929-31.*

Item	1929	1930	1931
	Number	*Number*	*Number*
Cattle first of year	7,882	9,125*	10,185
Purchased or otherwise acquired	345	610	57
Calves raised	3,222	3,448	4,176
Total	11,449	13,183	14,418
Sold	2,409	2,630	2,955
Died or lost	231	338	301
Slaughtered	36	30	41
Sub-total	2,676	2,998	3,297
Cattle end of year	8,773	10,185	11,121

*One new ranch added at the beginning of 1930.

There were three factors that helped to explain an increase of cattle numbers during the 1929-31 study as compared with a decrease during the 1922-25 study. First, the calf crop was slightly larger in the 1929-31 period (68 compared with 66 percent). Second, the average age of animals sold was less. Forty-four and four-tenths percent of all cattle sold in 1929-31 were yearlings, and 12.6 percent were calves, or 57 percent for both, while in 1922-25, 20.2 percent of all cattle sold were yearlings, and 14.6 percent were calves, or 34.8 percent for both. When younger cattle are sold, the ratio of sales to inventory can be higher than when older cattle are kept for sale. Third, the actual ratio of sales to first inventory was slightly lower in 1929-31 than in 1922-25, being 29 percent compared with 31 percent. When this is combined with a better calf crop and the sale of younger cattle, it explains the steady increase in size of herd during the 3 years.

Ranch Improvements and Equipment

The average investment in ranch improvements at the first of 1929 was estimated to be $10,198. After making deductions for depreciation and adding new improvements at cost, the average investment in improvements at the end of 1931 was $10,348. The investment in farm machinery and equipment was $2,151 per ranch at the beginning of 1929 and $2,033 at the end of 1931.

On the whole, the improvements on these ranches were quite moderate. Some, however, did display a number of items that might be considered useless and superfluous. This did not come about so much from poor judgment on the part of the operators as from the way the various parts of the ranches were acquired and built up. Each of the ranches in this study has been built up from a nucleus of one homestead or 160 acres. Most of the additions have been in the form of other homesteads proved up by other people. Many of these parcels were in themselves small ranches at the time of purchase, with full sets of improvements. This is the reason some of the ranches, especially the larger ones, have buildings scattered over them without any reference to convenience or actual needs in operating the present holdings as a unit.

Mechanical Equipment

Aside from automobiles and trucks, the machinery and equipment is mostly limited to haying tools and items used in the growing, harvesting, and feeding of the hay crop.

The hay-harvesting equipment, of which mowing machines is the main item, conforms closely to the number of acres in

hay land. There was an average of 5¾ mowers per ranch, with a range from 2 to 14. Figuring these machines against the area covered, we have about 175 acres per machine. The sulky rakes are next in importance. The average number per ranch was 5¼, or about 190 acres per machine. Replacement was less than on mowing machines, averaging a little over 6 percent for the 3 years compared with a 9-percent replacement for mowers. The sweep rakes, slide stackers, and plungers are all home-made at comparatively low cost. There was an average of 3⅓ sweep rakes per ranch, ranging from 2 to 12, or 280 acres of hay land per unit. Stackers averaged slightly less than 2 per ranch. This varied from 1 to 4 and figures out to be 535 acres of hay land per unit.

Wagons, sleds, and hay racks, each of which were found in almost equal numbers on each ranch, averaged 3 per ranch and ranged from one of each to 7 or 8. Harness averaged 12 sets per ranch, or enough for 24 head of horses. This is quite an item when it is considered that a good set costs from $65 to $75. Most of this equipment is used only for about 1 month each year but must be kept in good repair on account of using so many half-wild horses during hay harvest.

The automobile equipment underwent considerable change during the study. At the beginning of 1929 there was one automobile per ranch, with 1 ranch reporting 2 and another none at all. In addition, there were 6 ranches that had trucks, mostly of the lighter type. By the end of 1931 there was a total of 22 automobiles among the 18 ranches. During the 3-year study these ranches purchased a total of 14 new automobiles and 4 new trucks. This new equipment was purchased by 12 of the 18 ranches, the other 6 not getting anything new. One ranch bought 3 cars during this time, two others bought 2 cars each, one bought 2 trucks, and another 1 car and 1 truck. The cash outlay for these new cars and trucks, after deducting trade-in allowance, amounted to more than 70 percent of the total outlay for new equipment of all kinds.

The 3-year average investment in machinery and equipment, including automobiles and trucks, averaged $2,279 per ranch. It varied from $781 to $4,962, with two ranches under $1,000 and two over $4,000. The automobiles and trucks represented about 35 percent of this investment but more than 52 percent of the depreciation charge against equipment.

Work Stock

Work stock on these 18 ranches consisted almost entirely of horses, range bred and raised. The number varied but little during the study. It averaged 53 head, divided as follows: 30 head of work horses per ranch, 7 head of saddle horses, and 16

other or unbroken horses. This last-mentioned class includes, besides colts of various ages, a few range stallions and, in one case, ranch 202, a few thoroughbreds.

As in all other items of ranch organization, there was a great variation in number of horses. The number varied from 15 head on two of the smaller ranches to 125 head on two of the larger ranches, one of which had a surplus of at least 75 over and above ranch needs. While ranch work horses are used for other work besides putting up hay, and saddle horses for other work than herding cattle, it is noted that these ranches averaged 1 work horse for every 36 acres of hay land and 1 saddle horse for every 71 head of range cattle. In the case of the work horses, this varied from 14 acres of hay land per head to 57 acres on the largest ranch. The number of cattle per saddle horse varied from 35 head up to 150.

The largest number of horses, relative to both land and cattle, was on ranch 271, where the practice was followed of selling a few horses every year. There was noted a tendency for the smaller ranches to be less efficient in the use of horses than the larger ranches; i.e., it took more horses to do the work. This is true of both work and saddle horses, but it is more pronounced in regard to saddle horses.

The average inventory valuation on work horses was $41, on saddle horses $43, and on unbroken horses $18. Most ranchmen plan to raise just enough colts to replace the death loss. Some, however, raised a surplus, and where the stock was of fair size this proved to be a profitable sideline. Most work horses were rather undersized and for that reason did not fill the demand of the markets for draft or farm horses.

Ranch Labor

The typical ranchman included in this study kept one or two men the year around and hired the equivalent of about one extra year of day labor, most of which was for haying. In order to show changes, table 4 has been prepared for the 17 ranches

TABLE 4.—*Months of labor per year, 17 ranches.**

Item	1929	1930	1931	3-year average
Hired labor, months	32.9	32.0	33.2	32.7
Operator and unpaid family labor, months	12.0	11.8	12.3	12.0
Total	44.9	43.8	45.5	44.7
		Percent of total		
Hired labor	73.4	73.1	73.0	73.2
Operator and family labor	26.6	26.9	27.0	26.8
	100.0	100.0	100.0	100.0

*Ranch 281 not included because of having only 2 years' record.

with 3 years' continuous records. The months of hired labor changed very little. They were reduced a little in 1930 and were higher in 1931 than in 1929. The same thing was true of family labor.

Seven of these ranchmen reported no time away from the ranch business during the 3 years. At the other extreme, several operators did no ranch work during the winter season. Some lived away from the ranches; others merely supervised the ranches and hired all work done. Sometimes the operator of a small ranch will hire a man more for company than for work, because he dislikes to stay alone all winter.

TABLE 5.—*Wages of hired help, excluding cost of board.*

	1929	1930	1931	Decrease, 1929 to 1931
Average net wages:				
Per month	$48.00	$45.00	$41.00	14.6%
Per day	2.70	2.27	1.73	35.9%

Table 5 gives the average wages paid per month and per day for all ranches each year. Wages paid day labor dropped 35.9 percent from 1929 to 1931, while monthly wages dropped only 14.6 percent.

The more rapid drop in day rates reflects the tendency to hold monthly wages fairly constant during one season, or during the time the same worker was employed. Day wages reflect conditions more promptly. Each new job is paid for at the prevailing day rates.

The amount of hay purchased has considerable influence on the amount of labor used. When hay is purchased it is nearly always with the understanding that the seller is to feed it out. This relieves the purchaser of a great deal of winter feeding labor. Some of the labor costs on such ranches were concealed in the cost of purchased hay. No separation was made, but the "labor" charge in the hay would approximate 75 cents per ton fed under such conditions.

Labor on One Ranch

The various duties of the laborer, or the sequence of operations on a ranch, are perhaps best illustrated by following the labor operations on a typical ranch for an entire year. Starting with the beginning of the winter feeding season in the fall of 1930, ranch 266 had two hired men besides the operator. In addition there was an elderly man who repaired harness and other equipment "for his keep," but who did nothing else.

Feeding started November 17, and there were 970 cattle to feed. This kept the two men busy all the time and the oper-

ator part of the time, besides doing the chores. About January 1 a shipment of 150 head of cattle was made, and this took the operator away for about 10 days. The remainder of the winter to May 1 kept the same three men busy without a break. This indicates 273 head of cattle per man. In addition to the feeding, the men did a number of odd jobs, such as putting up ice, hauling and cutting firewood, and doing the chores. Also considerable time was spent in looking after sick animals. February and March are usually the worst time for abortion. In April the new calves began coming, and the operator had to spend a good deal of time looking after these. The feeding eased up considerably with the coming of warmer weather, and it was possible to spend some time working on ditches and getting ready for the irrigation water during the latter part of April.

On May 1 one of the men employed during the winter left, but no new help was put on until May 17, when an irrigator was employed. The water had been turned on May 5, but no special attention had been necessary. On May 10 the feeding of the main bunch of cattle was discontinued altogether, and only the 270 head of coming yearlings were continued on hay up to May 28. This required only part time of one man. A few days were spent in May piling stack pens and clearing meadows. Ordinarily the meadows, and especially the feed grounds, are dragged during May, but this year it was not done, because the ranch was somewhat shorthanded. During June the main concern was the irrigating which kept the two hired men, as well as the operator, busy most of the time.

The cattle had been on the public domain and in private pasture since winter feeding stopped, and during the latter part of June they were all gathered, the calves branded, and the herd shaped up for turning on the forest reserve. This was done on July 1, and considerable riding was required for a few days, getting cattle located and distributing salt.

All irrigation water was turned off on July 17, and the irrigator was used on other ranch work. During July some work off the ranch—county road work—was done; on July 28 the haying was started, and here 18 men were used besides the owner. All extra hired men worked by the day during haying and were used on equipment normally as follows: 5 mowers, 6 sulky rakes, 3 sweep rakes, 1 plunger driver, and 2 stackers; one man ground sickles and repaired machinery. The owner put in about half time in actual field work, filling in where most needed; the remainder of his time was given to supervision. The haying lasted until September 2, or 37 days. Only 27 actual working days had been put in by the crew in the hayfield; the rest of the time was rainy or bad weather. Some of the men, and particularly the regular ranch hands, were used

during these rainy days to fence haystacks or to ride on the forest looking after the cattle.

During September two regular or month men were again employed for the remainder of the year. In addition, three more men were hired in September for a total of 68 days, mostly for fence repairing and ditch work. Toward the middle of September the cattle began to come down off the forest, and one man full time and two men part time were required to gather these cattle. When all the cattle were home the second branding and vaccination took place, and this required about a day for six or seven men. During October most of the time was spent on ditching and fencing. On October 20 hay feeding started, with 138 steers fed every day, taking half of one man's time.

November 17 was again the date for starting feeding the main herd of cattle and was the end of the ranch year. This time there were again two hired men on the place besides the operator, but the total number of cattle to feed was now 1,171, or 392 per man. These cattle were not all wintered, however, as the 138 steers that were started on hay on October 20 were shipped on November 22, and another shipment of 135 head was made on January 3. This left about 900 to winter, or 300 per man.

Financial Organization and Income

Table 6 summarizes the investment at the beginning of 1929 and at the end of 1931 for the 17 ranches with continuous

TABLE 6.—*Changes in investment during 1929-31; average per ranch.**

Item	Average investment Jan. 1, 1929	Average investment Dec. 31, 1931
Total investment	$77,988	$70,512
Land	25,338	27,836
Improvements	10,198	10,556
Total real estate	35,536	38,392
Machinery and equipment	2,151	2,085
Range cattle	32,636	23,010
Horses	1,794	1,804
Other livestock	100	106
Total livestock	34,530	24,920
Feed and supplies	5,771	5,115
Indebtedness total	18,818	21,992
Owner's equity	59,170	48,520
Indebtedness		
Real estate mortgages	12,916	12,191
Chattel mortgages	5,520	9,169
Personal notes and accounts	382	632
Real estate debt as a percentage of real estate value	36.3	31.8
Chattel mortgages as a percentage of cattle value	16.9	36.8

*Seventeen ranches only; ranch 281 not included because of having only 2 years' records.

records. Of the $77,988 average investment per ranch at the beginning of 1929, 45.6 percent was in real estate, 44.3 percent in livestock, 7.4 percent in feed, and 2.7 percent in machinery and equipment. The owner's equity in 1929 amounted to 75.9 percent of the total investment. At the end of 1931 the average ranch had a 9.6-percent reduction in total investment, attributed primarily to the fact that the livestock investment had fallen 27.8 percent. The real-estate investment had increased 8 percent because of land purchases and the holding constant of real-estate valuations. Indebtedness had increased 16.9 percent, so that the owner's equity had decreased 18 percent. The equity at the end of 1931 amounted to only 68.8 percent of the total valuation and would have been less if current valuations had been placed on real estate.

The valuations used at the beginning of the study were reasonably correct, as shown by the fact that the return upon total investment was 6.93 percent for 1929.* The valuations for feed and livestock were based upon current ranch prices for these items. Land values were left constant for the 3 years. Improvements and machinery were reduced by yearly depreciation charges. Real-estate purchases and new improvements or equipment were entered at cost.

TABLE 7.—*Distribution of indebtedness on 17 ranches; average per ranch.*

Item	Jan. 1, 1929		Dec. 31, 1931		Closing inventory as percent of opening inventory
	Amount	Percent of total	Amount	Percent of total	
Real estate mortgages	$12,915.67	68.6	$12,191.17	55.4	94.4
Chattel mortgages	5,519.53	29.3	9,169.29	41.7	166.1
Personal notes	382.35	2.1	632.18	2.9	165.3
Total	$18,817.55	100.0	$21,992.64	100.0	116.9

Table 7 indicates considerable adjustment during the 3 years. Real estate mortgages had been slightly reduced, but loans on cattle or personal security had been increased to the extent that total indebtedness increased during the 3 years.

While the total indebtedness approached $22,000 per ranch at the end of 1931, the estimated market value of all cattle per ranch was $23,010 (table 6). The chattel and personal notes at the end of the study were $9,801.47, or only 42.6 percent of the market value of cattle as of that date. The real estate mortgage of $12,191.17 amounted to 31.8 percent of the valuation on real estate claimed at the beginning of 1929, adjusted for purchases and depreciation.

Under the conditions that prevailed in 1931, the income from these ranches would not pay current expenses, depreciation, and

*See line 28, table 10.

wages to the operator. If decreased inventory values of livestock and feed were completely ignored, the average income would not show any percent return upon the investment. In other words, from the viewpoint of the earnings of the single year 1931, these ranches had no value.

This clearly indicates the problems of ranch valuation. When it is said that the valuations in 1929 were reasonably correct as measured by the returns for 1929, it is as much in error as to say that the ranches had no value as viewed from the earnings of 1931.

Ranch Valuation Based Upon Earnings

Probably the most serious mistake made by ranchmen in connection with their plans for the future is that of taking an individual year as a guide. Shrewd business men consider values as related to long-time averages. This study gives incomes for 3 years. What would a 10-year study show? The study of mountain ranches for the years 1922 to 1925 gives 4 years' records. Eight North Park ranches in the period 1922-25 made earnings on their investment of $3,318 per ranch per year. In 1925 the average earnings on these ranches amounted to $4,637.

In the 1929-31 study the same eight ranches incurred an average loss of $3,091, but in 1929 they earned $7,452. What of the years 1926-28, inclusive? The trend of cattle prices during this period was one of sustained increase, reaching its peak in 1928, and it seems fair to assume that incomes would follow a similar course. If a point midway between the 1925 and the 1929 earnings were used, it would give an estimate of $6,044 per ranch per year for the years 1926-28. By a similar calculation the average investment during 1926-28 was estimated to be $93,682. For the 10 years the following may be assumed for these eight ranches:

TABLE 8.—*Summary of 10 years' earnings on investment, eight ranches.**

Year	Number of years	Earnings per year	Average investment per year
1922-25	4	$3,318	$79,601
1926-28	3	6,044	93,682
1929-31	3	−3,091	107,763
	10	$2,213	$92,274

*Data for years 1926 to 1928 estimated as mid-point of 1925 and 1929 actual data.

This means an average earning per ranch of $2,213, after all expenses are paid and allowance made for depreciation and the value of the operator's labor. This $2,213 is 2.4 percent on $92,274, which is the average investment on the eight ranches over the 10-year period.

This calculation leads to the following conclusions: These eight ranchmen valued their real estate, livestock, machinery, and supplies at approximately $92,000 per ranch. This investment returned them about $2,200 per year over a 10-year period, or less than 2.5 percent.

This raises the question, Why are valuations kept at such a high figure? To answer this question one must consider the whole problem of land values and the general attitude toward ownership. The social desirability of land ownership, the influence of national-forest and public-domain grazing privileges, together with a generation of experience prior to the World War during which time land values rose rather steadily, the high incomes of the war period, and the general optimism as to the possibility for improving the income from land, all conspire to cause Colorado ranchmen to overvalue land relative to its earning power.

Since this is such a deep-rooted tendency, its economic consequences should be given proper consideration. When ranch investment over a period of years earns less than one-half the interest rate which must be paid for use of borrowed capital, it would seem the part of wisdom to avoid heavy indebtedness on ranch or farm property. When prices are favorable, debts should be paid, and new investments in ranch property should be made on a cash basis. The operators of large ranches with heavy indebtedness will find that every dollar of income is needed to meet fixed charges over a period of years, leaving nothing to pay the operator, either for his own investment or for his time and assumption of risk.

Receipts, Expenses, and Cash Available for Family Living

Receipts

Table 9 gives the average receipts per ranch for each year. The cash sales of cattle dropped from $11,786 per ranch in

TABLE 9.—*North Park cattle ranch receipts; average per ranch, 1929 to 1931.*

	1929	1930	1931	Weighted average, 3 years
Sales				
Cattle	$11,786	$8,401	$5,965	$8,659
Cattle products	178	73	47	98
Other livestock	105	58	79	80
Other livestock products	43	25	17	28
Hay	939	242	95	416
Miscellaneous cash	178	80	75	110
Sub-total cash income	13,229	8,879	6,278	9,391
Increased inventory livestock	799	*	*	
Increased inventory feed	1,014	*	*	
Total ranch income	15,042	8,879	6,278	9,391

*There was a decrease for these items in 1930 and 1931.

1929 to $5,965 in 1931. This 49.4-percent drop in cash sales of cattle was accompanied by a 22.7-percent increase in the number of cattle sold, which indicates the terrific reduction in prices within 3 years. Hay sales dropped from $939 per ranch in 1929 to $95 in 1931. This was due to decreased hay production and increased numbers of cattle on hand. All cash sales dropped from $13,229 in 1929 to $6,278 in 1931, or more than half.

Expenses

Table 10 summarizes the important items of expense as a yearly average for all ranches. The average current expenses in 1929 (line 17) were $5,797. In 1930 savings in the expenses for labor, feeds, repairs, and land leases resulted in a reduction in the average current expense to $4,624. In 1931 there was a large increase in the feed bill which offset all other economies and resulted in an increase to $4,770 average expense per ranch.

TABLE 10.—*North Park cattle-ranch expenses; average per ranch, 1929-31.*

	Line	1929	1930	1931	Weighted average, 3 years
Labor:					
Month	1	$1,054	$1,127	$ 991	$1,057
Day	2	927	599	527	680
Board	3	979	659	454	692
Contract	4	22	53	146	75
Sub-total labor	5	2,982	2,438	2,118	2,504
Taxes	6	464	569	537	524
Land leases	7	365	251	338	317
Forest fees	8	137	150	163	150
Hay purchased	9	552	216	714	493
Other feeds	10	372	234	215	272
Salt	11	47	45	38	43
Vaccine and veterinary	12	38	38	34	37
Automobile and truck	13	261	232	209	234
Repairs to improvements	14	208	121	97	141
Repairs to machinery	15	139	124	148	137
Miscellaneous other expenses	16	232	206	159	198
Sub-total current expenses	17	5,797	4,624	4,770	5,050
Livestock purchased	18	2,055	2,022	405	1,483
Decreased inventory:					
Livestock*	19	.....	3,551	6,683	3,219
Feed*	20	.....	1,086	579	240
Depreciation, buildings	21	262	284	283	277
Depreciation, machinery	22	382	402	411	399
Unpaid family labor	23	94	89	79	87
Total ranch expenses	24	8,590	12,058	13,210	10,755
Net ranch income	25	6,452	−3,179	−6,932	−1,319
Value operator's labor	26	1,045	1,061	823	975
Return on investment	27	5,407	−4,240	−7,755	−2,339
Percent return on investment	28	6.93	−5.24	−10.14	−2.98
Adjusted net returns on investment†	29	6,455	1,837	−312	2,588
Adjusted percent return on investment†	30	8.28	2.27	−.41	3.30

*Average is adjusted for an increase for these items in 1929.
†With increased numbers of cattle at new inventory valuations and original first-of-the-year inventories held at constant values for each individual year.

Livestock purchases were comparatively heavy the first 2 years. They were reduced by 80 percent in value in 1931; 345 head were purchased in 1929, 610 in 1930, and 57 in 1931. Bulls comprised 65 percent of cattle purchased in 1931, while they were only 18 percent in 1929 and 13 percent in 1930.

Net Returns

The reduction in value per head of cattle resulted in large inventory losses on cattle in 1930 and 1931. As a result, the average ranch lost the equivalent of 5.24 percent on the investment in 1930 and made a further loss of 10.4 percent in 1931 (line 28, table 10). If inventory values of cattle on hand are held constant for each individual year, so that changes in the size of herd can show as increased or decreased investments, then the average net return on investment will be modified as shown in lines 29 and 30 of table 10. In 1929 this adjusted net return was 8.28 percent. In 1931 it had fallen to –.41 percent. The fall in cattle prices accounts for the reduced income. It vividly emphasizes the hazards of any business which depends upon one source of income.

Available Income for Family Living

The previous tables have analyzed the ranch business, covering changes in inventory and allowing for depreciation. During times of financial distress it is necessary to abandon many plans and to concentrate attention upon meeting current expenses and paying fixed charges. Table 11 analyzes the yearly cash situation. The cash income must cover current expense, the purchase of livestock, buying new machinery, making new improvements, and meeting interest on debts. After these annual charges are paid, the remainder is available for personal and family living and for payments on debts. Line 8 in table 11 shows that $3,310 was available for such purposes in 1929, but

TABLE 11.—*Capital expenditure and available cash for families living on North Park ranches; average per ranch, 1929-31.*

Item	Line	1929	1930	1931	Weighted 3-year average
Cash income from ranch operation	1	$13,229	$8,879	$6,278	$9,391
Cash expenditures:					
Current ranch expense	2	5,797	4,624	4,770	5,050
Livestock purchased	3	2,055	2,022	405	1,483
New buildings and improvements	4	339	525	100	321
New machinery	5	766	488	164	467
Interest paid	6	962	1,254	1,403	1,211
Total	7	9,919	8,913	6,842	8,532
Net income available for family living or to reduce debts	8	3,310	–34	–564	859

in the other 2 years nothing was available for such purposes. This explains why there was an increase in personal debts and chattel mortgages during the 3 years. The income in 1929 was sufficient to give $859 per year for the 3 years, but few ranchmen were foresighted enough to plan that far ahead. As a result, personal debts accumulated in 1930 and 1931.

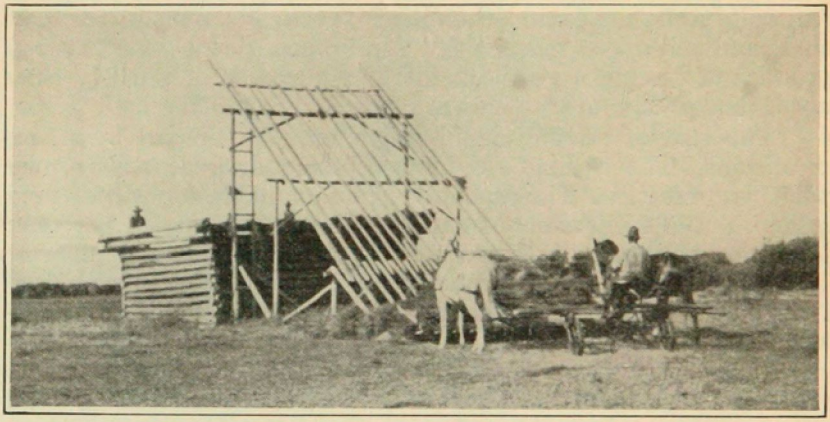

Figure 5.—Buck rake in operation; shown also are stacker and log pen on which stack is to be constructed.

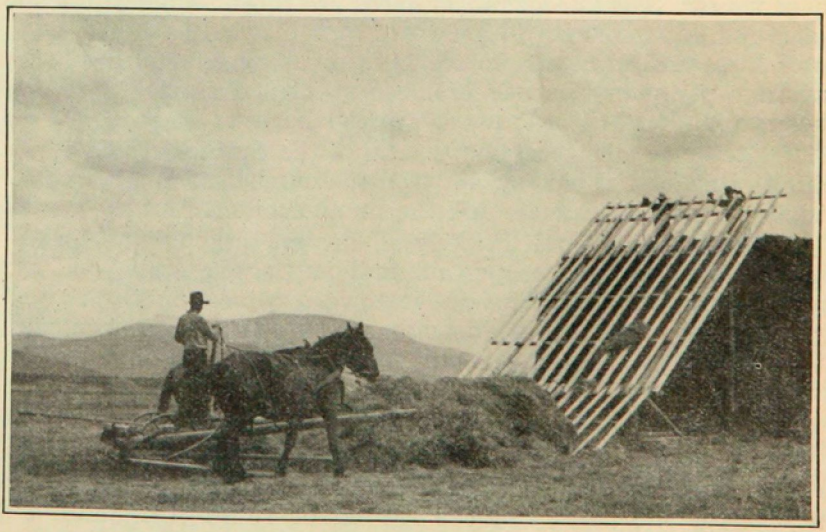

Figure 6.—Stacking hay in North Park area; load at bottom of incline.

Factors Affecting Ranch Organization and Income

Problems of Size of Ranch

THE SIZE OF a ranch business is perhaps most accurately determined by the number of cattle wintered, which in nearly all cases is the same as the number on hand at the first of the year. The amount of hay produced is another measure of size that would serve equally well were it not for the fact that it may vary greatly from year to year. Sometimes a ranchman will take a 1-year lease on another ranch and put up the hay on it and sell all or most of it. Again, some ranchmen make a practice of buying a very considerable quantity of the hay they need, thus giving no true indication of the size of the cattle herds.

The size of an individual ranch may be limited by many conditions. The available summer-grazing area represents one positive limitation. The amount of hay available for winter feed is another. The number of cattle that can be handled per man is a third, although in this case there is room for considerable variation. Under normal winter conditions one man can feed from 200 to 300 head of cattle, besides doing the other necessary ranch work.

Effect of Size Upon Efficient Use of Labor

Ranch work can be handled more efficiently if there are two or three men at work. This permits some time off for individual men and increases the economy in doing many tasks. With two men, a herd of from 500 to 700 cattle can be handled over winter. The uneconomical herds are those too large for one man and yet too small to keep two men busy. If a ranch operator hires an extra man to aid him in caring for 350 head, the average per man becomes 175. He could add from 150 to 200 head to his herd with no extra winter-labor cost.

Excessive labor costs on several of the ranches studied were due to this lack of balance between the number of head of cattle that one man can handle and the number of men on the ranch.

The land in North Park is all in use, although its ownership is divided between private individuals, the state, and the national government. Any move toward correcting the size of ranch must come about through adjustment between ranches by combination, leasing, or splitting up of existing units.

Problems of Ranch Organization

Ranch organization includes the size and layout of the ranch, the improvements and equipment, the size and age classification of the herd, and the leasing or renting of additional acreage.

For any individual ranch the existing organization has been the result of long growth and adjustment. An ideal ranch layout would differ materially from that which results from utilizing a narrow, winding stream valley for hay production or from the combination of several formerly separate ranches. The uneven shapes of hay fields increase the costs of hay production and result in extra winter labor in feeding, yet any attempt to straighten the streams would prove costly. There are many possibilities for improving ranch layout by exchanging poorly located areas of land.

Factors Affecting Income

The income from ranch operation is affected by many conditions. If efficiency is maintained, the larger the ranch the greater the total income. Yet, measured in relation to investment, a two-man or three-man ranch may show better returns. Efficiency is more essential than mere size. The attention given to the care of the breeding herd is of vital importance. The management of grazing to avoid death loss from poison plants, to avoid overgrazing, and to keep the cattle growing at all times; the possibilities of special feeding for the market and efficient winter feeding; controlled breeding to secure better calf crops; marketing cattle at ages that will result in securing the most economical growth, and selling at the most favorable prices; the efficiency in producing hay—all these are reflected in the net income for the year. In the following pages the variations in some of these factors will be analyzed.

Grazing Problems

The cattle in this region graze for approximately 200 days out of each year. The average dates for beginning and ending of the grazing season were, normally, May 4 and November 18. This varied little from year to year, but there was considerable variation on the different ranches. This is particularly true of the beginning date for the grazing season or, in other words, the end of the feeding season.

In general, it is the weather that determines the end of the grazing season and, to a certain extent, its beginning date in the spring. However, if the supply of hay is ample, a ranchman will profit by feeding until the grass has a good growth; if the supply of hay runs out early, he may have to graze his cattle, even if there is only a limited area of bare ground in sight. This is the most critical time in the ranch year, and the problem is to make the winter feeding and summer grazing periods meet at the proper time.

Use of National-Forest Grazing

The national forest was used for grazing by 12 of these ranches in 1929. They had a total of 3,796 head of cattle on the forest for an average period of 106 days. Three of the ranchmen, however, had only a very small part of their herds on the forest. In 1930 there were again 12 of the 18 ranches using the forest. The total cattle turned out was 4,294 head for an average period of 107 days.

In the season of 1931, 12 ranches had 4,378 head on the national forest, and the length of the season was 103 days. This grazing period, which averaged 105 days per year for the 3 years, is not the actual time that the cattle grazed on the forest, but rather the time allowed by the permit. Most cattle went on to the national forest between June 1 and July 1, with the majority going on July 1.

The date that the cattle must be off the forest varied from September 30 to October 31. Cattle will begin drifting down off the high ranges as early as September 1. This is because of storms and cold weather that occur about this time and also because of exhaustion or drying up of the forage. Ranchmen make the statement that "it would take an army of men to keep them pushed back" at this time. The only thing to do is to open the gates and let the cattle come into the home fields. There is frequently a delay of 10 or 15 days in turning the cattle out. This may be caused by unfavorable weather or by special administrative rulings designed to give the forage a better start. The result is that the net actual use of the grazing period is from 15 to 25 days short of the time specified in the permit.

Cost of National-Forest Grazing

In 1929 the seasonal cost of national-forest grazing was 59 cents per head turned out; in 1930, 62 cents; and in 1931, 68 cents per head. The actual fee per head, based on continuous grazing for the full season, was higher than this. The actual fees were approximately 18 cents per head per month in 1929, 19 cents in 1930, and 20.5 cents in 1931. On this basis, the seasonal fees for full-time grazing would average 63 cents in 1929, 66.5 cents in 1930, and about 72 cents in 1931. This is based on a season of 3½ months. The difference between actual grazing fees per head and computed seasonal charges is caused by an adjustment in grazing fees to allow for the "on-and-off" provision.

The exact area of national forest land used for grazing is not known. Some indication of its relative importance may be seen from the fact that the 403,903 acres of national forest within Jackson County represent 1,990 acres for every one of the 203 farms in the county. The 170,760 acres of public domain

amount to 842 acres per farm, while the state and unclassified lands amount to 752 acres per farm. When these areas are compared with the 1,583 total acres of deeded land per farm for the entire county, of which 1,119 acres were grazing land, it is apparent that national forest and other lands not privately owned have an important place in the maintenance of ranching as the dominant type of farming.

Six of these ranches reported using the public domain and other free range for a short period in the spring. Two of them turned out all their cattle, while the other four turned out only the she-stock. In 1929 these six operators put a total of 2,030 head on the free range for an average period of 41 days. In 1930 they placed 2,145 head on this range for 37 days, and in 1931 these same ranches turned out 2,630 head, but for an average period of 34 days. It will be noted that each year the numbers of cattle increased, while the days of use were reduced.

Summing up the grazing time used by these 18 ranches, only 5 percent of the total was on public domain or the so-called free range; 25 percent was supplied by the national forests; and the balance of 70 percent was on their own deeded and leased land.

The most economical gains are put on by livestock while on grass. In a locality such as that occupied by these 18 ranches, the grazing season is relatively short; consequently, the best possible use of grazing is desirable. Most ranchmen keep their steers of marketable age in special pastures in order to secure the best conditions for making rapid gains. Some ranchmen are beginning to realize the value of irrigated pastures. Some are trying out new varieties of grasses that will make green forage early in the spring. Some make a practice of reserving certain fields in the fall for the purpose of pasturing them in the spring. Special pastures for controlled breeding are used by a few men. Controlled-rotation grazing is not used very widely. Many ranchmen are beginning to take note of the experiments conducted by the various agricultural experiment stations in the range states and to look to them for possible ways to improve grazing practice.

Winter Feeding

The problem of winter feeding is one of the important phases of North Park ranching, if not the most important. This is chiefly because of the relatively higher costs of wintering an animal compared with the costs of carrying that animal through the summer.

At first only about ¼ ton per head was considered ample winter feed, but as the years have passed this has been increased

to from 1½ to 2 tons per mature animal and from 1 to 1½ tons for wintering weaned calves.

Duration of Feeding Period

The winter feeding season, as measured by the number of days that the main cow herd was fed hay, averaged 160 days for the 3 years. In the winter of 1928-29 this feeding period for cows was 150 days; in 1929-30, 159 days; and in 1930-31, 168 days. This period varied a great deal between ranches. Ranches with the shortest feeding period had 3.75 percent death loss on all cattle except calves, while the other ranches had 2.81 percent death loss.

The average duration of winter feeding for the main herd was from November 19 to about May 3. The coming yearlings were in some cases fed up to May 10 or 15, while some of the older steers were fed hay as late as June 1. When fed hay this late, it is necessary to feed the cattle in corrals from racks. Cattle will not continue to eat hay after they have had a taste of the new grass. No cows or bred heifers are "rack fed," but nearly all weaned calves are so fed.

Frequency of Feeding

Cattle on the regular feed grounds are seldom fed more than once a day, usually in the forenoon, while the calves and steers in corrals are usually fed twice a day. Keeping the cattle in a corral is practically a necessity when any kind of concentrate is to be fed. Sheds for shelter are particularly desirable in the case of weaned calves on feed.

The feed grounds for the main herd are for the most part located in or near the creek bottoms. This is because of the natural shelter in the form of willows and also because of the availability of stock water. Hay from the benchlands has to be hauled a greater distance for this reason.

Stock water in a majority of cases is furnished from the creek, which is kept open by chopping the ice. The water hole in swift, clear water is by far the best, because the stream is comparatively shallow and the bed is always gravelly and hard. These factors are very important, as they tend to prevent loss by drowning. A few of the ranchmen use well water for watering cattle that are wintered in corrals. Windmills and gas engines are used in such cases, and tank heaters are used to keep the water from freezing.*

Labor in Winter Feeding

The labor in winter feeding varied more than any other phase of ranch work. On one ranch two men fed 185 head of

*In the 1929-30 calf-wintering demonstration at the Dickens ranch in North Park, calves drinking warmed water made gains of 15.8 pounds more than calves drinking water from the creek.—Colorado Extension Service Report.

cattle, and on another one man fed 440 head. In several instances the number fed per man was over 400, while in many others it was less than 150 cattle per man. Feeding requires the hauling of approximately one good load of hay to each 100 head of cattle per day.

Nine of the 18 ranches fed more than 212 cattle per man during the winter period. The simple average for the nine was 272 head per man. None of these men lost money. The simple average for the nine ranches was 4.18 percent on the investment. The other nine ranches, with less than 212 cattle per man, averaged 171 cattle per man. Three of them lost money, and the average for all nine ranches was 0.56 percent on the investment. The number of cattle per man was obviously not the only cause of these differences.

Amount of Feed

Cows and heifers received an average of 1.84 tons of hay per head, with practically no cake or grain. The amount of hay varied from 1.55 to 2.44 tons, but on 10 of the ranches there were fed between 1.75 and 2 tons, with five ranches feeding less than 1.75 tons and three feeding over 2 tons.

One noteworthy fact about the wintering of the breeding herds on these ranches is that, while the length of the feeding season increased each successive year, the total amount of hay per head decreased. In 1929 the amount fed to cows and heifers, as shown in table 12, was 1.91 tons, in 1930 it was 1.86, and in 1931 it was 1.77 tons. Other classes of cattle were fed more uniformly. As hay yields and total hay production diminished, the breeding herd had to absorb most of the deficiency. The growing cattle were fed as usual to conserve their growth.

The coming yearlings or weaned calves received 1.37 tons of hay per head on the average. The amount varied from 1.18 to 1.72 tons on the different ranches. On five ranches they were fed under 1.25 tons, and on four they received more than 1.5 tons per head. The amount of hay fed per day to coming yearlings for the wintering season varied from 14.1 pounds to 20.3, while the average of the 18 ranches was 16.3 pounds. In addition to the hay, most of the calves were fed some concentrate, such as grain or cake, or both. Only five ranchers fed concentrates in the wintering ration during all 3 years; five ranches fed it 2 years, and three fed only 1 year. Four of the ranches did not feed cake or grain to weaned calves in any one of the 3 years. One of the ranches fed grain to weaned calves to make baby beef in 1930, but this is not considered in the wintering rations. In the winter-feeding period of 1928-29, 11 of these ranchmen fed concentrates as a supplementary feed to a total of 1,389

calves. The calves received an average of 63 pounds, at a cost of $1.63 per head.

During the next wintering period, nine of the ranchmen fed cake and grain to 1,745 calves, and these averaged 46.4 pounds, at a cost of $1.20 per head. In the wintering season of 1930-31, 10 of the 18 ranchmen fed concentrates to 1,922 calves, and these calves received 67.3 pounds, at a cost of $1.13 per head.

None of the ranches feeding grain and cake every year had any uniform system as to the kind of feed used. One year they would feed cake and the next corn and barley or oats, and sometimes the patent mixtures or any combination of these. Ranchmen should give more attention to comparative costs and feeding value in selecting these supplementary feeds.

The amounts of grain fed per head also varied a great deal. Ranch 265 fed 136 pounds to weaned calves the first year, 26 pounds the next, and 86 pounds the third year. Another ranch that fed grain to weaned calves for 2 of the 3 years fed 30 pounds the first year, nothing but hay the second year, and nearly 200 pounds of grain the third year. This great variation was apparent on all ranches that used the concentrates in the wintering ration. The use of this grain and cake did not seem to save any hay.

Did this extra feed result in better gains? Since no comparative weights could be secured at the end of the winter feeding period, the next best thing to do was to compare the sale weights of the yearlings as they were sold the following fall. When only the fall (October and November) sales of cattle are considered, the yearling steers that had grain the previous winter had an advantage of 48 pounds over those that were wintered on hay alone. If all the yearling-steer sales are considered, including the January stock-show sales, the advantage in favor of the grain-fed cattle was only 16 pounds. The inclusion of the stock-show sales, however, involves another hay-feeding period in the fall, varying from 1 to 3 months, with or without cake and grain.

The North Park calf-wintering demonstration, 1929-30, already mentioned, showed that steer calves wintered on native hay alone consumed 2,201 pounds each in a feeding period of 151 days. This compares with the results of this study, which shows that all calves wintered, 8,978 in number, consumed an average of 2,735 pounds of hay in a wintering period of 167 days and in addition received 33 pounds of concentrates per head. In this connection it should be taken into consideration that the hay used in the demonstration was weighed over a scale, while

that used in this study was measured.* All available data seem to indicate that the measured tonnage overruns actual scale weights by from 10 to 15 percent.

The coming 2-year-old steers averaged 4,284 pounds of hay per head. In addition, one ranch fed cake and grain to this class for two winters, and two other ranches for one winter. The average amount per head was 60.4 pounds, at a cost of $1.44.

The coming 3-year-olds averaged 6,035 pounds of hay per head. Only 38 of them were fed a supplementary grain ration, and for only one season. These received about 21 pounds per head, at a cost of 55 cents per head.

Coming yearling bulls had an average winter-feeding period of only 130 days. Most of them are purchased late in the fall, or even during the winter. Only 37 out of a total of 75 received cake or grain as a supplementary winter ration. The amount averaged 143 pounds, at a cost of $3.46 per head.

Table 12 shows winter-feed costs per head in addition to the average amounts of feed per head and length of feeding season. In this tabulation the actual cost of all purchased feeds has been used and the farm price for the home-grown feeds.

Cost of Winter Feeding

The winter feed cost for cows and heifers in the breeding herd averaged $11.07 for all ranches for the 3 years, varying from $9.30 to $14.70, with cost at nine of the ranches between $10.00 and $12.00. Costs on five ranches were more than $12.00 and on four less than $10.00. The five ranches with feed costs more than $12 per head either had higher-than-average feed prices, longer feeding periods, heavier daily rations, or a combination of any two of these conditions. The four ranches that were below $10 in feed cost per head all fed lighter-than-average rations. One had a 13-day shorter-than-average feeding period, two were below the average in price of feed, and two were slightly above.

The winter feed cost for weaned calves or coming yearlings averaged $8.78. This varied from $7.34 to $13.35, with costs on 10 ranches ranging between $8 and $10. Costs on three were more than $10 and on five less than $8. Of the three with costs above $10, one had high-priced hay, and another had a charge of $5.31 per head for grain and cake. All three had longer-than-average feeding periods and heavier-than-average rations. Of the five ranches that had feed costs of less than $8 per head of weaned calves, all but one fed shorter-than-average rations; three had lower-than-average feed prices; four had less-than-average or no charge for grain or cake; two had about the

*By substituting 469 for 422 as the number of cubic feet in a ton, the tonnage in a given stack is reduced 10 percent, and by using 496 it is reduced 15 percent.

TABLE 12.—*Winter-feed cost per head, actual feed prices used; average for all ranches for 3 years.*

	1929				1930				1931				Weighted Average			
	Days on feed	Tons hay per head	Pounds grain and cake per head	Feed cost per head	Days on feed	Tons hay per head	Pounds grain and cake per head	Feed cost per head	Days on feed	Tons hay per head	Pounds grain and cake per head	Feed cost per head	Days on feed	Tons hay per head	Pounds grain and cake per head	Feed cost per head
Cows and coming 2-year-old heifers	150	1.91	.....	$12.26	159	1.86	.....	$11.85	168	1.77	.....	$ 9.48	160	1.84	.....	$11.07
Bulls (of service age only)	158	3.03	101	22.00	161	2.87	77	19.76	166	2.77	8	15.19	162	2.88	58	18.75
Coming yearlings or weaned calves	159	1.33	39	9.59	166	1.37	25	9.20	174	1.38	38	7.85	167	1.37	33	8.78
Coming 2-year-old steers	179	2.09	.....	13.55	185	2.23	37	13.83	182	2.11	50	11.58	182	2.14	29	12.96
Coming 3-year-old steers	208	2.99	.....	19.34	182	2.69	62	15.46	200	3.18	.....	13.59	200	3.02	5	17.46
Coming 1-year-old bulls	116	1.72	45	12.41	136	1.44	111	11.83	142	1.41	71	8.78	130	1.54	71	10.92
Bull feed cost per cow				.93				.86				.66				.81

average feeding period and the other three considerably less.

The average winter-feed cost for the coming 2-year-old steers was $12.96. This varied from $9.11 to $16.75, with costs on seven ranches between $11 and $15. Costs on four were above $15 and on five under $11. Only two ranches made this their main market class, the others being mostly cut-backs or shortages.

Feeding for the Stock Show

Many ranchers practice fall feeding of market classes for stock-show feeder-cattle auctions in January. In the fall of 1929 two ranches fed 98 steer calves for an average of 74 days. They were fed 1,428 pounds of hay and 57 pounds of cake and grain per head. When sold, the average weight was 473 pounds. In 1930 four ranches fed 219 calves, of which group 25 were heifers. This year the average time on feed was only 60 days. These calves received 1,050 pounds of hay and a little over 50 pounds of cake and grain. When sold they averaged 464 pounds per head. In 1931 three of the ranches fed 184 steer calves. They were fed an average of 76 days and got 1,064 pounds of hay and 178 pounds of concentrates, mostly grain. The sale weights averaged 461 pounds. The ranch value of this feed averaged $4.52 for the 3 years, and the sale weight of the stock-show calves was 464 pounds, while that of the other calves sold was 400 pounds.

In the fall of 1929 five ranches fed 470 yearlings for the stock shows. Included were 34 heifers. These cattle averaged only 56 days on feed and got 1,520 pounds of hay and 83 pounds of cake and grain per head. In 1930 eight of the ranches fed 837 yearlings, again including 34 heifers, for an average of 61 days. They were fed 1,532 pounds of hay and 75 pounds of cake and grain per head. In 1931 seven ranchmen fed 498 yearlings, including 37 heifers, for an average of 70 days. These cattle got 1,642 pounds of hay and 127 pounds of cake and grain. The sale weights of the yearling steers for the 3 years averaged 720 pounds as compared with 677 pounds for the other yearling steers sold on the open market during the fall months. The average feed costs of this extra stock-show feed was $6.24 per head.

No considerable number of 2-year-olds were fall fed for the stock show. Some of them, as well as other market cattle, were fed hay for periods from a few days to a month or more before shipping, however, but not so much for the purpose of putting on extra weight as to harden the flesh slightly prior to marketing.

Calf Production

By percentage calf crop is meant the number of calves per 100 cows raised or saved up to the end of the year. Any calves that may be sold or disposed of prior to that time, of course, are considered as raised.

The number of cows on which the calf-crop percentage is based is the she-stock 1 year old and over that was run in the breeding herd the preceding year and carried through the winter.

The calf crop for individual ranches varied from a 3-year average of 55 percent to more than 90 percent. There was also considerable variation in calf crop on the same ranch from year to year. On some of the ranches the percentage calf crop held fairly steady throughout the 3 years, on others a more or less uniform increase or decrease took place, and on still others it fluctuated widely. Table 13 shows the yearly and average calf-crop percentages for each ranch.

TABLE 13.—*Percentage calf crops; average for each year and for 3 years.*

Ranch number	1929	1930	1931	Average	Breeder	Number cows per bull
	Percent	*Percent*	*Percent*	*Percent*		
279	92.00	92.35	86.96	90.38	Pasture	28
276	86.58	81.25	75.11	80.35	Pasture	33
277	62.65	79.57	87.24	78.11	Range	27
202	72.03	57.52	85.47	72.06	Range	26
214	64.32	73.28	72.12	70.16	Range	23
266	71.80	70.47	68.62	70.00	Range	32
275	77.54	58.48	74.18	69.92	Pasture	34
201	75.57	58.46	74.52	69.73	Range	31
281	.....	66.54	68.54	67.56	Range	41
265	65.52	69.31	66.09	66.87	Pasture	27
225	64.49	65.09	64.70	64.76	Range	22
274	62.87	62.50	67.67	64.52	Range	31
278	75.89	57.69	51.58	60.43	Pasture	31
280	50.55	64.52	64.14	59.89	Pasture	32
263	52.43	54.24	69.50	59.07	Pasture	29
273	55.98	51.95	66.94	58.42	Range	30
271	58.15	53.19	53.72	55.00	Range	42
Av.	67.10	65.80	69.85	68.18	(*)	

*Average for all pasture breeders=70.08; average for all range breeders=67.00.

The factors which influence calf crops are many and varied. These factors may be grouped under three general headings: (a) character and condition of the breeding herd; (b) character and condition of breeding grounds; and (c) methods used in handling and caring for the breeding herd and the calf crop.

Under these three heads are grouped the main factors considered by most cattlemen and research workers in this field to be conducive to good calf crops, and the reasons for so considering them follow:

Character and Condition of Breeding Herd

(1) A well-wintered cow herd results in stronger calves, the cows have more milk for the calves, and both will stand spring storms better than if cows are in a thin and weak condition. They will also breed earlier in the season, thus avoiding late calves.

(2) A cow herd should be made up of a large percentage of mature cows. Mature cows invariably make better mothers than heifers with their first calves. They have a more liberal milk supply and take better care of their calves. Mature cows also require less attention at calving time.

(3) Bulls must be well wintered and in vigorous condition before being turned out in the cow herd. This does not constitute a grave problem in North Park, as bulls are usually fed all the good hay they can eat through the winter, then are permitted to run on grass for a month or 6 weeks before the breeding season begins.

(4) A sufficient number of bulls must be provided to insure uniform service. This number depends on various circumstances. When young bulls are brought in from a much lower altitude they usually require a year to become acclimated. Many of these young bulls die because of the great change in climate and altitude. The number of bulls required depends also to a great extent on the nature of pastures and range. The older bulls may be used to good advantage in smaller pastures, while young, vigorous, and acclimated bulls are better suited for the rougher range, such as the national forests.

TABLE 14.—*Percentage calf crop resulting from varying numbers of cows per bull in the breeding herd the preceding year; average for 2 years.*

	Less than 29 cows per bull		29 cows per bull and more	
	Average number of cows per bull, 1929 and 1930	Average percent calf crop on same ranches, 1930 and 1931	Average number of cows per bull, 1929 and 1930	Average percent calf crop on same ranches, 1930 and 1931
Pasture breeders	26.6	76.6	32.1	63.7
Forest-range breeders	22.9	69.0	34.0	65.2
All ranches	23.5	70.4	33.4	64.8

The data in table 14 indicate that it would be a waste of money to fence for pasture breeding unless enough bulls were used. It also suggests that pasture breeding results in better calf crops when there are enough bulls. Assuming a breeding herd of 665 cows and using the percentage calf crops shown in table 14 for each method of breeding, the following results are obtained: With pasture breeding, 26.6 cows per bull would result

in 510 calves, while 32.1 cows per bull would give 424 calves; this means 86 extra calves by adding four bulls to the breeding herd. With range breeding, 22.9 cows per bull gave 460 calves, which is 50 fewer calves than could be secured with 26.6 cows per bull on pasture. The pasture breeders, with 4 fewer bulls and 50 more calves from 665 cows, show a clear advantage over the range breeders. With 34 cows per bull on the range, 436 calves would be secured; in this case there was little advantage from increasing the number of bulls, as the 22.9 cows per bull resulted in only 460 calves from 665 cows, or nine extra bulls resulted in only 24 more calves.

Character and Condition of Breeding Grounds

The character and condition of breeding grounds undoubtedly has a great influence on the size of the calf crop. Under this head the factors are:

(1) Size of breeding grounds. This may range, in actual practice, from a small pasture with feed enough for 30 or 40 head to practically limitless areas, as in case of most national-forest ranges. In all research so far, the smaller pastures for the breeding herd have proved the better from the standpoint of good calf crops. Breeding in fenced pastures is not always guarantee of a good calf crop, as some pastures may be so large and of such rough topography that their only advantage lies in enabling the user to keep his cattle separate from neighboring herds.

(2) The pasture should not have too many watering places; one is best, as it tends to throw all the cattle together at least once each day.

(3) A pasture that is not too rough or broken in topography is desirable; it is easier on bulls, and therefore older bulls may be used to advantage; also a rider may go through and observe all the cattle in much less time.

These ideal pastures are not always possible on most ranches, particularly on the larger ones, without great outlay for fences.

Methods of Handling Breeding Herd

The care and attention that the individual cattleman gives his breeding herd and the methods he uses to get better calf crops are by no means the least important in this list of factors, but they are by far the hardest to measure and compare. The only valid reason for keeping a breeding herd is to produce calves, and any part of the breeding herd that does not produce calves adds to the cost of the part that does produce. After providing the ideal, or as nearly as possible to it, in the breeding herd and breeding pastures, the ranchman must constantly be on the alert to see that all goes well with his cattle.

If his cattle run in pastures, the breeding season need not continue so long and will require less riding than when cattle are run on the forests or open range. After the breeding season is over, care and attention count the most. Throughout the winter feeding period, care should be used in feeding any spoiled hay, as this is likely to cause some abortion, as will rough handling. Heavy cows should be segregated from other cattle, and 2-year-old heifers that are to calve should be kept where they can be given assistance in calving if needed.

In this region the bulls are generally run in the cow herd from about July 1 to the end of the grazing season. This makes the bulk of the calf crop come during April and May. This breeding season is undoubtedly the best where a ranchman has no special equipment, such as calving barns or sheds, which are necessary when early calves are desired. Some ranchmen are providing creep shelter for range calves. Creep shelters are so built as to admit the calves but not the cows. This saves many calves from exposure in severe storms and is of the greatest value where early calving is practiced.

Caring for sick calves is also of great importance. Many ranchmen dislike to "fool with them," but every cattleman should know how to diagnose and treat the more common causes of loss, such as calf diptheria and scours. A considerable cause for loss of calves in the spring of the year is exposure. Many losses result from calves drowning in ditches and swollen streams. Calves should be kept away from such places until they can to some degree take care of themselves.

The records show that the percentage of cows with calf was 74.8, while the actual calf crop raised (table 13) was only 68 percent. This is a difference of practically seven calves from 100 cows. Care of the breeding herd that might result in saving all or most of these seven calves would be time well spent.

Effect of Calf Crop Upon Income

The size of the calf crop as related to the percentage return on the investment shows up to good advantage in this 3-year study. Table 15 shows the relationship between calf crops and percentage earned on the investment.

It will be noted from table 15 that the three best calf crops among the pasture breeders excelled the three best of the range breeders by 6.5 percent in calf crop but only 0.88 percent in the matter of return on investment. On the other hand, the three poorest calf crops among the range breeders had a 3.7-percent better calf crop and a 1.17-percent better return on the investment than the three poorest calf crops in the pasture group.

This indicates that a high-percentage calf crop is of even more vital importance for the pasture breeder than it is for

the forest-range user, due to the relatively greater investment in land and improvements. The number of ranches in these groups is too small to warrant placing unlimited confidence in this relationship. The conclusions, however, are in accord with general opinion.

TABLE 15.—*Effect of calf-crop percentage on income.*

	Percent calf crop	Percent return on investment*
Best calf crops:		
Three pasture breeders only	82.3	6.17
Three range breeders only	75.8	5.29
Six best calf crops, all ranches	78.0	5.59
Poorest calf crops:		
Three pasture breeders only	57.2	0.42
Three range breeders only	60.9	1.59
Six poorest calf crops, all ranches	59.7	1.19

*Return to investment, with cattle inventory values the same at the end of each year as at the beginning, but with increases in numbers at new inventory values.

Cattle Losses

The causes listed for death losses are many and varied. The data show that about 12 percent of the cow loss was charged to the effects of calving; 27 percent to "missing"; 25 percent to "cause of death not determined"; and 21 percent to accidents, such as drowning, bogging down, being struck by lightning, and falling and breaking bones. The remainder or 15 percent of the cow loss, was listed as due to scattered causes, such as poison weeds, bloat, woody tongue, big jaw, cancer eye, and old age.

Causes for death loss among 2-year-old heifers were not so numerous. Fifty-three percent of such deaths were due to calving, 29 percent to "missing," 15 percent to "found dead but cause unknown," and about 3 percent accidental.

The yearlings were subject to many afflictions. In this group 43 percent of the death loss was reported as "missing," 24 percent as "cause undetermined," 7 percent as caused by dropsy, 5 percent as caused by pneumonia, and 4 percent down to 1 percent was attributed to each of the following causes: dehorning, scours, eating musty hay, bloat, diphtheria, blackleg, and drowning and other accidents.

The operators reporting on the loss in 2- and 3-year-old steers were so few that the figures are not significant, but it seems the biggest share of this loss comes in the "missing" class. A few steers died of dropsy.

Death loss in bulls, including the yearling bulls that have not been put in service, was reported as 60 percent resulting from dropsy or brisket disease, which in turn was attributed to the high altitude. The remainder of the death loss resulted from

fighting, accidents, pneumonia, "missing on the range," old age, "cause unknown," and blackleg.

The greater part of the loss in small calves occurred in the spring of the year, mostly during calving season, and was of the preventable type. Of the calf loss, 28 percent was attributed to freezing or chilling, 22 percent to drowning or falling into the ditches and creeks, 12 percent to scours, 16 percent to "found on range and cause undetermined," 8 percent each to "missing" and predatory animals, 2 percent to accidents, 3 percent to effects of castration, and ½ percent each to poison weeds and blackleg. In addition to these losses, 3.1 percent of all cows bred lost calves by abortion.

Summing up these causes, it is found that of all cattle other than calves, more than one-third "turn up missing." Many of these die on the range, and their carcasses are not found, but it is also out of this division that the modern cattle rustler takes his toll. The loss from poison plants is comparatively small in North Park.

Many of these losses are preventable. Cow and heifer loss at calving time is nearly all avoidable, if proper care and attention is at hand. The great loss in new calves can be prevented to a considerable extent by providing shelter and keeping them away from ditches and flooded streams. Diseases such as diphtheria and scours yield to proper treatment that any veterinarian will outline. Losses of imported bulls by dropsy may be reduced by using mountain-bred bulls.

The average loss in all cattle other than young calves was 2.87 percent in 1929, 3.66 percent in 1930, and 2.95 percent in 1931. The 3-year average was 3.17 percent. The percentage loss in young calves was 6.28 in 1929, 5.22 in 1930, and 5.46 in 1931; and the 3-year average was 5.63 percent. Of the cattle other than calves, the loss in bulls was the heaviest when taken on a percentage basis. Out of a total of 800 bulls for the 3 years,

TABLE 16.—*Percentage of cattle losses by classes for each year, and average.*

	Percent of total number			
	1929	1930	1931	3-year average
Cows	1.97	1.86	2.30	2.05
Two-year-old heifers	3.34	4.46	2.94	3.52
One-year-old heifers	4.76	3.51	4.13	4.07
Bulls in service	4.24	6.12	6.02	5.49
One-year-old bulls	.....	6.25	8.00	5.66
Steers, 1's	4.11	7.80	2.81	4.96
Steers, 2's	2.00	2.49	2.81	2.44
Steers, 3's	.96	.....	11.63*	3.70*
All cattle except calves	2.87	3.66	2.95	3.17
Calves, percent of total born alive	6.28	5.22	5.46	5.63

*Number on hand too few to make this figure significant.

44 were lost, or 5.5 percent. This includes the yearling bulls not in service. Table 16 shows the percentage cattle loss for each class by years, and the 3-year average.

The losses in cattle that were grazed on the national forests were about 1 percent higher than for cattle grazed in fenced pastures. Table 17 sets forth the 3-year average for each class

TABLE 17.—*Percentage death loss on various classes of cattle run in pastures and on the national-forest range; average for 3-year period.*

Class of livestock	Pasture	Forest range	All ranches
	Percent	*Percent*	*Percent*
Cows	1.96	2.08	2.05
Two-year-old heifers	2.64	3.76	3.52
One-year-old heifers	3.61	4.21	4.07
Bulls (service)	5.23	5.56	5.49
Steers, 1's	2.76	6.18	4.96
Steers, 2's	1.31	5.56	2.44
Steers, 3's	.99	8.20	3.70
One-year-old bulls not in service (all in pasture)	5.66	.....	5.66
Calves	6.93	5.22	5.63
All cattle except calves	2.44	3.43	3.17

in the two groups. It will be noted that the greatest difference appears in the steer classes of all ages. However, the figure for 3-year-old steers is not significant because of the relatively small number in this class. The loss in cows and bulls did not differ a great deal in the two groups, but the loss in 2-year-old heifers was more than 1 percent greater in the forest-range group. The greater losses on the national forest are due to the opportunities for rustlers to work unobserved.

The loss in calves showed higher in the pasture-breeding group than on the range. This seems inconsistent with the loss in other classes, which tended the other way in all cases. It may be explained, in part at least, by the fact that all calves born in fenced pastures are usually accounted for, while many calves are born after the cattle are turned out on the open range and so are not counted until branding time; hence, any loss among these calves cannot be checked up unless their carcasses are found. Some ranchmen attempt to check up on the calf loss on the range by the number of dry cows in the fall. This is not an accurate method, as any one of three things may have happened: First, the cow may not have had a calf at all; second, she may have lost her calf before being turned out; and third, she may have calved and lost the calf on the range.

The number of cows and heifers in the breeding herd that aborted varied from none at all on some ranches to as high as 17.4 percent in one case and 16.5 in another.

When this study first began, a number of ranchmen were using certain patent abortion "preventives" and would swear

by the efficacy of them, only to be rudely awakened by finding that they had as much or more abortion than some of their neighbors who used no medicines but who perhaps observed some common-sense rules as to sanitation and segregation of infected animals.

A certain proportion of this abortion should not be classed as contagious, but no doubt is caused by accidents, such as slipping on ice, floundering in deep snow, or being hooked or bumped by other cattle on the feedgrounds. Some ranchmen insist that feeding spoiled hay or hay with a considerable amount of certain weeds at a critical time in the gestation period will cause cows, and particularly heifers with their first calves, to abort.

Most of the ranchmen were able to give the proportion of cows and heifers that aborted. These data indicate that about 75 percent of all abortion is among the 2- and 3-year-old heifers having their first calves. This seems to support the contention that a high percentage of cows become immune after aborting once. For this reason, it would seem to be a mistake to sell off all aborters, particularly the heifer that has just lost her first calf.

The economic aspect of cattle losses assumes importance when we consider that the total loss on these ranches numbered 443 head in 1929, 528 in 1930, and 542 in 1931, exclusive of loss by abortion.

No ranchman can hope to eliminate all loss, but here is at least a chance to turn some loss into profit. Every animal saved means that much more cash. In this connection, it may be noted that some ranchmen, when they find a calf sick from exposure or other cause, will prefer to "knock him in the head" rather than "fool with him" and try to "pull him through."

Pounds of Beef Produced

The average operator of a cattle ranch seldom thinks in terms of "yield" in connection with the production of beef. The rancher thinks mostly in terms of the "ranch" or the "bunch of cattle," with so-many calves, so-many steers, and so-many dry cows to sell. His output, however, is sold on a hundredweight basis, and even if he sells by the head, the price is always based on an estimate of the weight.

Table 18 sets forth the number of pounds produced per head for each ranch. These figures are based on the gains and the natural increase from all cattle on hand at the beginning of the year.*

The average beef production per head of cattle on hand on January 1 for all ranches was 284 pounds. It was 291 pounds in 1929, 272 pounds in 1930, and 288 pounds in 1931. The lower-

*See footnote, table 18, for method.

TABLE 18.—*Pounds of beef produced per head.**

Ranch number	1929	1930	1931	3-year average
	Pounds	*Pounds*	*Pounds*	*Pounds*
201	318	290	326	311
202	268	252	315	277
214	289	314	299	301
225	312	242	258	268
263	260	225	312	264
265	242	265	294	269
266	312	304	296	302
267	216	176	299	235
271	222	224	261	236
273	275	267	278	274
274	276	241	285	267
275	320	263	289	288
276	341	319	304	319
277	286	358	327	325
278	307	279	262	280
279	339	348	321	335
280	239	302	257	266
281	.....	286	281	283
Average	291	272	288	284

*Based on number of head of cattle on hand the first of the year, and on sale weights, increased weights of young cattle, natural increase from calf crop, and death loss from these cattle.

than-average calf crop in 1930, coupled with higher death loss, was responsible for the low beef production for that year. In 1929 four of the ranches had a production of less than 250 pounds, in 1930 there were five, and in 1931 none were below this amount. One ranch had a production as low as 176 pounds per head in 1930, caused primarily by the heavy death loss. The highest individual-production records were made on ranches 277, with 358 pounds per head, and 279, with 348 pounds. Strangely enough, both records occurred in 1930, and both are traceable directly to high calf crops and low death loss. Ranch 279 had a 335-pound average for the 3 years, six ranches averaged over 300 pounds, and the lowest 3-year average was 235 pounds.

The number of pounds of beef produced per head or per unit depends entirely on three factors: namely, calf-crop percentage, death losses, and gains put on by the different classes throughout the year. All three factors are important, but in varying degrees, according to the kind of cattle marketed. A ranch that sells cattle in the form of calves needs to watch the calf-crop percentage closely, while one that sells older steers must also see to it that the death loss is kept down and that the cattle are given every chance to make substantial gains throughout the year. The calf crop is the most important factor affecting beef production per head.

It was found that for every 100 pounds of beef produced on these ranches, an average of 1,258 pounds of hay was fed to cat-

tle, together with about 5 pounds of cake and 3¾ pounds of grain. This includes all beef produced and all feed fed, both for wintering and fall feeding of market cattle. At the 3-year-average prices, these feeds would have a value of $3.95 for every 100 pounds of beef produced.

The group of ranches that made a practice of selling calves as their main market class used an average of 1,405 pounds of hay and nearly 18 pounds of cake and grain for every 100 pounds of beef produced. The group that sold mostly yearlings used 1,271 pounds of hay and 8 pounds of cake and grain. Those ranches that sold only heavy cattle, that is, nothing less than long 2-year-olds, used an average of only 1,075 pounds of hay and 7½ pounds of concentrates. A fourth group that sold calves, yearlings, and 2-year-olds, and for that reason would not fit into either of the other three groups, used an average of 1,293 pounds of hay and 5 pounds of cake and grain per 100 pounds of beef produced.

This feed was in addition to the grazing. No information was secured showing the relation of quality or amount of grazing and its effect upon gain per head and upon the need for winter feed. This feed may be considered as a maintenance cost occasioned by long winters and shows the handicap compared with cattle production where year-long grazing was available.

Ranch Expenses per Head of Cattle

The problem of costs and returns faces every rancher or farmer. In its simplest terms, this is a question of "getting one's money back." Table 19 summarizes the ranch expenses as a charge per head of cattle on hand the first of the year. The actual cash expenses per ranch are shown in earlier tables. The current expenses were $12.50 per head of cattle for 1929 and had decreased to $8.43 per head in 1931. This reduction in expense per head was partly due to actual cutting of expenses per ranch and partly to the increased size of cattle herds handled without an increase in expense. In this table a straight 6 percent on the investment was used as the basis of the interest calculation.

Investments such as the purchase of new machinery, new-building costs, and livestock purchased are not shown in the table, the purpose being to compare necessary operating charges with cash income. Some of the more important items of expense in 1929 were paid labor $6.44, operator labor $2.25, purchased feeds $2.09, and depreciation $1.39. Current expenses were $12.50 and all expenses $26.43 per head of cattle. The cash income amounted to $28.53 per head. By 1931 cash income had fallen to $11.09 per head, while all expenses, including 6-percent interest, were down to $20.38.

All ages and classes of cattle are combined in arriving at the averages shown in table 19. Obviously this is not a satis-

TABLE 19.—*Ranch expenses per head of cattle.*

Item	1929	1930	1931	3-year weighted average
Average number cattle first of year	464	507	566	513
Current expenses, total	$12.50	$9.12	$8.43	$9.84
Labor and board	6.44	4.81	3.74	4.88
Taxes	1.00	1.12	.95	1.02
Leases and fees	1.08	.79	.89	.91
Feeds and salt	2.09	.98	1.71	1.58
Automobile and truck	.56	.46	.37	.45
Repairs to improvements	.45	.24	.17	.27
Repairs to machinery	.30	.24	.26	.27
Miscellaneous expense	.58	.48	.34	.46
Depreciation, buildings, and machinery	1.39	1.35	1.23	1.32
Decrease in feeds	.....	2.14	1.02	.47
Family labor, unpaid	.20	.18	.14	.17
Operator's labor	2.25	2.09	1.45	1.90
Sub-total operating expense	16.34	14.88	12.27	13.70
Interest at 6 percent	10.09	9.57	8.11	9.18
Total all expenses	26.43	24.45	20.38	22.88
Cash income per head	28.53	17.52	11.09	18.30

factory approach to answering the questions of what it costs to produce a calf or what age of cattle can be produced at lowest costs.

Ranch Expenses for Each Class of Cattle

Producing cattle and hay constitutes the major enterprise on these ranches. If receipts from cattle or from hay sales are less than expenses, then that part of the business is conducted at a loss.

Accurate records of hay-production costs were kept each year. Some ranchmen produced part of their hay crop on rented land. In order to avoid any chance of error from combining rented and owned acreages in the analysis, a study was made eliminating ranches with rented hay-land. Current expense, depreciation, and family and operator labor were included under "operating expense" for the ranches. From this total there were deducted the actual costs of producing hay,* costs of purchased feeds, and the income from sales other than of cattle or hay†. The difference between these items and the total operating expense represented the amount which must be met from cattle sales, irrespective of the age-class of cattle. These "general ranch expenses" amounted to $4.77 per head of cattle

*The ranch costs of producing hay and for purchased feeds were deducted so that actual feed costs for each class of cattle could be used in table 20.

†This income was deducted on the assumption that every dollar of such income reduced the ranch expenses that must otherwise be met from cattle sales.

in 1929, $4.72 in 1930, and $4.39 in 1931. From the total interest on investment, all interest charges connected with hay production were deducted, leaving net interest chargeable to cattle of $7.19 per head of cattle in 1929, $6.84 in 1930, and $5.87 in 1931.

The death loss and depreciation in the breeding herd amounted to $2.56 per head in 1929, $4.31 in 1930, and $3.76 in 1931.* The small charge in 1929 was due to the fact that old cows in the fall of 1929 were sold for a slight gain over their inventory value at the first of the year. In the other years they were sold for less than inventory values.

With the quantity of feed shown in table 12 modified by uniform feed prices plus the general ranch expense and depreciation per head as discussed above, table 20 has been assembled to show ranch costs per head and per hundredweight at time of sale for calves, yearlings, and 2-year-olds.

The calf cost is based upon the cost of keeping a cow in the breeding herd. Costs without interest and including interest are shown separately. For example, in 1929 it cost $19.68 to keep a cow a year (line 5, table 20). The calf crop that year was 67 percent, which made each calf cost $29.37, without interest. The extra costs of keeping a calf until it was a long yearling were composed of general ranch expenses, feed, and death loss. These, added to the original calf costs, made $44.53 as the cost, other than interest, for producing a long yearling in 1929. Similarly, a long 2-year-old had accumulated costs of $63.35 for his 3 years as a calf, a yearling, and a 2-year-old.

Lines 18, 19, and 20, table 20, show these costs per head in terms of cost per hundredweight at the time of sale. The weights used in lines 19 and 20 as the basis of the cost per hundredweight represent the September-to-December average-sale weight of all yearling and 2-year-old steer sales; i.e., 685 and 1,022 pounds, respectively. The 385-pound weight for calves, in line 18, is not an average-sale weight. Very few calves were sold in the fall. The oldest and best calves were sold or fed for the Denver stock-show sales. The 385-pound weight was selected, after some investigation, as representing approximately the weight for steer calves where the majority of the calves were sold in the fall. Late calves would not come up to this weight. Most of the early calves would exceed this weight.

Obviously, the cost per hundredweight of calves will depend upon the sale weight. If calves could be marketed in the fall at weights of 450 pounds or greater, the cost per hundredweight shown in line 18 would be approximately the same as for long yearlings of 685 pounds each.

*If inventory loss on old cows were eliminated, most of which was occasioned by decreasing prices, net losses in the breeding herd would be $2.58 in 1929, $2.16 in 1930, and $1.91 in 1931. The calculations in subsequent tables include the inventory loss.

TABLE 20.—*Ranch costs per head and per hundredweight.*

	Line	Without interest			Simple 3-year average	Including interest			Simple 3-year average
		1929	1930	1931		1929	1930	1931	
Cost of producing calves									
General ranch expense per head of cattle	1	$ 4.77	$ 4.72	$ 4.39	$ 4.63	$ 4.77	$ 4.72	$ 4.39	$ 4.63
Depreciation and death loss in breeding herd	2	2.56	4.31	3.76	3.54	2.54	4.31	3.76	3.54
Feed cost per cow (including feed for bulls)	3	12.35	11.99	11.33	11.89	12.35	11.99	11.33	11.89
Interest on net ranch investment per head of cattle	4	.....	.....	.....	.....	7.19	6.84	5.87	6.63
Total calculated expense per cow	5	$19.68	$21.02	$19.48	$20.06	$26.87	$27.86	$25.35	$26.69
Percent calf crop	6	67	66	70	68	67	66	70	68
Production cost per calf	7	$29.37	$31.85	$27.83	$29.50	$40.10	$42.21	$36.21	$39.25
Extra cost of keeping calf to long yearling									
General ranch expense per head of cattle	8	$ 4.77	$ 4.72	$ 4.39	$ 4.63	$ 4.77	$ 4.72	$ 4.39	$ 4.63
Feed cost for coming yearling	9	8.96	8.86	9.25	9.02	8.96	8.86	9.25	9.02
Interest on net investment per head of cattle	10	.....	.....	.....	.....	7.19	6.84	5.87	6.63
Death loss of 3.31 percent on yearling steers*	11	1.43	1.50	1.37	1.43	2.02	2.07	1.84	1.97
Total cost of long yearling, including calf costs	12	$44.53	$46.93	$42.84	$44.58	$63.04	$64.70	$57.56	$61.50
Extra cost of keeping long yearlings to long 2-year-olds									
General ranch expense per head of cattle	13	$ 4.77	$ 4.72	$ 4.39	$ 4.63	$ 4.77	$ 4.72	$ 4.39	$ 4.63
Feed cost for coming 2-year-olds	14	12.54	14.29	13.94	13.59	12.54	14.29	13.94	13.59
Interest on net investment per head of cattle	15	.....	.....	.....	.....	7.19	6.84	5.87	6.63
Death loss of 2.44 percent on 2-year-old steers	16	1.51	1.61	1.49	1.53	2.14	2.21	1.99	2.11
Total cost of long 2-year-olds, including calf and yearling costs	17	$63.35	$67.55	$62.66	$64.33	$89.68	$92.76	$83.75	$88.46
Cost per hundredweight at time of sale									
Calves of 385 pounds	18	$ 7.63	$ 8.27	$ 7.23	$ 7.66	$10.41	$10.96	$ 9.40	$10.19
Long yearlings of 685 pounds	19	6.50	6.85	6.25	6.51	9.20	9.45	8.40	8.98
Long 2-year-olds of 1,022 pounds	20	6.20	6.61	6.13	6.29	8.77	9.08	8.19	8.66

*Based upon 1929 and 1931 records only, as 1930 loss was abnormal because of unexplained disappearances.

With the weights used in lines 18 to 20, the older steers were produced at less cost per hundredweight. This is in agreement with the opinion among cattlemen in the mountain valleys of Colorado that steers should be kept until they are yearlings or 2-year-olds before sale. It would take better calf crops or heavier sale weights for calves to cut calf costs per hundredweight down to those for yearlings and 2-year-olds. One ranchman obtained a 90-percent calf crop consistently. With such a calf crop, calves in 1929 would cost $21.87, excepting interest, and $29.86, including interest, as compared with $29.37 and $40.10 for the average calf crop. A 385-pound calf on this ranch would cost $5.68 per hundredweight, excepting interest, and $7.76, including interest, as compared with $7.63 and $10.41 for the average calf crop. If such calves could be produced to sell at 450 pounds, the cost per hundredweight would be $4.86 and $6.64. Thus a 90-percent calf crop would result in reduced costs per hundredweight as calves, and consequently lower final costs per hundredweight as yearlings or 2-year-olds.

One phase of the costs summarized in table 20 deserves further consideration. The extra costs, other than interest, for keeping a calf to a long yearling in 1929 amounted to $15.16. The long yearling sold at a weight of 300 pounds above the assumed calf weight. This means a cost of $5.05 per hundredweight for putting on the extra 300-pound gain in weight. This is less than the cost of keeping a long yearling until it becomes a 2-year-old, which was $18.82, excepting interest.

The long 2-year-old sales showed a 337-pound increase in weight as compared with sales of long yearlings. This gain cost $5.58 per hundredweight. This indicates that yearlings put on the cheapest gains of the 3 years. The sale weights used may explain this fact, yet the 337-pound gain for 2-year-olds was greater than the 300-pound gain for yearlings, which gave an advantage to the long 2-year-olds. Unfortunately, the weights used are not for the same cattle. Sale weights for 2-year-olds were for steers that were not weighed either as calves or yearlings. The weight of identical cattle for 3 consecutive years would be needed to determine actual gains and costs from year to year.

The foregoing discussion has been based upon the average costs for all ranches each year. Individual ranches show higher or lower costs per head and per hundredweight because of variations in general ranch expense, in death loss, in amount of winter feed used, in percentage calf crop, and in sale weights. The effects of such variations are obvious; consequently, the details for individual ranches are not discussed separately.

Hay Production

Detailed records of hay production were kept on 16 of the ranches for all 3 years, while the other 2 ranches kept such records for only 2 years. A great variation was disclosed in the efficiency of putting up the native hay. This was not entirely the result of different systems or methods used but depended to a large extent on climatic conditions. One ranch may have the finest of haying weather throughout the season, while a neighboring ranch may have showers to delay operations from time to time, causing expenses to mount and hay to spoil.

Various Sizes of Haying Crews

There were many variations, however, in handling hay labor that may be worthy of study. The most common practice was to have from 9 to 11 men in the crew at haying time and to shift them between operations as follows: mowing, 2 or more men; raking, 3 or fewer; sweep raking, 2 or fewer; operating pusher drivers, 1; stacking, 2 or fewer; and sickle grinding and supervising, 1, part-time. Very seldom can the boss assign to each hay hand one job for the season. This results in too much lost time. Frequently the mowers will get too far ahead of the stacking gang, resulting in hay getting too dry; or the mowers may not be able to keep far enough ahead of the stackers and rakers, causing delay and loss of time. The thing that must then be done is to shift men to whichever end of the crew is in need of help. The owner himself, if he works in the field at all, usually assumes the job of taking up the slack, or he may have one of his regular year-around men do it.

Another type of hay-crew organization is the half-size, but double-duty, crew. The operator will hire five or six men, all of whom are experienced in all phases of the work. He will then plan to do all the mowing in the forenoons and the raking and stacking in the afternoons. This has the advantage of permiting longer hours in the field. It also has the advantage of having fewer men to board in bad weather and of having all the men under closer supervision. This line-up has a disadvantage in that it requires more equipment, owing to the fact that some of the machinery must be idle part of the time. However, these data disclose no greater machinery expense per ton for this type of crew than for all ranches. This system requires more and better horses, as the longer hours and the changing from one task to another requires horses, as well as men, that are readily adaptable to different kinds of work.

Table 21 shows the average distribution of labor required to produce 100 tons of hay. It will be noted that the direct hay-harvest labor represents about two-thirds of the total. The

TABLE 21.—*Distribution of hay labor in days per 100 tons produced.*

	1929		1930		1931		Average	
Number of ranches	16		18		18		52	
Non-harvest	*Man-days*	*Horse-days*	*Man-days*	*Horse-days*	*Man-days*	*Horse-days*	*Man-days*	*Horse-days*
Dragging and clearing meadows	1.48	3.60	1.37	3.28	1.50	3.34	1.44	3.39
Repairing irrigating systems	1.26	2.24	2.75	4.16	3.44	4.43	2.53	3.68
Irrigating	6.76	6.94	6.68	6.37	6.26	6.26	6.57	6.50
Fencing stacks, repairing machinery, etc.	5.21	3.44	4.18	3.18	4.13	3.37	4.47	3.32
Total non-harvest	14.71	16.22	14.98	16.99	15.33	17.40	15.01	16.89
Harvest labor								
Mowing	9.00	18.00	7.94	15.87	9.16	17.68	8.64	17.08
Raking	9.01	18.02	8.34	16.68	9.20	18.41	8.82	17.63
Sweeping	5.86	11.72	5.37	10.73	5.42	10.85	5.53	11.06
Driving pusher team	2.09	5.60	2.24	4.74	2.33	4.87	2.23	5.04
Stacking	4.43	.....	3.93	.....	4.32	.....	4.20	.....
Supervision, etc.	1.24	.62	1.00	.46	2.08	.58	1.42	.54
Total harvest	31.63	53.96	28.82	48.48	32.51	52.39	30.84	51.35
Total all labor	46.34	70.18	43.81	65.47	47.84	69.79	45.85	68.24
Average yield, tons per acre	.98		.94		.84		.91	

remainder was spent in work on meadows and ditches, at irrigating, and at fencing haystacks. Of the total horse labor used in hay production, three-fourths was in the harvesting and one-fourth in non-harvest work.

Size of ranch in terms of tons of hay produced did not seem to influence the amount of harvest labor per ton in the least. Dividing the 18 ranches into groups of 6 each, the 6 largest ranches were found to average about 1,600 tons of hay, the 6 next in size about 700 tons, and the 6 smallest slightly more than 400 tons. The largest and the medium-sized groups each used 30.5 days of harvest labor per 100 tons produced, while the group of 6 smallest ranches used 30 man-days per 100 tons.

When hay labor other than harvest is considered, which includes such tasks as dragging and clearing meadows; work on ditches, dams, and dykes; irrigating; repairing hay machinery; breaking horses for hay harvest; and fencing stacks, the group of smaller ranches uses more labor. Expressed in days per 100 tons produced, the group of six largest ranches used 14.6 days of labor other than direct harvest, the intermediate group 13.3 days, and the six smallest ranches 19.3 days per 100 tons produced. This extra time on the smallest ranches was due to the fact that the operators did much of this work themselves, spending more time at it than they would willingly spend were it to be done by hired labor.

The size of the haying crew seems to have some bearing on the efficiency with which hay is harvested and stacked. Tak-

ing the five ranches with the largest hay crews (table 22), using from 12 to 17 men in the crew, it was found that they required 34.4 man-days to put up 100 tons of hay. Five ranches with the smallest crews, using from 5 to 7 men, required 33.0 man-days to the 100 tons, while the five ranches using 8 to 11 men in hay harvest put up 100 tons with only 27.8 man-days. The three ranches where the system of alternating mowing in the mornings and stacking in the afternoons was practiced consistently averaged 26.7 man-days per 100 tons for the 3-year period.

TABLE 22.—*Man-days used in harvesting 100 tons of hay, with yield per acre and cost per ton; 3-year average.*

Size of crew	Number of ranches	Man-days per 100 tons harvested	Yield per acre, tons	Labor, machinery, and overhead cost per ton	Land charges (tax and interest) per ton	Total cost per ton
12 to 17 men	5	34.4	0.97	$3.63	$1.38	$5.01
8 to 11 men	5	27.8	0.88	2.86	1.53	4.39
5 to 7 men	5	33.0	0.89	3.81	1.51	5.32
Alternating crew	3	26.7	0.87	2.89	1.55	4.44
Average for all ranches*		30.8	0.91	3.29	1.47	4.76

*The average crew for the 3 years put up 28.6 tons of hay per day.

Table 22 compares the four different sizes and types of harvest crews on the basis of man-days per 100 tons harvested. In addition, this table shows yield in tons per acre and cost per ton. This cost is not for harvesting alone but includes all charges against the hay crop. It will be noted that the large-crew group of five ranches shows about 1/10-ton better yield than the other three groups. This fact, which cannot be attributed in any way to size of haying crew, caused this group to make a somewhat better showing than would have been the case had the yield been the same in all groups.

One factor that must not be overlooked in determining the size of crew to use is that the job must be completed within a certain length of time. Otherwise the quality of the hay will be impaired. It is better to use two smaller crews than one that is overly large. The large crew is awkward and unwieldy to handle. Most of the hands are strangers, and some may not be familiar with the work. The greater the number, the longer it takes the boss to find out these discrepancies and to adjust them. The medium-sized crew seems to be the best balanced. It permits the operator to work in the field at least part of the time, besides overseeing. The small-sized crew is less flexible than either the large or medium-sized crews but has the advantage of responding to the operator's initiative. In this size of crew, the operator invariably works in the field with his men. The alternating crew is the equivalent of a large crew that works part-

time at different tasks. When this crew is mowing there may be six or seven teams in the field. This is as many or more than the largest crews use at any one time. Likewise, when stacking they equal any stacking crew in number. As already mentioned, more hours of work per day are obtained in this organization. Since the pay per day is very nearly the same in all cases, it is obvious that this system will reduce the cost per ton. To compensate the laborer for the greater total hours per day is the fact that the tasks are changed during the day. The monotony of the work is broken, and more work is done per worker.

Only one of these ranches used a tractor in hay production, and then only for 1 year. This, of course, was insufficient data upon which to base any definite conclusions, but it is interesting to note that, for the 1 year the tractor was used, man-days per ton of hay produced were higher and horse-days per ton slightly less than for the other 2 years that this particular ranch kept detailed records.

Horses are raised by most ranchmen and at very small expense, running for the most part on the public domain and even in winter requiring but scant attention and feed. The work of breaking them to work fits in nicely with other jobs on the ranch, such as cattle feeding in the winter time. The snow is usually deep enough to prevent serious runaways and the smashing of expensive machinery. For these reasons, it is believed improbable that the tractor will find a very wide use in this section, at least until conditions change the cost of producing horses.

In computing the cost of producing hay, the charge for labor is the most important factor. As shown in table 21, the average man-labor to produce a ton of hay was 0.46 days. With average wages of $3.08 per day, including board, this would amount to $1.41 per ton. The horse-labor requirement was 0.68 days per ton. This was figured at a rate which averaged $1.42 per day, or 97 cents per ton of hay. The charge for machinery, which is made up of depreciation, repairs, and interest on investment, amounted to 65 cents per horse-day, or 45 cents per ton. The other items that enter into the cost of hay production aside from the land charge, called overhead charges, include such items as taxes on hay machinery, machine shed costs, automobile and truck expense, maintenance and interest on investment in improvements used in hay production, telephone, lights, transportation, and other miscellaneous expense with labor. The overhead amounted to 46 cents per ton produced.

The 3-year-average cost of producing hay was $3.29 per ton for all costs except that for use of land, and $4.76, including taxes and interest on land. The hay sold brought $6.54, which was $1.78 more than enough to pay all costs, including interest. How-

TABLE 23.—*Cost of producing hay on 18 North Park ranches.*

	Cost per ton			
	1929	1930	1931	Weighted average
All man labor	$1.72	$1.36	$1.20	$1.41
All horse labor	1.05	.98	.87	.97
Machinery charges	.46	.42	.47	.45
Overhead charges	.46	.44	.48	.46
Total	3.69	3.20	3.20	3.29
Taxes on hay land	.25	.26	.22	.24
Interest on investment in hay land	1.18	1.19	1.33	1.23
Total cost, including land charges	5.12	4.65	4.57	4.76
Sale price per ton	7.13	7.23	4.25	6.54
Ending-inventory price per ton	6.26	5.36	4.83	5.47

ever, in 1931 hay was sold at a price which failed to pay 6 percent on the land investment. It did, however, pay all costs except interest and left $1.01 per ton to cover interest. This is a much better comparative showing than that made by the cattle ranches as a whole, whose total sales in 1931 failed to give any return upon investment, even when no charge was made for reduced inventories. In most years hay production is more profitable than cattle production, if these reports may be taken as of a representative situation.

Variations in Hay Costs

These costs, including interest, varied considerably between the individual ranches. In 1929 the lowest was $3.31 and the highest $6.95 per ton of hay. Costs on only two ranches were under $4.00, and on only two were they over $6.00. In 1930 the costs varied from $3.39 to $6.10, while in 1931 the lowest cost was $3.57 and the highest $7.48. In 1931 costs on 4 of the 18 were under $4.00 and on 4 were above $6.00. The ranches where costs were above $6.00 (in 1931) had yields that averaged slightly more than ½ ton per acre.

The reason for low yields was mostly lack of irrigation water. This is particularly true of those ranches located on the smaller streams, as these streams always dry up first in a dry season. The yield per acre influences the cost per ton more than anything else. The same area must be covered, the same machinery and horses used, practically the same amount of harvest labor employed, and the same amount of taxes paid, regardless of the yield. As a matter of fact, in a dry year more labor may be spent on irrigating than in a normal season, in an effort to make the best use of the water.

Some ranchmen consider a "moderate" shortage of irrigation water a blessing rather than a curse. The reason given is that under such circumstances more care is used in irrigating, and

the water is changed from one field to another instead of turning it on in the spring and letting it run in the same place the entire season, which is the usual practice when there is an abundance of water. While there is as yet no evidence that changing or alternating the irrigation water actually increases the tonnage, close observers among the ranchmen are emphatic in their statements that this practice improves the quality and feeding value of the hay.

Analysis of Selected Ranches

A study of the tabulated data will at once disclose the fact that some of these ranches were more profitable than others, some were moderately profitable, while the others were very unsatisfactory in their returns.

Two ranches will be discussed in some detail, with a view of discovering, if possible, why one ranch makes money for its owner while another loses.

Ranch 279

This ranch made the highest percentage return to investment. It is made up of a total of 2,480 acres of deeded land, of which 1,000 acres is hay meadow. In addition to this, there were 1,420 acres of grazing land and 100 acres of hay meadow leased in 1929. In 1930 and 1931 a total of 2,440 acres was leased, of which 600 was hay land. The leased grazing land was used to take the place of national-forest grazing permits for cattle. Some of the horses, however, were run on the forest reserve.

The leased hay land was not needed for the production of winter feed, but the operator saw a chance to increase his cash income with the sale of hay. Some pasture was also sold during the first 2 years.

At the beginning of the study in 1929, there were 208 cattle on this ranch, of which 200 were mature cows and 8 were bulls. By the end of 1931 the herd had increased to 380 head. Of this number, 212 were cows, 59 coming 2-year-old heifers, 88 coming yearling heifers or heifer calves, 5 steer calves or coming yearling steers, 4 coming 2-year-old steers, and 12 bulls. Based on the opening inventories of each year, the average number of cattle of all ages was 282.

Based on the amount of hay produced on owned land and the customary feeding practices, this ranch will winter about 285 cattle units without buying additional roughage or leasing hay land. This ranch was about 27 percent understocked in 1929 and about 17 percent overstocked at the end of 1931.

This ranch is very well improved and equipped. It is part of a once much larger ranch, and nearly all the improvements and equipment used in the larger production of the past

are now charged against this smaller herd. The average investment in improvements amounts to $58 per head of cattle, in machinery and equipment $11 per head of cattle, and in horses $6.50 per head of cattle.

One of the handicaps on this ranch was the extremely high total investment compared with the number of cattle. At the beginning of 1929 it stood at $331. This was very drastically reduced, however, for at the end of 1931 it figured $161. This reduction was accomplished mostly by the increase in cattle numbers, together with the reduced inventory values of cattle. Six percent on $161 is almost $10 and makes a heavy charge against an animal, even in the best of times. Six percent interest on the 1929 investment would be nearly $20 per head for interest charges.

The indebtedness was also relatively high. It stood at $27,500 at the beginning of the study and was reduced but $1,450 during the 3 years. The total debt averaged $96 per head, and the total chattel debt $44. The real estate debt averaged only about $5.65 per acre of deeded land.

The high-percentage calf crop obtained on this ranch was an outstanding factor in making it a successful ranch. An average of more than 90 percent was secured over the 3-year period. This was accomplished chiefly through a careful selection of the breeding cows, getting rid of those that were not regular breeders, and keeping the good ones as long as possible. Out of a total of 603 cows bred to calve during the 3 years, only 26 were heifers bred to drop their first calves. This, of course, is not sufficient replacement to maintain a breeding herd, but the entire cow herd was composed of 4-, 5-, and 6-year-old cows at the beginning of 1929, and the 26 heifers were added in 1931. Ordinarily, not less than 12.5 percent of the breeding herd should be heifers with their first calves.

The use of fenced pastures for the breeding herd also contributed toward the high calf crops. An average of 4,600 acres was used for pasturing the cattle each year. Of this, 3,180 was summer pasture, and about one-sixth was irrigated. This carried the cattle from about the first of June to the end of August. After adjusting for pasture sold, this figured out to be about 9.3 acres per head, not counting the young calves. The hay meadows were used for spring and fall pasture for about 1 month in the spring and again through September and October, and sometimes through most of November, in the fall. The average date of the end of fall grazing was November 15. The meadow pasture amounted to slightly more than 4 acres per head, not counting the small calves.

The main market class was steer calves sold about the middle of January, after being fed native hay and some cake and

grain for a period of from 70 to 90 days. About 10 percent of the steer calves were held back and sold as yearlings the following season. No heifer calves were sold, but long yearling heifers were culled out and sold. These were not by any means "culls" from a market viewpoint, as they averaged 760 pounds on the Denver market, while the average for all ranches was 671 pounds for this class.

All livestock marketed averaged better in weight than that from the other ranches. This greater weight was caused to some extent by the fact that some 600 pounds more hay was fed per head over a season about 20 days longer than the average winter feeding period for all ranches.

The steer calves fed in the fall of 1929 and 1930 got all the good native hay they could eat, together with ½ to ¾ pound of cottonseed cake. In 1931 the concentrate ration was changed to about 2 pounds of barley and ¾ pound of cake per day. The hay consumption averaged about 18 pounds per day.

The 1929 steer calves averaged 465 pounds at their mid-January sale, the 1930 calves 482 pounds, and the 1931 calves 499 pounds. A fair estimate is that these calves averaged 400 pounds when feeding began in the fall. Charging market value for the feeds used makes the average feed cost per 100 pounds of gain $6.50.

Death loss was held to a minimum, except on young calves in 1931, when it amounted to 7.7 percent. This had the effect of reducing the calf-crop percentage to 87 for that year. Naturally, under these conditions the beef production per head of cattle is quite high. This averaged 335 pounds and ranked highest of all ranches in this study.

Hay production was highly efficient on this ranch, being the third lowest in operating expense per ton. On this ranch the practice of mowing in the morning and stacking in the afternoon was followed. The operating cost per ton was $3.40 in 1929, $2.65 in 1930, and $2.52 in 1931. Interest on investment in hay land is not included in these costs.

Cash income on this ranch averaged $31.50 per head of cattle for the 3 years. Of this, a little over $22 was from cattle sales. In 1929 the hay and pasture sold netted nearly $1,900, or almost enough to cover the entire hired-labor expense. In 1930 the hay and pasture sales brought in nearly $2,000, or $450 more than enough to cover the total ranch-labor bill. In 1931 hay was sold for $1,140, which lacked about $280 of paying the ranch laborers.

Another source of cash income, aside from sale of cattle, was from the work of the extra horses and equipment off the ranch. In 1929 a contract was taken to put up the hay on an adjoining ranch, which brought in about $1,000. Some work

was done on the county roads which amounted to $200 in 1929 and $400 in 1931. This ability to make some extra money without very materially increasing the ranch expense has proved a life-saver to a good many cattlemen.

Cash operating expenses on this ranch amounted to $12.50 per head of cattle, or $2.66 higher than the average for all ranches. The various items of expense, when compared with the average for all ranches, show a good deal of variation. Hired labor was 77 cents higher, taxes 20 cents higher, leases and fees $1.00 higher, automobile and truck expense 49 cents higher, and miscellaneous expense 39 cents higher. The items of purchased feed and repairs to improvements and equipment were less than the average; namely, 9 cents and 11 cents, respectively.

Cash paid out, other than operating expenses, also was considerably more than the average. Interest payments totaled $3.68 per head; purchases of livestock, mostly bulls, $1.96; new improvements 46 cents; and new equipment $3.07 per head. This last item consisted of a new car and a new truck.

SUGGESTED REORGANIZATION PLAN FOR RANCH 279.—As stated before, the capacity of this ranch, exclusive of rented land, was about 285 cattle units. This is based on the hay tonnage produced on the deeded land and on actual feeding practices. If a herd is set up on this basis, using the actual percentage calf crop and death loss, it gives an inventory of cattle to winter somewhat as follows: 200 cows, 32 coming 2-year-old heifers, 90 coming yearling heifers, and 9 bulls. One of the reasons for high calf crops on this ranch was the small proportion of heifers in the breeding herd. Therefore, in this reorganization plan we will replace a minimum of cows and have the replacement of heifers bred to drop their first calves as 3-year-olds. The steer calves will be sold as has been the regular practice, and the surplus heifers will be sold as long yearlings.

With the aforementioned numbers of cattle at the beginning of this study in 1929, keeping the herd constant from year to year and using actual market weights and prices for this ranch, the cash income from cattle sales would have been $9,665 greater for the 3 years than it was under the actual conditions. This is a yearly average of $3,222, which would be reduced by the elimination of hay sales and income from rented pasture. After adjusting the figures for these items and the saving in expenses, such as hay baling, lease cost of hay land, purchase of hay, and decrease in hay labor, there is still more than $2,400 cash income per year in favor of this suggested plan.

Table 24 summarizes some of the data for ranch 279, together with comparative information for ranch 263.

TABLE 24.—*Comparison of selected ranches, 3-year averages.*

Ranch number	279	263
Total ranch area	4613	2353
Owned	2480	1060
Rented	2133	1293
Acres hay land	1000	550
Tons hay produced	1085	582
Number cattle first of year	282	278
Cows	192	150
Heifers, coming 2's	17*	37
Heifers, coming 1's	55	46
Steers, coming 1's	8	29
Steers, coming 2's	.....	8
Steers, coming 3's	.....	2
Bulls	10	6
Number calves branded	182	111
Number horses first of year	115	15
Investment, total	$67,383	$48,612
Land	20,200	17,349
Improvements	16,463	5,817
Equipment	3,042	1,646
Cattle	23,282	18,168
Other livestock	.....	689
Horses	1,828	605
Feed and supplies	2,566	4,338
Indebtedness	27,000	16,500
Owner's equity	40,383	32,112
Cash income	8,871	5,302
Cash expenditures, total	6,108	6,417
Current expenses	3,524	3,369
Livestock purchased	552	859
New improvements	128	503
New machinery and automobiles	867	408
Interest paid	1,037	1,278
Net cash	2,763	−1,115
Depreciation, buildings	665	184
Depreciation, machinery	550	329
Unpaid family labor	13	.....
Operator's labor	956	1,100
Net†	635	−2,706
Adjusted net‡	6,075	−277
Percent return on investment‡	9.01	−.57

*Only 9 head used in breeding herd.
†With correction for changes in inventory values of livestock and feeds.
‡Net when first-of-the-year valuations are held constant for each year.

Ranch 263

Ranch 263, table 24, was a small ranch of 900 acres at the beginning of this study. This land was used as follows: 550 acres in native-hay meadow, 290 acres in irrigated pasture, and 60 acres of dry grazing. This was increased at the beginning of 1931 by the purchase of 480 acres of dry grazing land. An average of 1,293 acres of pasture was leased for each year. The national forest was used for grazing only 1 year, and then for only 50 head.

At the beginning of the study in 1929 there were 259 cattle inventoried. Of these, 157 were cows, 28 coming 2-year-old

heifers, 44 coming 1-year-old heifers, 5 bulls, 20 coming yearling steers, and 5 steers 2 years old and over. In addition, there were 23 head of sheep. At the end of 1931 the inventory stood at 318 head of cattle and 116 sheep. Of the cattle, 174 were cows, 47 coming 2-year-old heifers, 70 coming yearling heifers, 7 bulls, and 20 coming yearling steers.

The weights and prices at the market seem to indicate that the quality of the cattle was near or above the average. The cows sold from this ranch averaged 60 pounds more than the cows from all ranches, steer calves 10 pounds more, and the long yearling steers 8 pounds less. The cows netted about 45 cents per 100 pounds more than the average, and the steer calves fell short 55 cents in 1930 but exceeded the average by $1.25 per 100 pounds in 1931. Long yearling steers sold for a little less than the average for all ranches. Bulls that were bought during this study were high-priced, and this should be an indication of good-quality cattle. A total of six bulls was purchased at an average price of $311, while the average for all bulls bought by the 18 ranches was $212.

The investment on this ranch is rather high, being $175 per head of cattle for the 3-year average. The opening inventory valuations per head of cattle in 1929 were apportioned as follows: land $62, buildings and improvements $21, machinery and automobile $6, range cattle $65, sheep $2.50, horses $2, and feeds and supplies $16. At the end of the year 1931 the investment was $57 in land per head of cattle, $20 in buildings and improvements, $4 in machinery and automobile, $40 in cattle, $3 in sheep, $1 in horses, and $10 in feeds and supplies.

The indebtedness on this ranch underwent several changes during this study. In 1929 there was $15,000 against the real estate. No mortgage was against the livestock at this time, but some money was borrowed at a bank for operating expenses, and this debt was secured by personal notes. Because fewer cattle were sold than usual, this debt was increased by $1,100 in 1929. In 1930 the real estate mortgage was refinanced by a federal farm loan for $8,000, and the balance of the indebtedness was covered by a $9,000 chattel mortgage against the livestock. This was again slightly increased during 1931. The 3-year-average debt per head of cattle, both real estate and chattel, was over $59.

The method of handling the breeding herd was to breed in the pasture. Only 50 head were run on the national forest 1 year, and these were not breeding stock. However, the pasture was for the most part leased and was located a considerable distance away from the headquarters and in other respects was not much different from the national forest. The average dates for starting and ending winter feeding of hay were November 16 and

May 7 for breeding stock and November 12 and May 10 for coming yearlings and older steers. A great deal of variation in the method of feeding market cattle occurred. In the winter of 1929-30 there were 20 coming 2-year-old steers fed hay from November 1 to February 10, then hay and grain to June 10, then grain on pasture to August 10, at which time they were shipped. The grain ration, which consisted of two-thirds corn and one-third barley, averaged about 3½ pounds per day per head for 180 days. The steers averaged 883 pounds on the market and netted only $7.45 per hundred. This was about 50 cents less than the net per hundredweight for all steers of this age sold by all ranches in 1930, as well as 114 pounds lighter than average weight.

The calf crops on this ranch were very unsatisfactory in 1929 and 1930, being 52 and 54 percent, respectively. In 1931, however, there was a fair calf crop of nearly 70 percent. It is rather difficult to ascribe reasons for those two poor calf crops. The death loss in young calves was about three per hundred in excess of the average for those 2 years. The loss by abortion was 3.5 greater per 100 cows. Nearly all the abortion occurred among the 2-year-old heifers. The proportion of 2-year-old heifers in the breeding herd was a little high, but not excessive.

Death loss was greater than the average for all ranches. With the low calf crop and the larger death loss, the beef production per head was 264 pounds as against 284 pounds for all ranches.

The marketing practice was not consistent, either as to class of cattle sold or time of sale.

The hay production on this ranch would allow for a few more cattle than were actually kept during the study. An average of 582 tons were put up per year. The amount of hay fed per head averaged slightly more than 2¼ tons. This would allow for an average of 258 cattle, which is 9 more than the number actually wintered. It is not a fault, but rather a good plan, to have just a little more hay than has been found to be the actual requirement.

The hay was produced with practically the same efficiency as the average for all ranches. The operating cost was 20 cents per ton less than the average for all ranches. The average yield per acre was slightly higher than for all ranches. More labor was used in growing the hay crop, but less for harvesting than the average for all ranches. The alternating system of handling the hay-harvest crew was used, mowing in the mornings and raking and stacking in the afternoons.

Cash income on this ranch averaged $5,302 per year, or $19.10 per head of cattle, of which $17 was from sales of cattle. The other cash income averaged $170 per year from sale of

lambs and wool, and $406 from sale of hay and miscellaneous items.

The cash current expenses on this ranch averaged $3,369 per year, or $12.13 per head for the 3 years, and was $2.29 higher per head than the average for all ranches. Paid labor accounted for nearly half of the cash current expense, with $5.81 per head; other items of cash current expense were taxes $1.34, pasture and grazing fees 90 cents, feed and salt $1.12, automobile expense $1.61, and repairs 30 cents; the remainder of $1.05 was spent for other miscellaneous items, such as vaccine, telephone, insurance, and travel. There were other cash outlays which made heavy inroads upon the income. Chief among these was the item of interest payments on borrowed capital. This amounted to an average of $4.60 per head, which is $2.24 more than the average for all ranches.

The purchase of bulls required $2.24 per head of cattle against $1.42 for the average. New buildings and improvements cost $1.81 per head, while 63 cents was sufficient for the average. New machinery and equipment bought amounted to $1.47 per head, and this item was 56 cents higher than the average for all ranches.

Summarizing, this rancher spent $22.25 per head of cattle for the items of current expenses, interest, purchase of bulls, and new buildings and equipment, while the cash income was only $19.10 per head. The obvious difficulties center around excessive expenditures, low calf crops, high death loss, and unstable marketing practices.

SUGGESTED REORGANIZATION PLANS FOR RANCH 263.—The average of the opening inventories of cattle on this ranch was 187 cows and coming 2-year-old heifers, 46 coming yearling heifers, 8 bulls, 28 coming yearling steers, and 10 2-year-old steers. Using the actual percentages of calf crop obtained and death loss incurred, the actual market weights and prices received, and selling the same age classes actually sold, but selling all cattle above the heifers needed to maintain the herd, would have increased the cash income from the sale of cattle by an average of $1,057 per year. This increased income could have been obtained without additional cost.

Another alternative program that might be suggested for this ranch is to produce for market long yearling steers and heifers. About 13 percent of the heifers would be reserved each year to replace cull cows. A calf crop of 80 percent (3-year average of four pasture breeders) should be possible. This ranch will carry 250 cattle, exclusive of work stock. On this basis there would be in the beginning-of-the-year inventory 152 cows, 22 coming 2-year-old heifers, 7 bulls, and 139 coming yearling heifers and steers.

The sales would consist of all surplus cattle. If the average weights and net prices obtained during this 3-year study by all ranches is applied to these sales, this ranch would have had a cash income from cattle sales of $6,500 per year, which is $1,200 more than the actual figure. If this program can be adopted at all, it should be possible to accomplish the change without much, if any, added expense. No additional feed or pasture would have to be purchased. The possibilities for increasing income on this ranch are limited by the size of the outfit.

Figure 7.—Stacking hay in North Park area, showing push driver.

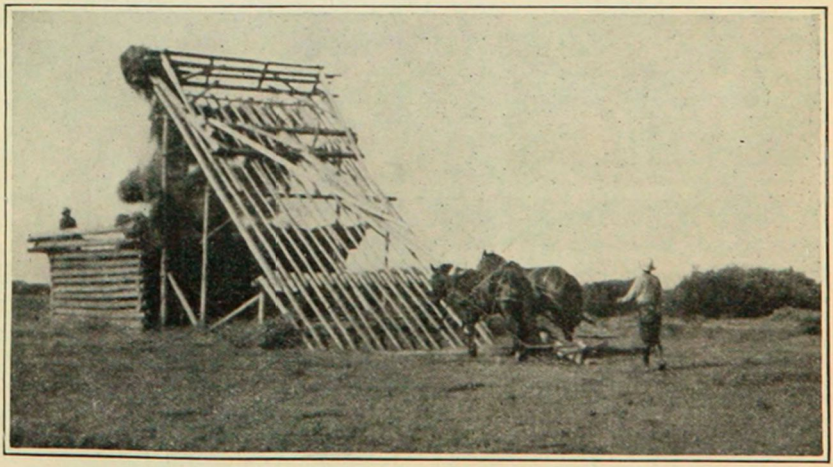

Figure 8.—Stacking hay in North Park area; pushing load of hay to top of stack.

Calculated Ranch Budgets

THE DATA analyzed in this study have been used as the basis for preparing budgets to indicate sales and expenses on theoretical ranches organized to sell their surplus cattle as calves, yearlings or 2-year-olds, and fat cows. The average sale price for the 3-year study was used for each class of cattle. Since the average hay production per ranch for the 3 years was 1,005 tons, this was taken as a starting point. No change was made in the horses; they used 36 tons of hay per year, according to the available data. Using average calf crops and death losses, table 25 shows the cattle organization and sales.

The basis for establishing the relative proportions between cows and bulls was as follows: Cows were kept 8 years in the breeding herd, requiring 12.5-percent replacement each year; bulls were kept 3 years in service, requiring 33⅓-percent replacement each year; 27.4 cows and heifers were kept for every bull. With these ratios, herds were organized so that they would consume about equal quantities of hay. In some instances slight modifications in numbers were necessary in order to avoid fractions. As a result, the final set-up causes a variation from 468 to 509 head of cattle the first of the year and from 861 to 875 tons of hay required for winter cattle feeding.

In order to eliminate the influence of the Denver stock-show sales, the sale weights and sale prices used were the simple 3-year averages for the months of September to December, inclusive, except in the following cases: For fat cows the late July and August sales were included, as many ranchmen cut out dry cows at this time; for yearling heifers the average price was for the 2 years 1929 and 1931, since the 1930 prices were not typical; for heifer calves an estimated sale price was used, as no sales were reported for these months.

The most difficult data to assemble for such an analysis proved to be that regarding sale weights of each class of cattle. Ranchmen differ widely in their practices as to the time of year at which they sell cattle and as to practices in culling out their herds. In table 25 the average sale weights for each class of cattle for the months of September to December, inclusive, were used, except for calves. Here the data were too meager to justify their use, and estimated weights of 385 pounds for steer calves and 350 pounds for heifer calves were selected as representative of spring calves. Obviously, the sale weights and the sale prices affect the final results. Individuals when studying this table may substitute their own experience and check the results.

Six organization budgets were prepared. They are found in table 25. The significant differences between these budgets are

as follows: Budget A was for a ranch that sells all its surplus cattle as calves; 136 steer calves and 84 heifer calves were sold, and the remaining heifer calves were kept to replace old cows. Using the 3-year-average price, the net cattle receipts from this ranch would be $9,749.

Budget B is for the sale of all surplus cattle as yearlings, 96 yearling steers and 59 yearling heifers being sold, together with fat and cull cows. The net cattle receipts would be $9,372.

Budget C is for the sale of 2-year-old cattle, 68 steers and 42 heifers being sold. The net cattle receipts would be $9,073.

Budget D is similar to budget A, except that all heifers are kept until they are mature and then are sold as fat cows. One hundred nineteen calves and 98 fat cows would be sold each year. The net cattle receipts would be $10,843.

Budget E is similar to budget B, except that fat cows are sold in place of yearling heifers. The net cattle receipts would be $10,597.

Budget F sells fat cows in place of 2-year-old heifers, 75 2-year-old steers and 67 fat cows being sold. The net cattle receipts would be $10,744.

Table 26 compares these six budgets, covering all receipts and expenses in contrast to the 3-year averages for all ranches. Hay sales vary between budgets. The miscellaneous sales of $208 used in the budgets represent the cattle products and miscellaneous sales of the actual ranches, while the $316 miscellaneous sales for the actual ranches include some sheep and horse sales.

Expenses were handled on a uniform basis: general ranch expense at $4.63 per head of cattle, purchased feed at $1.78 per head, 1,005 tons of hay in each case at $3.53 per ton, bull purchases at $185 each. Miscellaneous costs not chargeable to hay or cattle were $316 per ranch for the actual ranches. They were entered at this figure for all budgets. Interest on cattle was charged at $6.63 per head, while interest on hay land was charged at $1.23 per ton. While these charges may appear out of line with present conditions, they were used since they were based upon expenses during 1929-31 and permit a direct comparison between actual and theoretical returns.

The last two lines in table 26 show the comparative results. The actual ranch records, when set up according to this table, had $1,499 available to pay interest on investment. With the theoretical budgets, this varied from $2,305 for the 2-year-old steer budget to $3,771 for 2-year-old steers and fat cows.

The fat-cow combinations were the best. Fat cows and 2-year-old steers resulted in $2,272 more cash income than the

TABLE 25.—*Ranch budgets; a comparison of cattle sales at uniform prices for ranches selling calves, yearlings, and 2-year-olds.*

	Number first of year	Number purchased	Calves raised	Death loss number	Sales number	Weight per head, pounds	Total pounds sold	Simple 3-year-average net price	Net receipts	November, 1932 net price	Net receipts
A. Selling calves, except replacement heifers											
Cows	350		400*	7	11	963	10,593	$3.71	$ 393.00	$1.52	$ 161.01
Cows, fat					30	1,085	32,550	5.71	1,858.60	2.49	810.50
Heifers, 2's	50			2							
Heifers, 1's	52			2							
Bulls	16	5		1	4	1,420	5,680	3.93	223.22	1.52	86.34
Calves, heifers			136		84	350	29,400	8.25	2,425.50	3.50	1,029.00
Calves, steers			136		136	385	52,360	9.26	4,848.54	4.57	2,392.85
Total	468	5	272	12	265		130,583		9,748.86		4,479.70
B. Selling yearling steers and excess yearling heifers											
Cows	259		296*	5	8	963	7,704	$3.71	$ 285.82	$1 52	$ 117.10
Cows, fat					23	1,085	24,955	5.71	1,424.93	2.49	621.38
Heifers, 2's	37			1							
Heifers, 1's	100			4	59	643	37,937	6.39	2,424.17	3.48	1,320.21
Bulls	12	4		1	3	1,420	4,260	3.93	167.42	1.52	64,75
Calves, heifers			100								
Calves, steers			101								
Steers, 1's	101			5	96	685	65,760	7.71	5,070.10	4.49	2,952.62
Total	509	4	201	16	189		140,616		9,372.44		5,076.06
C. Selling 2-year-old steers and excess 2-year-old heifers											
Cows	191		218*	4	6	963	5,778	3.71	214.36	1.52	87.83
Cows, fat					16	1,085	17,360	5.71	991.26	2.49	432.26
Heifers, 2's	71			3	42	846	35,532	5.73	2,035.98	3.10	1,101.49
Heifers, 1's	74			3							
Bulls	9	3			3	1,420	4,260	3.93	167.42	1.52	64.75
Calves, heifers			74								
Calves, steers			74								
Steers, 1's	74			4							
Steers, 2's	70			2	68	1,022	69,496	8.15	5,663.92	4.37	3,036.98
Total	489	3	148	16	135		132,426		9,072.94		4,723.31

TABLE 25.—*Ranch budgets. (continued)*

	Number first of year	Number purchased	Calves raised	Death loss number	Sales number	Weight per head, pounds	Total pounds sold	Simple 3-year-average net price	Net receipts	November, 1932 net price	Net receipts
D. Selling calves and fat cows											
Cows	236		350*	5	7	963	6,741	$3.71	$ 250.09	$1.52	$ 102.46
Cows, fat					98	1,085	106,330	5.71	6,071.44	2.49	2,647.62
Heifers, 2's	114			4							
Heifers, 1's	119			5							
Bulls	17	6		1	5	1,420	7,100	3.93	279.03	1.52	107.92
Calves, heifers			119								
Calves, steers			119		119	385	45,815	9.26	4,242.47	4.57	2,093.75
Total	486	6	238	15	229		165,986		10,843.03		4,951.75
E. Selling yearling steers and fat cows											
Cows	198		294*	4	6	963	5,778	3.71	214.36	1.52	87.83
Cows, fat					83	1,085	90,055	5.71	5,142.14	2.49	2,242.37
Heifers, 2's	96			3							
Heifers, 1's	100			4							
Bulls	14	5		1	4	1,420	5,680	3.93	223.22	1.52	86.34
Calves, heifers			100								
Calves, steers			100								
Steers, 1's	100			5	95	685	65,075	7.71	5,017.28	4.49	2,921.87
Total	508	5	200	17	188		166,588		10,597.00		5,338.41
F. Selling 2-year-old steers and fat cows											
Cows	161		239*	3	5	963	4,815	3.71	178.64	1.52	73.19
Cows, fat					67	1,085	72,695	5.71	4,150.88	2.49	1,810.11
Heifers, 2's	78			3							
Heifers, 1's	81			3							
Bulls	12	4		1	3	1,420	4,260	3.93	167.42	1.52	64.75
Calves, heifers			81								
Calves, steers			81								
Steers, 1's	81			4							
Steers, 2's	77			2	75	1,022	76,650	8.15	6,246.98	4.37	3,349.60
Total	490	4	162	16	150		158,420		10,743.92		5,297.65

*Represents number of cows and heifers used as basis for calculating calf crop.

TABLE 26.—*Comparison of ranch income and expense for methods of sale given in table 25.*

	Calves	Yearlings	2-year-olds	All actual ranches	Calf and cow	Yearling and cow	2-year-old and cow
	A	B	C		D	E	F
Number head	468	509	489	513	486	508	490
Receipts:							
Cattle	$ 9,749	$ 9,372	$ 9,073	$ 8,659	$10,843	$10,597	$10,744
Hay	648	600	576	416	594	588	564
Miscellaneous	208	208	208	316	208	208	208
Total	10,605	10,180	9,857	9,391	11,645	11,393	11,516
General expense at $4.63	2,167	2,357	2,264	2,375	2,250	2,352	2,269
Purchased feed @ $1.78	833	906	870	913	865	904	872
Hay production costs on 1,005 tons	3,548	3,548	3,548	3,548	3,548	3,548	3,548
Miscellaneous costs	316	316	316	316	316	316	316
Bull purchase	925	740	555	740	1,110	925	740
Sub-total	7,789	7,867	7,553	7,892	8,089	8,045	7,745
Interest on cattle at $6.63 per head	3,103	3,375	3,242	3,401	3,222	3,368	3,249
Interest on hay land @ $1.23 per ton	1,236	1,236	1,236	1,236	1,236	1,236	1,236
Total, including interest	12,128	12,478	12,031	12,529	12,547	12,649	12,230
Available toward interest	2,816	2,313	2,304	1,499	3,556	3,348	3,771
Advance over actual ranches	1,317	814	805		2,057	1,849	2,272

average for the actual records. Where surplus cattle were sold as growing cattle, rather than as fat cows, the calf budget was best.

The effect of changing inventory values was not considered in preparing these budgets. They were based upon 1,005 tons of hay, of which approximately 100 tons were sold. This gave a margin which should cover variations in hay yield or feed requirements from year to year. They were based upon the assumption that the size of the herd would be kept constant. As stated previously, the sale weights and sale prices are important features of any budget.

Since the weights of cattle sold should remain fairly constant, the use of current cattle quotations and the sale weights shown in table 28 will permit a study of the comparative cattle income from these budgets under any market condition. For example, in November 1932 the existing prices at Denver resulted in the largest cattle sales from the yearling-steer and fat-cow budget, and the smallest sale from the steer-and-heifer-calf combination. For the 9 years 1927 to 1935, inclusive, the net prices to North Park cattlemen for sales on the Denver market were as shown in table 27. Applying these prices, the yearling-steer and fat-cow budget was highest and the calf budget the lowest, but all six budgets gave better returns than from the average of all ranches. If these budgets may be taken as

representing possibilities, then it is apparent that cattlemen can improve their income by re-organizing their business and adopting consistent sales policies.

TABLE 27.—*Average Denver prices; cattle sale prices reduced by average marketing and transportation costs to represent "net prices to ranchmen" for western Colorado; 9-year-average prices, 1927 to 1935 inclusive.*

Class	Net price per cwt.
Cows	$4.90
Heifers, yearlings	5.68
Heifer calves	5.82
Steer calves	6.95
Bulls	4.22
Yearling steers	6.78

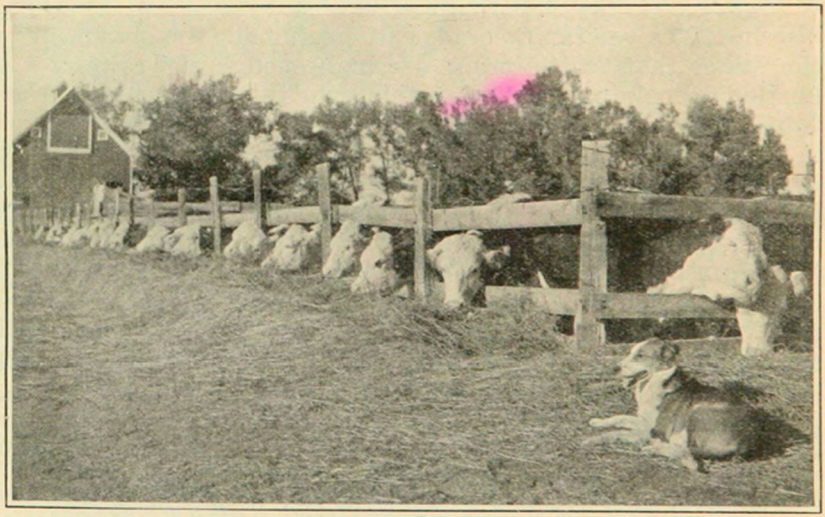

Figure 9.—Hereford cattle in a Colorado feedlot.

Problems of Cattle Prices and Marketing

PRICE TRENDS have perhaps a greater influence on ranch incomes than any other single factor. On this factor, at least, more blame for failure and more credit for success or profit are showered than on almost any other. It is usually forgotten or overlooked that the seeds of failure and ruin are sown in periods of high prices and good times, and likewise, that the foundations for a sound and profitable ranch enterprise are more often laid during a period of depression or of low prices and hard times.

During a period of high prices and good times, certain personal expenses have a tendency to increase, and it is almost impossible to eliminate some of these when prices decline. These do not, as a rule, take the form of increased ranch-operating expense so much as they appear in the personal or family living expense. It is comparatively an easy matter to get along with a little less hired labor, fewer repairs, and fewer other ranch-expense items when cattle prices decline.

In 1925 a veteran Colorado cattleman made the statement to the writer that "cattle prices are high enough right now for a hustler to make money." But this man further remarked that "you can't make money in the cattle game if you want to live in town or chase around in a car all the time. You will even have to get out of the saddle and do something besides riding around and looking at the cattle." This man had started with cattle back in the 90's and related that "for many years after that $32.00 for a good 3-year-old steer was considered a good price."

It may be of interest to note that in 1925 prices of 3-year-old steers from the mountain ranches of Colorado averaged $64.00, or exactly twice as much as the "good price" of the earlier years. It is of further interest to note that in 1929 steers of the same age class from the North Park ranches netted the producers nearly $149.00, or four and two-thirds times as much

TABLE 28.—*Net sale price per hundredweight, North Park ranches.*

Class of cattle	1929	1930	1931	3-year weighted average
Cows, breeding stock	$ 7.97	$ 7.50	$ 5.00	$ 7.70
Cows, fat	8.04	5.27	3.84	5.99
Cows, culls	5.28	3.29	2.45	3.67
Heifers, 2's	8.66	8.16	4.02	6.87
Heifers, 1's	8.98	6.90	4.07	6.53
Heifer calves	.....	6.82	.....	6.82
Steer calves	13.67	9.87	7.12	9.46
Steers, 1's	11.11	8.19	5.11	7.55
Steers, 2's	10.96	7.92	5.43	8.22
Steers, 3's	11.70	7.47	5.04	9.81
Bulls for breeding	12.21	12.53	6.57	11.29
Bulls, culls	6.18	3.79	2.33	4.32

as what were considered good prices 20 or 30 years before. It must be borne in mind that quality had increased considerably during the same time.

Average Prices

The prices received varied considerably during the period of this study. Table 28 shows the average net price per hundredweight for cattle of all ages from the North Park ranches for the 3-year period.

In 1929, when the average net return on investment was 8.28 percent, all cattle sold from these ranches averaged $9.60 per hundredweight net. Fat cows netted $8.04, cull or canner cows $5.28, 2-year-old heifers $8.66, yearling steers $11.11, 2-year-old steers $10.96, and 3-year-old steers $11.70. Only 215 steer calves were sold that year, mostly through the show ring, and they netted $13.67 per hundredweight. The average net return to investment in 1930 was 2.27 percent, and the net prices received per hundredweight for all cattle sold averaged about $7.25. Fat cows netted $5.27 and 2-year-old heifers $8.16. The yearling steers brought $8.19 and the 2-year-olds about $7.90. The sale of steer calves increased somewhat over sales of the previous year, and these netted $9.87 per hundredweight.

In 1931, the last year of the study, the average net return to investment was a minus 0.41 percent. This year the cattle sold from these ranches averaged only $4.81 per hundredweight. Fat cows brought about $3.84, culls $2.45, and 2-year-old heifers $4.02. The yearling steers went at $5.11 net, and the 2-year-old steers brought $5.43 net. The sale of steer calves had more than doubled over the 1929 figure, these bringing a net of $7.12.

Marketing Practices

The marketing practices in this area lean very strongly to shipping to the central markets and selling there on a per-hundredweight basis. Very few cattle are sold by the head. The few local sales were made mostly to traders or speculators who, in turn, gathered their purchases to a common loading point and shipped to the central markets. This study discloses several instances where speculators purchased cattle at less than market prices.

Cattle were sometimes sold to feeders who came to the ranch to make the deal. The rancher, if he sells at the ranch, has three choices: (1) He can sell to a speculator; (2) he can sell to a feeder for direct shipment to the feedlot; (3) he can keep the cattle, "warm them up," and await a more favorable price. When he ships to the market, he must take the ruling price.

The method of selling at the ranch, while gaining in favor very slowly, has many things to recommend it, both to producer and feeder. Among these are elimination of the double commission, costs of yardage, costs of feed and bedding, and numerous other charges at the stockyards; the better chance for the buyer to judge quality in young stock by observing the foundation stock on the ranch; the advantages to the producer in being able to defer the actual sale, if the price does not suit, and the important one of eliminating a certain amount of shrinkage or actual loss in flesh due to prolonged shipping, unloading, and reloading. Some cattlemen ship one or more carloads of sorted cattle. These receive first attention by the salesmen. The smaller ranches "load everything in one car"; i.e., they tend to have mixed shipments in order to cut down freight costs by filling the car.

The feeder, on the other hand, is often afraid to trust his own judgment in buying cattle, and often he has also a reluctance toward attending to the dêtails of a deal personally. Stockyard agencies develop a very high degree of efficiency in buying and selling or actually moving the stock. On Mondays during the rush season most salesmen must sell many cattle in a few hours. When it is seen that some of these carloads of cattle from the range may be split into as many as 10 or more separate sales at different prices, and a salesman may have 15 or 20 such carloads to dispose of in the few hours of trading, it is clear that no salesman could give each lot the special attention and effort that the ranchman thinks his cattle are entitled to receive. The salesman has no alternative but to sell, as holding over or reconsigning to another market is usually disastrous because of the heavy additional expense. The feeder-buyer on the central markets is not under the same pressure as the seller; he can postpone his purchases for a few days or weeks. For these reasons, it may be stated that a central market is usually a "buyer's market" and seldom, if ever, a "seller's market" where feeder cattle are concerned.

The central markets with their facilities for handling large numbers and for establishing prices are unquestionably necessary, but there are many adjustments that would make them more satisfactory to producers of feeder and stocker cattle.

Age at Which to Sell Range Cattle

The demand for smaller cuts of meat has caused certain stockmen as well as a great many careless investigators to recommend the marketing of younger cattle, or in other words, of calves. It is well known that there is a limited market for these feeder calves, and certain fancy grades bring prices that seem to be considerably above prices for older classes.

The question is, Are these better prices sufficient to offset the greater costs of production and particularly the greater risks connected with ranch operation on a cow-and-calf basis? In the first place, the success of a business is dependent on high calf crops. High quality and good prices are also important factors but cannot overcome the handicap of a poor calf crop. Calf crops vary greatly from year to year, despite all that good management can do; and so do prices, but more in cycles of a number of years. It sometimes happens that a poor calf crop and poor prices hit the producer at the same time. The impact of such a combination is nearly always disastrous to the breeding herd. In order to meet current expenses, part of the breeding herd must be sold, frequently at sacrifice prices.

The man who produces 2-year-old steers to sell is also affected by calf crops and prices, but not to the same extent that the cow-and-calf man is affected. Instead of having his entire livestock investment in the breeding herd, as has the calf man, he has some of it in the form of weaned calves, some in yearlings, and some in 2-year-olds. When low calf crops or hard times come, he can cut into his yearlings for needed cash revenue; he can go farther than that and sell some calves, but ordinarily he is able to keep the breeding herd intact. It may be seen that this system is more flexible in riding over the rough spots. When prices improve and normal calf crops are secured, he can gradually work back to his status as a big steer producer without having sacrificed his breeding herd.

The cow-and-calf man, when he finds that his main market class is insufficient to meet his operating costs, must either borrow money to continue operations or he must cut into his breeding herd for ready cash.

The 2-year-old-steer producer has a better chance for improvement in quality of breeding stock, because he keeps his heifers and can make a better selection for building up the breeding herd.

The answer to the demand for smaller cuts of beef is found in the terse statement of Dr. A. F. Vass of the University of Wyoming, "We have now learned that the size of the cut is within the control of the meat cutter."

Time of Selling

A great many cattle, especially young stock, are marketed from the North Park region in January, mostly at the stock-show feeder-cattle auctions. This is about the closest that the producer and the feeder ever get to each other via the central markets, and it is noteworthy that prices received by the producer, as a rule, average better than at any other time during the season.

The 3-year average indicated in table 29 shows that 38 percent of all cattle sold from the North Park ranches was sold in January. In 1930 this figure ran up to 45 percent. Very few cattle are sold during the period from the Denver stock show through to the month of July. During late July the "beef" is usually shipped, and this may extend into the first week in August. By the term "beef" the ranchman means the dry, fat cows, and the table shows that the proportion of the total sold at this time remained practically constant through the 3 years. During August, which is the busy hay-harvest month, very few cattle are marketed except during the first few days, but shipments are resumed again in September and increased sharply through November, which is the peak of the fall marketing season. The cattle sold in December are marketed mostly during the first week or 10 days of the month. There is then a lull until the stock-show feeder sales. At this time the bulk of the sales are yearling steers, 63 percent, and steer calves, 25 percent.

TABLE 29.—*Percentages of total number of cattle marketed at various seasons of the year.*

	1929	1930	1931	3-year average
	Percent	*Percent*	*Percent*	*Percent*
Five months, February to June, inclusive	0.71	2.66	0.44	1.25
July	4.86	4.49	4.97	4.78
August	2.32	1.82	3.59	2.63
September	8.23	12.28	1.76	7.17
October	17.10	8.29	12.69	12.57
November	23.24	18.56	27.79	23.38
December	10.17	6.84	14.01	10.50
January (first two or three weeks)	33.37	45.06	34.75	37.72

Markets Used

In 1929, 68 percent of all cattle sold from these ranches were shipped to Denver and 17 percent to Omaha and other river markets, while 15 percent were sold locally or on the ranches. In 1930, 69 percent went to Denver and 13 percent to the river markets, and 18 percent were sold on the ranch. In 1931, 70 percent went to Denver, 26 percent went to Omaha and other river markets, and only 4 percent were sold locally. Of the cattle shipped to Denver, about one-half were sold on a freight-paid-to-the-river basis.

Ages and Classes of Market Cattle

Table 30 shows the numbers of cattle sold by each ranch by classes, and table 31 shows the percentage of each class by years. There was considerable change during the 3 years as to age at which cattle were sold. In 1929 about 33 percent of the total sales

were of cows, 7 percent of heifers, 9 percent of calves, 32 percent of yearling steers, 16 percent of 2- and 3-year-old steers, and the remainder of bulls. In 1930 the yearling-steer class made

TABLE 30.—*Numbers of cattle sold by classes; average per year for period studied.*

Ranch number	Total sold	Cows	Bulls	Calves	Yearlings		2-year-olds		3-year-old steers
					Heifers	Steers	Heifers	Steers	
201	159	43	3	.....	.....	.....	.....	111	2
202	149	37	3	2	.....	88	17	2	.....
214	309	83	8	17	36	135	10	20	.....
225	469	127	6	2	.....	318	.....	10	6
263	83	25	1	28	.....	19	.....	8	2
265	45	15	1	.....	.....	28	.....	1	.....
266*	239	14	4	59	.....	113	.....	22	27
267*	258	52	2	.....	22	147	11	15	9
271	69	30	1	.....	.....	32	.....	5	1
273	78	33	2	.....	1	2	1	39	.....
274	118	24	2	34	.....	55	.....	3	.....
275	71	23	1	.....	.....	42	.....	5	.....
276	96	14	1	.....	3	54	19	5	.....
277*	160	19	8	34	10	73	4	12	.....
278	72	12	.....	31	12	17	.....	.....	.....
279	123	10	.....	90	17	6	.....	.....	.....
280	80	32	1	.....	.....	40	.....	5	2
281	130	41	2	55	1	22	4	1	4
Average per ranch	151	35	3	19	6	67	3	15	3

*These ranches bought some cattle for resale.

up 49 percent of the total, while calves were over 12 percent. The older steers had dropped to 11 percent. In 1931 yearling steers accounted for 50 percent of the total sales and calves for more than 15 percent. The older steers made up only 9 percent of the total. In 1930 and 1931 the cows sold were 21 and 17 percent of the total, respectively, and the heifer class was 5 and 6 percent, respectively. In contrast, the 32 Colorado mountain ranches studied in 1922-25 (Colo. Exp. Sta. bul. 342) had 27 percent of all sales consisting of 2-year-old and aged steers and only 20 percent yearling steers.

TABLE 31.—*Percentages of various classes of total cattle sales by years.*

	1929	1930	1931	3-year average
	Percent	*Percent*	*Percent*	*Percent*
Cows	32.71	21.25	17.46	23.30
Bulls	2.74	1.21	1.29	1.70
Calves	9.30	12.36	15.40	12.56
Yearling heifers	4.79	3.61	4.24	4.19
Yearling steers	32.05	49.25	50.05	44.36
Two-year-old heifers	2.57	1.56	2.03	2.04
Two-year-old steers	11.58	10.23	8.26	9.91
Three-year-old steers	4.28	.53	1.28	1.94

Marketing Expenses

Table 32 shows average marketing expenses for North Park cattle per head and per 100 pounds by different markets and on different weights of cattle.

The marketing expense at the central markets remained practically unchanged during the period of this study, except in special charges at stock-show time. From North Park points to Denver (flat rate) the expense averaged 49.9 cents per hundredweight on heavy cattle (average 1,076 pounds). Of this, 33.5 cents was freight, 3.3 cents yardage fees, and 7.1 cents commission, and 6 cents was classed as "other charges." These other charges include feed, bedding, insurance, brand inspection, etc. In comparison, heavy cattle shipped to Denver and sold F. P. R. (freight paid to the river) averaged 63.9 cents total expense per hundredweight. Of this, 49 cents was freight charges, 3.1 cents yardage, 6.8 cents commission, and 5 cents other charges. These

TABLE 32.—*Shipping expenses on North Park cattle; average for period of study.*

Shipping point and how sold	Heavy cattle		Light cattle		Calves	
	Per head	Per 100 lbs.	Per head	Per 100 lbs.	Per head	Per 100 lbs.
Omaha	*(Av. wt. 1015 lbs.)*		*(Av. wt. 709 lbs.)*		*(Av. wt. 369 lbs.)*	
Freight including feed enroute	$5.36	$0.528	$3.81	$0.539	$2.07	$0.560
Yardage at destination	.35	.035	.35	.050	.25	.068
Commission	.56	.056	.44	.062	.25	.069
Other charges	.30	.030	.20	.028	.15	.040
Total expense	$6.57	$0.649	$4.80	$0.679	$2.72	$0.737
Denver flat rate	*(Av. wt. 1076 lbs.)*		*(Av. wt. 698 lbs.)*		No data	
Freight	$3.60	$0.335	$2.33	$0.340		
Yardage	.35	.033	.35	.051		
Commission	.76	.071	.53	.077		
Other charges	.65	.060	.38	.055		
Total expense	$5.36	$0.499	$3.59	$0.523		
Denver F.P.R. rate	*(Av. wt. 1125 lbs.)*		*(Av. wt. 730 lbs.)*		No data	
Freight	$5.51	$0.490	$3.65	$0.500		
Yardage	.35	.031	.35	.048		
Commission	.76	.068	.60	.082		
Other charges	.56	.050	.42	.058		
Total expense	$7.18	$0.639	$5.02	$0.688		
Denver F.P.R. rate (Stock show)	No data		*(Av. wt. 703 lbs.)*		*(Av. wt. 436 lbs.)*	
Freight			$3.62	$0.515	$2.48	$0.552
Yardage			.35	.050	.35	.078
Commission			.53	.075	.39	.088
Other charges			1.55	.222	1.73	.385
Total expense			$6.05	$0.862	$4.95	$1.103

last figures are based on only two cars of cattle averaging 1,125 pounds per head, and therefore may not be representative. Heavy cattle are not, as a rule, sold on the F. P. R. basis. Heavy cattle shipped direct to Omaha averaged 64.9 cents total expense per hundredweight.

The medium or lightweight cattle, including the long yearling and short 2-year-olds, were sold at both the Denver and river markets and on almost every freight-rate basis available. Those sold in Denver on a flat-rate basis averaged 52.3 cents per hundredweight total expense. These cattle averaged 698 pounds. The cattle in this class that were sold in Denver on the F. P. R. basis (not including stock-show sales, however) averaged 730 pounds in weight and 68.8 cents per hundredweight total expense. The same class of cattle, averaging 709 pounds, shipped direct to Omaha incurred a total expense of 67.9 cents per hundredweight. A very large proportion of the medium-weight class was shipped to the Denver stock show and there almost invariably sold on the F. P. R. basis. These cattle averaged 703 pounds and 86.2 cents total marketing expense per hundredweight.

With the exception of 118 head to Omaha, calves in straight lots were shipped from this area to Denver only at stock-show time and, therefore, their sales afford no satisfactory comparison with sales at other markets.

The foregoing analysis of marketing expenses is based on the actual sale weights of the cattle and the actual amounts deducted from the gross proceeds for the various services. It does not in any way purport to show official or published rates and fees.

When figured as a percentage of the gross receipts from all cattle sales, the marketing expense averaged 8.75 percent for the 3 years. In 1929 it was 6.11 percent, in 1930 it was 9.25 percent, and in 1931 it was 12.31 percent.

Choice of Markets

In making a choice of markets, the ranchman has a good many things to guide him, but none are infallible. He has the press market quotations, the radio reports, the government market news service, the market letters sent out by the various commission agencies at the stock yards, and information from the traveling representatives of these same agencies.

Some ranchmen who have 200 or 300 head of cattle to sell have found that it paid well to make personal visits to one or two of the central markets some weeks before shipping time. This was done, not only to study the market, but also to get in touch with feeders in the surrounding territory. This and many other devices were tried by individual ranchmen in an attempt to improve the sale price of their cattle.

Ranchmen have been urged to market their cattle before or after the normal heavy movement to market during August, September, October, and November. This, of course, is impracticable for the mountain ranches, and especially for those that use the national forests for summer grazing. The cattle must be gathered at the end of the grazing season, sorted, and worked. This cannot be accomplished before the latter part of September on most Colorado mountain valley ranches, which takes them into the middle of the "heavy movement."

As for waiting until after the rush season, some ranchmen who are favorably situated in regard to finances and feed delay shipments until the time of the Denver stock show, which furnishes a good but limited outlet for feeder cattle of show-ring caliber. The advantage in this, however, is very largely offset by the high costs, not only of the marketing at this time, but of carrying the stock on full winter feed until stock-show time. The use of this hay for carrying a large bunch of cattle through to stock-show time may mean a shortage for the wintering of the main herd, or it may necessitate the selling of more cattle than normally in order to have hay sufficient for winter.

A ranchman cannot base his selling policies entirely on the condition of the market, especially of the late fall and winter markets. He must first consider the feed and range conditions on his ranch and let this be his guide to marketing. In general, it is a good policy to defer selling as long as cattle are making good gains on cheap feed, such as grass. There is, however, one advantage to the practice of feeding hay to the market stock for a short time before shipping. It tends to harden the flesh and reduce the shipping shrink to some extent.

Price Quotations

In comparing price quotations on different markets, the Omaha and Denver markets were selected. The mean of the daily range in quotations was averaged for each week and charted for 22 weeks, beginning about September 1, which corresponds with the marketing season for these ranches. The class of cattle used in this comparison was good-to-choice feeder steers (500 to 800 pounds) which corresponds to the class known as long yearling steers sold from the North Park area. The Denver prices are all on the F. P. R. basis.

In 1929 the Omaha prices were a little in the lead for the first part of the season, while during the latter half the Denver market was higher. The net advantage for the season, however, was only about 5 cents per 100 pounds in favor of Denver. The following year showed a much greater spread and favored the Omaha market through the entire season. The average advantage was 39 cents, with some weeks running as high as 70 cents,

and at only one time during the season did the Denver price equal the Omaha price.

In 1931 the spread in favor of Omaha was greater, averaging 59 cents per hundredweight for the season. This wide gap closed up very perceptibly toward the end of the season, as indeed it did during all the years charted. This, no doubt, was a result of the influence of the feeder show and auction sale at Denver. The prices were equal at both places the last week of the season.

In the section dealing with marketing expense, it has been shown that, on the basis of actual shipments, expenses on light cattle shipped direct to Omaha practically equalled the expense on similar cattle shipped to Denver and sold on the F. D. R. basis. In the 2 years when the price advantage lay with Omaha, the 18 ranches in this study shipped over a million pounds of yearling steers to Denver and sold them on the F. P. R. basis.

Comparing other classes of cattle in a similar way, it was found that 2-year-old steers, good-to-choice feeders (800 to 1,050 pounds), were quoted considerably higher in Omaha than Denver. In 1929 the difference averaged 84 cents, and for 8 of the 22 weeks comprising the season the difference in favor of Omaha was more than $1.00. In 1930, 1931, 1932, and 1933 the average difference was 32 cents, 45 cents, 35 cents, and 34 cents, respectively, in favor of Omaha. On steer calves the respective quotations favored Omaha by 69 cents, 50 cents, 83 cents, and 52 cents for the years 1929 to 1933, inclusive.

The quotations on good slaughter cows averaged between 40 and 50 cents per hundredweight in favor of the river market. Here, however, must be considered the fact that the Denver quotations are on a flat-freight-rate-to-Denver basis. This made the marketing expense on heavy cattle about 15 cents less per hundredweight to Denver as compared with Omaha.

Feeder heifers, good-to-choice, seemed to have the distinction of being the only class of range cattle quoted higher in Denver than in the river market. In 1929 the difference averaged 48 cents in favor of Denver, and in the 4 following years it was 28 cents, 29 cents, 26 cents, and 11 cents, respectively. In each of the 5 years, Omaha's quotations on this class would start the marketing season, about September 1, equal to or above the Denver market. After a few weeks, however, the advantage would invariably shift to Denver and stay there the remainder of the season. These variations indicate that ranchmen should watch market prices, shipping costs, shrinkage, and every additional condition which would aid in selecting the best market at the time.

Sale Weights

For comparison with other studies, and as a guide to individual ranchmen, table 33 is submitted, showing the average sale weights for each year.

TABLE 33.—*Yearly sale weights of North Park cattle, all ranches.*

Class of Cattle	Average sale weights all sales			
	1929	1930	1931	3-year average weight
	Pounds	*Pounds*	*Pounds*	*Pounds*
Cows, breeding stock	973	1,080	1,000	979
Cows, fat	1,086	1,092	1,071	1,085
Cows, cull	938	931	984	957
Two-year-old heifers	874	869	839	860
One-year-old heifers	648	696	674	671
Heifer calves	.....	416	.....	416
Steer calves	439	447	425	435
Veal calves	161	229	187	190
One-year-old steers	700	702	693	698
Two-year-old steers	1,006	1,007	1,010	1,008
Three-year-old steers	1,272	1,172	1,155	1,234
Bulls for breeding	1,289	967	1,312	1,227
Bulls, cull	1,427	1,386	1,443	1,422

Summary and Conclusions

1. Cattle-ranch organization studies were undertaken in cooperation with the Bureaus of Agricultural Economics and Animal Husbandry, U. S. Department of Agriculture, in 1922. This work was continued for a period of 4 years, and the results were reported in two Colorado Experiment Station bulletins. One of these, bulletin 327, dealt with ranch organization in eastern Colorado, and it included a detailed review and description of 22 ranches varying in size from 3.5 to 108 sections. The second report, bulletin 342, contained an analysis of cattle-ranch organization in the mountains of Colorado and was based upon records obtained for 32 ranches which varied in size from 860 acres to more than 55,000 acres. This report involves a 3-year study of 18 ranches located in North Park, in Jackson County, Colo. These units average slightly more than 4,000 acres in size, 2,567 acres of which were classified as owned land and 1,435 acres as rented land.

2. A part of the conclusions in the former study of cattle-ranch organization in the mountains of Colorado is directly applicable to this analysis, and it is given herewith: "A study of the ranch business as represented by this group will demonstrate clearly that there is a wide variation in the selection and combination of the factors of production. . . . It would appear, therefore, that each individual operator should be able to obtain the maximum results by adapting the best practices and the most successful organization to his own conditions."

3. There are certain factors in ranch organization and management that appear to have a very direct bearing upon ranch income from year to year. The influence of these factors was clearly in evidence in the former study, and it is reflected in the records made available through this 3-year period of observation and research. It is, therefore, entirely correct to say that ranch profits are modified and controlled by (a) the size of the ranch business, (b) efficiency in the use of labor, (c) proper care of herds in order to maintain good condition during the winter, (d) taking the necessary precautions to insure a high-percentage calf crop, (e) a proper appraisal of market trends and conditions, and (f) the managerial ability of the ranch operator.

4. The prices received by these operators varied considerably during the period of this study. In 1929, when the average net return to investment was 8.28 percent, all the cattle sold from these ranches averaged $9.60 per hundredweight net; fat cows netted $8.04, cull or canner cows $5.28, 2-year-old heifers $8.66, yearling steers $11.11, 2-year-old steers $10.96, and 3-year-old steers $11.70. Only 215 steer calves were sold that year, mostly

through the show ring, and they netted $13.67 per hundredweight. During the last year of the study, the average net return to investment was minus .41 percent. For this particular year, 1931, the cattle sold from these ranches averaged only $4.81 per hundredweight; fat cows brought about $3.84, culls $2.45, and 2-year-old heifers $4.02. The yearling steers went at $5.11 net, and the 2-year-old heifers brought $5.43 net. The sale of steer calves had more than doubled over the 1929 figure, and these brought a net of $7.12 per hundredweight.

5. The 3-year-average cost of producing hay on these ranches was $3.29 per ton for all costs except the use of land, and $4.76 per ton including taxes and interest on land. The hay sold brought $6.54 per ton, which was $1.78 per ton more than enough to pay all costs, including interest. The yield per acre influenced the cost per ton more than anything else. In harvesting the hay crop the same area must be covered, the same machinery and horses must be used, practically the same amount of harvest labor must be hired, and the same amount of taxes will have to be paid, regardless of yield. It is important, therefore, to give attention to those practices that will enhance yield per acre.

6. The marketing practices in this area lean very strongly to shipping and selling at the central markets on a per-hundredweight basis. Very few cattle are sold by the head. The few local sales reported were made mostly to traders or speculators who, in turn, assembled their purchases at a common loading point and shipped to the central markets. A great many cattle, especially young stock, are marketed from the North Park region in January, mostly at the stock-show cattle-feeder auctions. Within the period of this study considerable range was noted in the age and class of the cattle marketed from these ranches. The discussion relating to the market experience of these individual operators is worthy of consideration.

7. In making a comparison of any individual ranch with the results reported in this study, the reader may discover that his business fails to measure up to the best organization in this limited list. But following the matter further, he may note that his organization happens to be deficient in one or more of the factors mentioned. If steps are taken to correct these deficiencies, it should be possible to improve the ranch income quite appreciably over and above the results in previous years. The ranch organizations which are reported in this bulletin, and the ranch practices which are described, should serve to stimulate inquiry and study in this field and should, in turn, lead to distinct improvements in the ranch business.

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BULLETIN SERVICE

The following late publications of the Colorado Experiment Station are available without cost to Colorado citizens upon request:

Popular Bulletins

Number	*Title*	*Authors*
419	Soil Blowing and Its Control in Colorado	J. F. Brandon, Alvin Kezer
422	Colorado Fattening Rations for Cattle	H. B. Osland, E. J. Maynard, George E. Morton
423	The Parshall Measuring Flume	R. L. Parshall
424	Grape Growing in Colorado	George Beach
425	Timber Milk Vetch as a Poisonous Plant	I. E. Newsom, J. W. Tobiska, L. W. Durrell, and Others
426	Oiled-Gravel Roads of Colorado	E. B. House
427	Insect and Mite Pests of the Peach in Colorado	George M. List, J. H. Newton
428	Pyrethrum Plant Investigations in Colorado	C. B. Gnadinger, L. E. Evans, C. S. Corl
429	Poisonous and Injurious Plans of Colorado	L. W. Durrell, I. E. Newsom
430	Oat Production in Colorado	D. W. Robertson and Others
431	Barley Production in Colorado	D. W. Robertson and Others
432	Western Rose Curculio	John L. Hoerner
433	Equipping a Small Irrigation Plant	W. E. Code
434	Improving the Farm Wagon	William P. Kintzley, Dudley P. Craig

Technical Bulletins

15	The Influence of Various Factors, Including Altitude, in the Production of Angel Food Cake	Mark A. Barmore
16	A Study of Some Abnormalities Occurring in Certain Potato Varieties in Colorado	Rudolph Daniel Anderson
17	Notes on *Cryptolestes Ferrugineus* Steph	Elwood H. Sheppard
18	Further Studies on Vitamins in Alfalfa Hay	C. E. Vail, J. W. Tobiska, Earl Douglass
19	Protein Content of Corn as Influenced by Laboratory Analyses and Field Replication	Warren H. Leonard, Andrew Clark

Press Bulletins

89	Some Injurious Plant Lice of the American Elm	George M. List, C. P. Gillette
90	Beet Tops for Fattening Steers	George E. Morton, H. B. Osland, R. C. Tom