

Efficient Cattle Production On Colorado Ranges

By DAVID F. COSTELLO
Rocky Mountain Forest and Range Experiment Station,
Fort Collins, Colo.¹

As an aid to securing increased efficiency in range cattle production, this bulletin presents some of the latest results of investigations made in Colorado by the Rocky Mountain Forest and Range Experiment Station. These results have been obtained on short-grass ranges and on ponderosa pine-bunchgrass ranges and are applicable in general to most of the plains and mountainous areas of the State. In addition to these research results, some of the important items in ranch operation which should be checked periodically are discussed.

Short-Grass Ranges

The short-grass range studies, from which the following data were obtained, were started in cooperation with the Colorado State Agricultural College and the Soil Conservation Service on the Central Plains Experimental Range near Nunn, Colorado, in 1939. Each year approximately 600 Hereford cattle have been provided for the experiments by members of the Crow Valley Cooperative Livestock Association. These cattle have been weighed once each month throughout the summer season and have been grazed under close control in several experiments which are still in progress.

Rates of grazing

On a series of six 320-acre pastures predominantly blue grama and buffalograss and typical of much of eastern Colorado, three rates of grazing have been tested for the season May 10 to November 10, for 4 years. To determine the effects of stocking on both livestock and forage, yearling Herefords have been grazed at the approximate rate of 20 head per section for light use, 40 head for moderate use, and 60 head for heavy use. This is the equivalent of slightly over 7, $3\frac{1}{2}$ and $2\frac{1}{3}$ acres per adult animal per month. The weight gains these yearlings have made for the 4 years of study are listed in table 1.

The heavy rate of stocking has produced the lowest gains per individual animal in every year. Moderate grazing has produced, on the average, about 35 pounds more weight per animal per season than

¹Maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with Colorado State College of Agriculture and Mechanic Arts, Fort Collins, Colo.

Table 1.—Seasonal weight gains of yearling Herefords on short-grass range, May 10 to November 10, for 4 years.

Rate of stocking	Year				4-year average
	1940	1941	1942	1943	
	Pounds				
Heavy	235.0	259.0	210.0	251.2	238.8
Moderate	296.5	270.0	246.0	283.2	273.9
Light	321.5	264.0	269.0	317.4	293.0

heavy grazing; and light grazing has produced 19 pounds more per animal than the moderate rate.

In terms of total pounds of beef gain, heavy grazing has produced the most, owing to the greater number of animals; 60 animals gaining at the rate of 238.8 pounds per season show a gain of 14,328 pounds per section. Similarly the moderate stocking rate with 40 animals indicates a total gain of 10,956 pounds and light stocking with 20 animals only 5,860 pounds of gain per section per year.

Although heavy stocking has produced the greatest total pounds of beef to date, it has resulted in a state of forage deterioration which would be calamitous to many a livestock operator in a drought year. Furthermore it has produced animals worth \$1.00 less per hundredweight than similar animals on lightly grazed pastures; has resulted in greater death losses; and has left no reserve of plant cover to control erosion and retain needed moisture for early spring growth.

Greater profit from fewer animals

Some of the financial aspects of grazing at the three rates of stocking in 1943 are shown in table 2. On May 10, the opening date of the grazing season, the cattle averaged 400 pounds per head and were appraised at \$12.50 per hundredweight. Individual animals grazed at the heavy, moderate, and light rates made average gains of 251.2, 283.2, and 317.4 pounds, respectively. At the end of the season, and considering the expenses involved, 60 head with a quoted market value of \$10.00 per hundredweight on November 10, showed a return of \$762.00 per section; the return for 40 head at the appraised value of \$10.50 per hundredweight was \$769.60; and for 20 head at \$11.00 the return was \$526.60.

Any rancher can make similar computations based on his own costs of operation. His costs for salt, branding, vaccinating, and incidentals may vary slightly from the figures quoted, and he may wish to assume a different rate of interest on the cattle investment. If he rents grazing privileges on an animal month basis, the comparison in favor of moderate grazing will be even more striking because in the example presented in table 2 the cost of a section of land was considered to be the same in all three instances.

Table 2.—Possible return per section of land from cattle under three rates of grazing on short-grass range.

Item	Stocking rate		
	Heavy	Moderate	Light
Number of yearlings per section	60	40	20
Average initial weight, lb. (May 10)	400	400	400
Initial market value per cwt.	\$12.50	\$12.50	\$12.50
Initial value per head	\$50.00	\$50.00	\$50.00
Average final weight, lb. (Nov. 10)	651	683	717
Final market value per cwt.	\$10.00	\$10.50	\$11.00
Final market value per head	\$65.10	\$71.71	\$78.87
Interest on investment, 6 months at 5%	\$ 1.25	\$ 1.25	\$ 1.25
Salt and incidentals, per head	.50	.50	.50
Death loss at 1%	.65	.72	.79
Summer increase in value per head	\$15.10	\$21.71	\$28.87
Expenses	2.40	2.47	2.54
Returns per head	12.70	19.24	26.33
Returns per section	\$762.00	\$769.60	\$526.60

Computations such as these illustrate conclusively that more than mere numbers of livestock or total pounds of weight gain are involved in the final profit from grazing. They indicate that stocking rates which maintain good ranges in satisfactory condition and which permit improvement of ranges below topnotch condition can produce greater profits than the heavier stocking rates now practiced on many Colorado ranges.

A. safe forage margin

Different rates of grazing affect the forage as well as the weight gains of livestock. Heavy grazing on the Central Plains Experimental Range has produced many damaging results: gradual disappearance of the taller grasses, thinning of the short-grass cover (fig. 1), decrease in numbers of palatable weeds, reduction in vigor and abundance of valuable shrubs, and a deficiency in production of seeds by all forage species. On the other hand, moderate grazing has maintained the forage stand in good productivity and has left a reserve of plant material on the ground at the end of the season which prevents excessive erosion and which adds fertility to the soil. Light grazing has not only maintained the forage stand but has resulted in marked improvement on areas (fig. 2) which were in poor or depleted condition at the beginning of the study.

In general, proper use of short-grass ranges in eastern Colorado will be attained if a leaf stubble of $1\frac{1}{4}$ to $1\frac{1}{2}$ inches is left on blue grama at the end of the grazing season. Approximately $\frac{1}{4}$ of the seedstalks should be left standing. Ranges in satisfactory condition



Fig. 1.—Heavy grazing on this pasture has thinned out the sod cover and lowered the quality of the forage crop by causing the disappearance of taller grasses, palatable weeds, and nutritious shrubs.

should consist of a more or less continuous sod or turf of short-grasses. If the sod pieces are separated by spaces not wider than 3 to 6 inches the range is still in good condition but is not at maximum producing capacity. Further thinning of the sod, disappearance of wheatgrasses and other taller grasses, and heavy utilization of palatable weeds and shrubs are indicators of unsatisfactory range conditions and generally denote decreased cattle gains.²

Quality of forage is important

Early in the range studies it was discovered that cattle gained better on some pastures than on others, even when forage was everywhere abundant. This fact indicated that quality as well as quantity of forage was an important factor affecting cattle weight gains. Similarly it was found that weight gains have not varied directly with rainfall and forage production from one year to the next. Again, the indication is that quality as well as quantity of forage fluctuates from year to year.

²Judging condition of short-grass range is discussed at length in Colorado Extension Service Bull. D-33, "Maintaining Short-grass Ranges," and in U. S. Dept. of Agric. Farmers Bull. No. 1949, "Judging Condition and Utilization of Short-grass Range in the Central Great Plains."



Fig. 2.—This range has improved from fair condition to nearly excellent condition under light-grazing use. Cactus is disappearing, and a mixture of desirable weeds, taller grasses, and shrubs is developing.

Forage production by blue grama and buffalograss since 1938, for example, has varied (fig. 3) from a low of 335 pounds per acre in 1939 to a high of 748 pounds per acre in 1942. In 1939, rainfall was low, forage production was low, and weight gains were low. In the very wet season of 1941, a large amount of fair-quality forage was produced on all pastures and the differences between the three grazing rates were small (table 1) because there was more than enough forage even under the heaviest rate of stocking. In 1942 an even greater amount of forage was produced as a result of continued rainfall which was well distributed throughout the growing season. That year an adjustment was made to secure a proper balance between forage and cattle numbers with the result that real differences in gain appeared between animals grazed at the three rates of stocking. The moderately and lightly grazed cattle, however, made only fair gains even though they had ample quantities of fair-quality forage.

The implications of these findings are important. Forage of good or excellent quality is the outcome of conservative grazing which permits the establishment and maintenance of a variety of forage species, including grasses, perennial weeds, and shrubs that contribute

FORAGE PRODUCTION AND CATTLE GAINS SHORT-GRASS RANGE

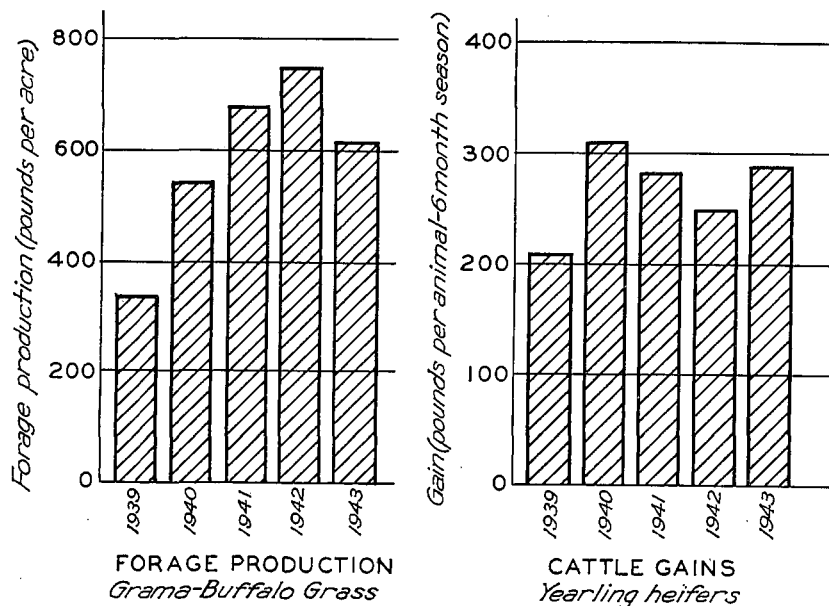


Figure 3.

AVERAGE MONTHLY WEIGHT GAINS, YEARLING HEIFERS, SHORT-GRASS RANGE (1940-1943)

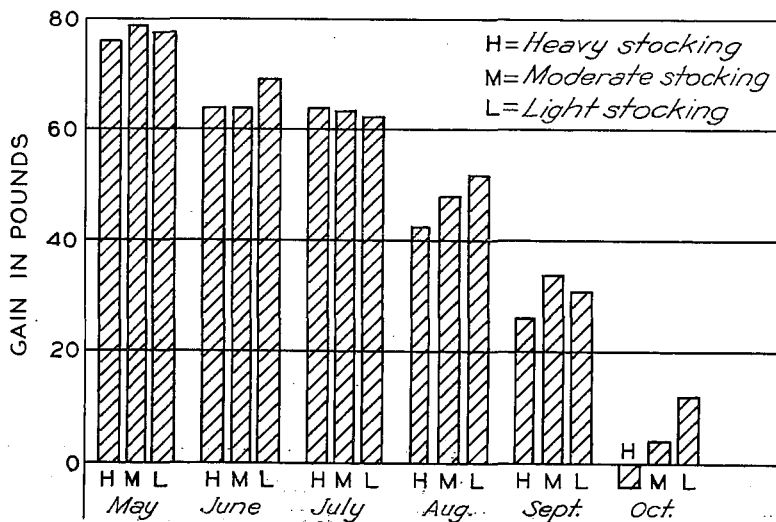


Figure 4.

to a well-balanced animal diet. Grazing management contributes more to this variety of plants on the range than the occasional year of heavy precipitation. Consequently, the rancher should not be lulled into the hope and belief that rain will solve all his forage problems and will result in maximum beef production. Instead, he should consider both the wet years and the drought years as exceptions, and should aim at sustained yield of grass and livestock on the basis of average or slightly below average forage production over a long period. He may be able to compensate for low-quality forage in wet years by the use of supplements on the range, but he should also remember that the highest-quality forage is maintained best by conservative grazing at all times.

Take advantage of trends

A seasonal decline in rate of monthly gain per animal appears to be consistent from year to year on short-grass ranges (fig. 4). This decline is correlated with seasonal decrease in the quality of the forage. Yearling Herefords have consistently gained approximately 200 pounds in the first 3 months and only from 90 to 110 pounds in the last 3 months of the summer grazing season.

Fundamentally, this decline in gain as the season progresses may be traced to an increasing lack of balance between carbohydrates, fat and protein in the available forage. This lack of balance may be corrected to a considerable extent by the use of protein supplements on the range. Even a small amount of cottonseed cake or similar supplement fed from August to November may result in increased gains per steer of 30 to 50 pounds.

Early marketing of slaughter cattle and early transfer of feeder cattle to the feedlot is recommended on the basis of these trends as a means of saving forage which would otherwise be used only for maintenance, and as a means of avoiding late-season losses in weight. These losses have been as much as 20 to 30 pounds on some pastures in October on short-grass range during 2 of the last 4 years.

Plan pasture use wisely

The amount of crude protein in range plants (fig. 5) is highest in summer; it begins to drop after the peak of forage development in early summer and by late fall and winter becomes a limiting factor for proper growth and development of livestock.³ Grasses such as blue grama and buffalograss are consistently lower in crude-protein content than are palatable perennial weeds, and many of the more desirable shrubs such as winterfat and fourwing saltbush.

³The analyses for crude protein were made by the Chemistry Section of the Colorado Agricultural Experiment Station.

SEASONAL TREND OF CRUDE PROTEIN SHORT-GRASS RANGE

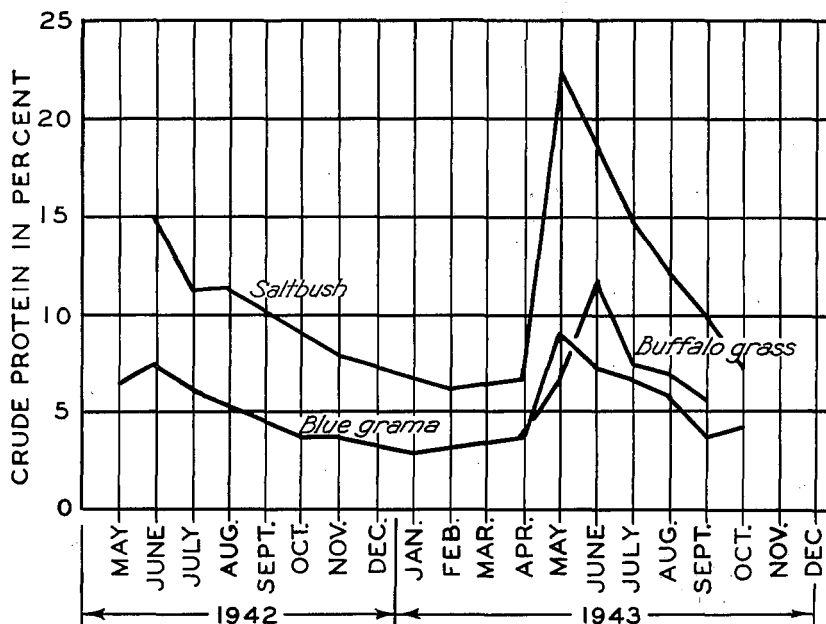


Figure 5.

These palatable perennial weeds and desirable shrubs should and can be maintained by conservative grazing. Cattle on pasture consisting of a good mixture of forage species on the Central Plains Experimental Range have consistently gained from 30 to 50 pounds more per season than similar cattle on pure-grass pastures.

Wise planning of pasture use should consider the possibilities of grazing low-protein-value pastures, containing primarily grasses, in summer when their forage value is naturally highest; and grazing the better pastures, consisting of a mixture of shrubs and grasses, in fall and winter when forage value on the grass areas is normally low. The better pastures also can be used profitably for producing range finish on market livestock, for replacement heifers, and for the breeding herd at calving time.

Bunchgrass Ranges

The grazing studies on bunchgrass ranges are being made at the Manitou Experimental Forest near Woodland Park, Colorado, in co-operation with Colorado College at Colorado Springs. This project is located in the ponderosa pine zone of the Front Range of the Rockies, and the pastures are typical of many thousands of acres of similar range at medium elevations in the State. Cattle for the study are furnished by local permittees on the Pike National Forest.

More beef from conservative grazing

In 1942, three rates of stocking were established in duplicate on a series of six pastures. Yearling Herefords were grazed June 1 to October 31, at the rate of 56, 43, and 24 head per section for the heavy, moderate, and light rates, respectively. In this test the greatest total weight gains and maximum economic returns have been obtained from the moderately grazed pastures (table 3).

Table 3.—Seasonal weight gains of yearling Herefords on ponderosa pine-bunchgrass range.

Grazing rate	Year	
	1942	1943
	Pounds	
Heavy	184	153
Moderate	215	206
Light	230	236

In 1943, the second year of the test, heavy use produced approximately 13.4 pounds of gain per acre; moderate use, 13.8 pounds of gain per acre; and light use, 8.9 pounds per acre (fig. 6). In terms of total gain per section, 8,568, 8,858, and 5,664 pounds were obtained for the three rates of stocking in the order named. Considering the numbers of animals involved, interest on investment, final market value, etc., but not including land investment and labor costs, it has been estimated that ranchers with similar ranges using similar rates of stocking would have realized a return from the use of their forage of \$316, \$592, or \$487 per section, depending on whether they stocked heavily, moderately, or lightly.

On the intangible side, heavy grazing, 3 acres per cow month, is definitely injurious to plant growth and forage production (fig. 7). The bunchgrasses on the heavily used areas which were utilized about 50 percent in 1943 are developing dead centers, are failing to produce seed, and are thinning out. This deterioration is apparently reflected in the cattle gains under heavy use which dropped from 184 pounds per animal in 1942 to 153 pounds in 1943. Moderate stocking, 4 acres per cow month, resulted in utilization of 37 percent of the available forage weight and is maintaining the pastures in about

**AVERAGE WEIGHT GAINS, FORAGE USE, AND BEEF
PRODUCTION BY STOCKING RATES
BUNCHGRASS RANGE, JUNE TO NOVEMBER 1943**

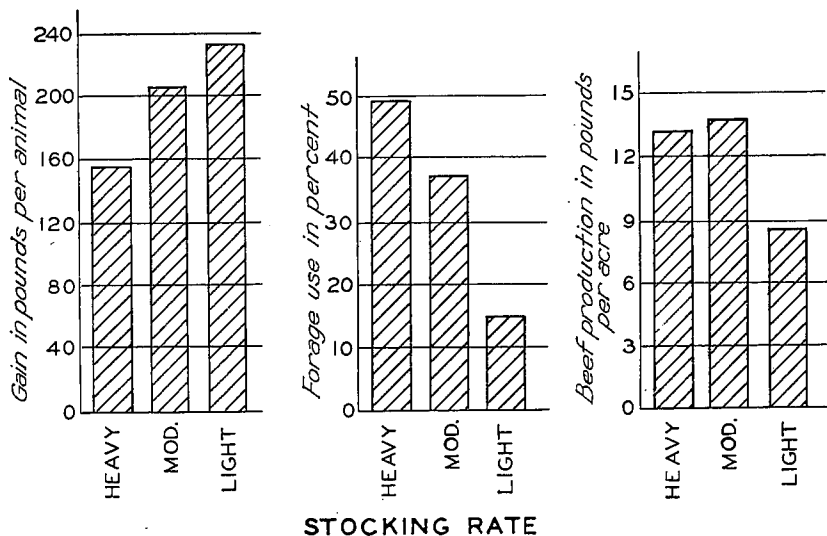


Figure 6.

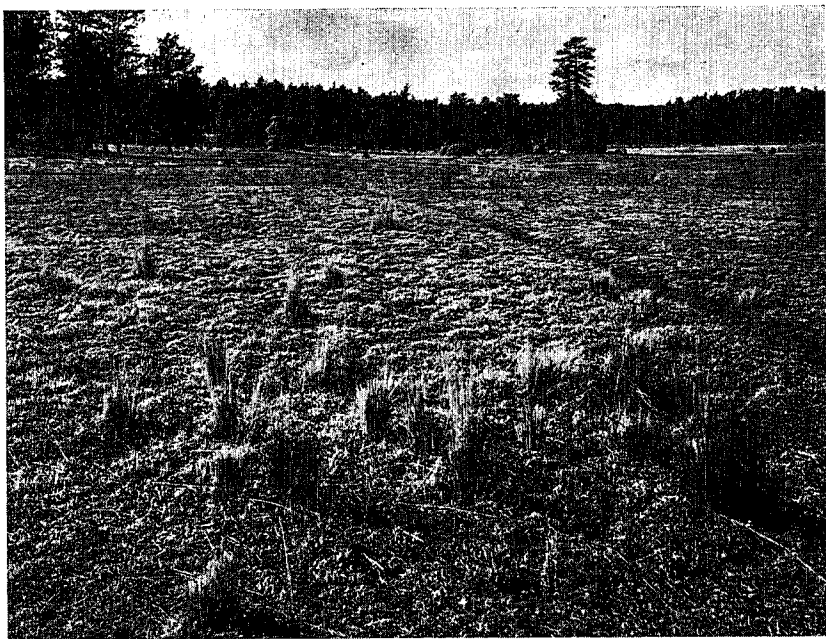


Fig. 7.—Heavy grazing results in death of bunchgrasses and ultimate replacement of valuable plants by worthless weeds and low-value shrubs such as fringed sagebrush.

the same condition as they were at the beginning of the study. Light use, 7 acres per cow month, resulted in utilization of 15 percent of the current volume of forage produced, and is allowing the pastures to make considerable improvement over their original condition (fig. 8). Forage production by the major species, Arizona fescue and mountain muhly, has greatly increased, and highly palatable minor species such as little bluestem, timber danthonia, bluestem wheatgrass, and slender wheatgrass have become fairly abundant.

Late-season losses should be avoided

A gradual decline in rate of gain per animal occurs with advance of the grazing season on bunchgrass ranges, just as it occurs on short-grass ranges. This decline appears to be related to nutrient quality of the forage from June to September. The October low gains and losses (fig. 9), however, are influenced by adverse weather conditions as well as by forage deterioration.

In October 1943, cattle on the heavily grazed pastures lost an average of 20 pounds per head and on moderately grazed pastures, 15 pounds per head. Cattle on lightly grazed pastures did not lose; instead, they gained an average of 8 pounds during the same period. As in previous years the first snows of the fall occurred during this month.

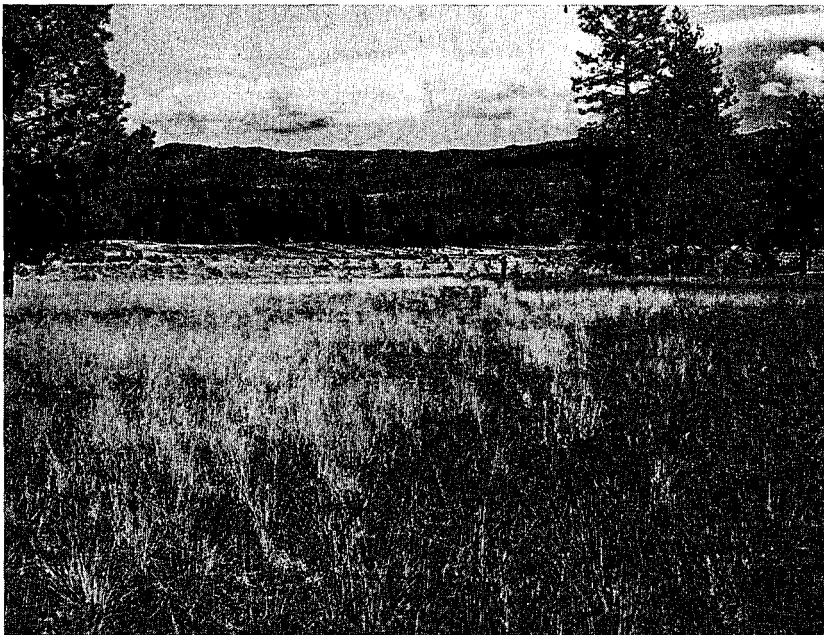


Fig. 8.—A bunchgrass range which is recovering under light use; excellent cattle gains are being obtained at the same time.

AVERAGE MONTHLY WEIGHT GAINS OF YEARLING HEIFERS BUNCHGRASS RANGE AVERAGE 1942 AND 1943

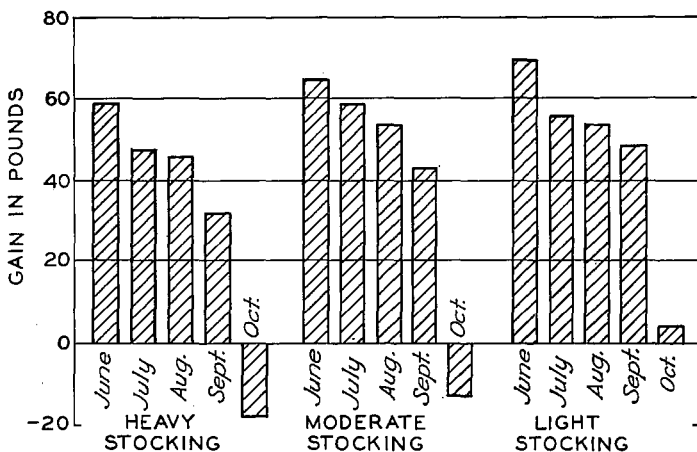


Figure 9.

Since these studies were started some ranchers have reported the removal of their livestock from high elevations a month to 6 weeks earlier than has been the common practice in the past. Without exception they were satisfied with the results and have variously estimated the saving in weight at 15 to 40 pounds per animal. Certainly the evidence is accumulating that worth while gains on livestock on high-altitude ranges probably should not be expected after the killing frosts and the first snows in autumn.

Accepted Practices for Increased Efficiency

Improved methods of management on the ranch may make many existing practices obsolete; other well-established practices, however, should not be forgotten. Ranch efficiency can be maintained and improved only by constant attention to the following important items.

Quality of bulls

The quality of the herd is determined to a large extent by the quality of bulls used. Good bulls contribute to greater weight for age, more uniformity of marketable animals, and develop breed character in the herd. Good bulls contribute to the elimination of such defects as extremes in body size, poor body conformation, long legs, narrow heads, restricted heart girth, sloping rump, and coarse hide and hair. Good bulls contribute to carcass utility and consequently to profits from the ranch.

The number of bulls should not be less than 1 bull to 25 or 30 cows on the range. Poor bulls should be disposed of early; good

bulls should be retained, since they are usually as effective at 6 or 7 years of age as they were at 3 or 4 years of age. Pooled purchases of bulls by several owners at one time may result in marked savings and where community allotments are used, a group of uniform bulls may achieve greater uniformity in their marketable offspring.

Culling the herd

Regular and systematic culling of the breeding cows and replacement heifers will improve the calf crop percentage, increase weight gains, and save feed and forage. Good-quality animals on the Central Plains Experimental Range have gained 40 to 65 pounds more per season than poor-quality animals. Non-breeders in the cow herd are expensive because they eat without producing offspring. Cows which produce good-quality calves should be retained in the herd to produce 8 or 9 calves in their life times, while poor producers should be cut out by 4 or 5 years of age and replaced by heifers from the good cows.

The calf crop

Every rancher should strive for at least a 90-percent calf crop. High-percentage calf crops permit a better selection of replacement heifers and require fewer animals, less work, and less feed per hundred pounds of beef production.

A 90-percent calf crop saves feed. The cow that produces a calf each year eats approximately one-half as much per calf weaned as one that calves only once in 2 years. A 90-percent calf crop means approximately 8 dry cows per hundred at weaning time, allowing for death losses; and it requires approximately 20 heifers for replacements each year. A low-percentage calf crop means more dry cows for market and a greater number of replacement heifers, and with the smaller number of animals available for choice it means slower improvement in the herd.

The calf-crop percentage can be increased through the use and improved care of better bulls, culling the breeding herd, and conservative grazing. This combination of good practices raised the calf crop in the vicinity of the Central Plains Experimental Range from approximately 58 percent in 1937 to nearly 90 percent in 1942.

Controlled breeding

A controlled breeding season is more profitable than promiscuous breeding throughout the year. If all calves are born within a relatively short period a greater uniformity of weight of marketable animals is obtained. A properly planned breeding and calving program enables the rancher to take advantage of the weather, markets, forage growth, and trends in seasonal weight gains. Weaning can be done systematically and the mother cows can be given a chance to recuperate on good forage before winter. The resulting improvements in

condition of the cows may also mean an increased calf crop and reduced death losses among calves.

The ranch equipment

Needed repairs should be made in the slack season of the year. When branding, castrating, dehorning or vaccination time arrives it is disconcerting to find that the corral gate is off the hinges and the holding chute is broken down. When summer drought arrives it is poor economy to find that the windmill needs repairs, the pump needs washers, and the watering tank leaks. Lubrication of equipment and protection from the weather are important. Replacement of worn parts, inspections, and adjustments of machinery may prevent a costly breakdown during rush periods. Every repair, replacement, and rearrangement that can be made on the ranch will contribute to faster and more efficient working of cattle when time and manpower are precious.

Recommendations for the Rancher

1. An optimistic attitude; a belief that the forage crop and the methods of handling livestock on every ranch can be improved.

2. Conservative grazing; maximum numbers of animals are not necessary to produce maximum beef gains and maximum profits.

3. An inquisitive habit; a constant checking of the financial aspects of the ranching enterprise. What are my profits? What are the latest practices? Why does my neighbor's grass look better than mine?

4. Understanding of forage production and utilization; forage is the principal commodity which the rancher has for sale. What are the indicators of proper grazing, of overgrazing? The rules for judging range conditions? The progressive rancher will seek guidance from his county agent, from the extension service and the experiment stations, from bulletins and published material, from comparisons between neighborhood ranches and their methods of operation.

5. Plan pasture use wisely to take advantage of forage when its quality is highest; use the better forage for the animals that need it, the breeding herd.

6. Market sale cattle before they begin to lose weight and use forage only for maintenance.

7. Graze lightly on ranges in need of improvements; moderately on ranges already in good or excellent condition.

8. Systematically and regularly check all practices on the ranch; quality of bulls, the breeding season, the calf crop, culling methods, marketing practices, range condition, the need for supplemental feed, pastures in need of rehabilitation, the ranch equipment.

Make needed adjustments indicated by this inspection and keep a record of the economic returns in order to be convinced that efficient management pays.