# FORAGE PROGRAMS and CATTLE SYSTEMS

*Colorado Mountain-Meadow Cattle Ranches*

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CONTENTS




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## SUMMARY

Cattle raising is the major agricultural activity in the mountainous portions of Colorado. Meadows produce practically all of the winter feed and some of the summer grazing for these cattle. The production from these meadows is low; average hay yields for Colorado meadows seldom exceed 1 ton per acre. The yield per acre has declined somewhat over the past 50 years. Recent trials show that with improved practices a large portion of these meadows can produce considerably more forage.

The first part of this study examines five improved meadow-management programs to produce additional forage for a lower cost. Each of the improved practices reduces the cost per ton of producing hay. The analysis reveals that the lowest production cost per ton of hay is realized when the meadow is rough leveled (extreme low and high spots removed) and reseeded, followed by a program of phosphate fertilization and the periodical reseeding of legumes (for a typical ranch $13.55 per ton).

The next lowest cost combination per ton is a rough-leveling, reseeding, and nitrogen-fertilization program ($14.29), followed by nitrogen-fertilization ($15.52), rough leveling and reseeding ($15.64), and phosphate fertilization and periodic seeding of legumes ($15.93). Comparable costs under usual management practices are $16.27 per ton.

In each instance, adequate water control is the key to the success of the improved forage programs. This is undoubtedly the reason that the rough-leveling programs are able to produce hay for the least cost, because rough leveling increases the opportunity to improve control over irrigation.

The second part of the study analyzes the relative profitableness of various livestock systems for a typical Colorado mountain-meadow ranch, when the meadow is managed under a rough-leveling, reseeding, and nitrogen-fertilization program.

This meadow-management program is used rather than the least-cost program (rough leveling, phosphate fertilization, and periodic seeding of legumes) because of the higher yield per acre. The larger production of hay allows the cattle operation to be somewhat larger, partly offsetting the higher cost per ton of hay. Also, the least-cost combination is more limited in adaptability than is the one used in the analysis.

Five livestock systems are budgeted for a typical mountain-meadow ranch. Two of them examine the typical ranch with a grazing permit for 150 cattle on Federal rangeland. Returns to the operator for his labor and management for a cow-calf system amount to $1,735 annually, compared with $2,740 for a cow-yearling system. When the cow-yearling system is budgeted on the same ranch without a grazing permit, the return to the operator is $1,455 annually. Without a grazing permit, the most profitable system is fall-purchased calves--wintered and grazed through the summer. This system would produce a return of $3,545 annually to the operator. If calves are bought in the spring and sold in the fall--an exclusive summer-grazing system without a grazing permit--the returns are $2,275 annually.

With a Federal grazing permit, the operator has an opportunity to increase the scale of his operation and income. Improved forage practices and use of the most profitable livestock system for a particular ranch may be a way to increase the scale of operation and income. Improved forage management and selection of the best livestock program can influence net ranch returns as much as or more than the gain or loss of a Federal grazing permit without any change in production practices or livestock management.

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## Colorado Mountain-Meadow Cattle Ranches

By Elmer C. Hunter, Agricultural Economist
Farm Production Economics Division, Economic Research Service

## INTRODUCTION

In the Rocky Mountain areas of Colorado, livestock sales represent about nine-tenths of the value of all farm products sold. Not only is livestock the chief source of income to ranchers, it is the major generator of business income within the area. Consequently, any improvement in the ranching income is reflected in the economy of the entire area.

Forage is basic to cattle raising in the mountain-meadow areas. Here, forage and grass are practically synonymous. Rangelands and improved pastures provide the forage for summer grazing, while meadows produce hay for winter feed.

The relative size and profitableness of the livestock industry in the area is determined to a large extent by the locally available forage resources. The area's rough terrain, relatively short growing season, low rainfall during the growing season, and poor soils make it unsuitable for agricultural uses other than livestock production.

The forage available from both ranges and meadows has declined through the years. This has reduced both the number of cattle and the profits per ranch unit. Because of this, the Agricultural Research Service of the U.S. Department of Agriculture and the Colorado State University Experiment Station began a general forage research program about 10 years ago, with the intention of finding ways to increase forage production on rangelands and meadows.

Some efforts are being made to increase forage production on rangelands, but productivity per acre is relatively small at best. Moreover, much of the rangeland is federally owned and is in demand for game and recreation uses.

In the mountainous areas, meadows produce a major part of the winter feed for livestock. Information obtained from experiments and ranchers' trials has shown that these meadowlands could produce more and better forage. In some experiments, the increases in forage production have been remarkable. These increases can be obtained by using, either singly or in combination, better irrigation practices, nitrogen fertilizer, phosphate fertilizer with legume seeding, and land leveling on meadows. Higher production of better-quality forage on these meadows provides an opportunity to increase the output from these ranches.

A rancher's meadows are his most productive land resource. They are the resource on which his management decisions have the greatest impact. Because of this, we have analyzed certain forage practices applicable to these meadowlands to illustrate the importance that improved range management might have on a particular ranch.

The objective of the study reported was to determine how forage production can be increased at least cost and to appraise the impact of various systems of livestock and land management on cattle ranching as an industry in the mountain-meadow areas.

This report attempts to answer the question, What forage practices and livestock systems will increase profit and income stability on the area's cattle ranches? The information presented here is applicable to the part of Colorado that lies within the confines of the State's mountain areas above 6,000 feet in elevation. The growing season is short and cool. Farming activities are generally limited to raising grass or grass-legume mixed hays and some small grains.

Most ranches in this area are family-type, with the management and most of the labor supplied by the operator himself. The typical ranch has 2,000 acres of land, including 200 acres of irrigated meadowland. In addition, the ranch has a summer grazing permit for 150 cattle on lands administered by the U. S. Forest Service or the U. S. Bureau of Land Management.[1] Nearly all of

[1] Based on U. S. Census of Agriculture, 1954 and 1959, and data collected for the study reported here.

the rancher's income is from the sale of feeder calves or yearlings.

A study of the area's cattle ranches was necessary before the various forage practices and livestock systems could be appraised. Information on costs, production, and management practices was needed. Survey data were obtained from 20 cattle ranches. These data, supplemented by additional data from 25 other ranches and research findings on meadows, provide the basis of this study.

## FORAGE PRODUCTION PRACTICES AND COSTS

Certain economic aspects of forage management were analyzed in greater detail in a publication issued in 1959, which indicated that good control of irrigation water is the first requirement for increasing the yield and quality of forage on irrigated meadows.[2] Proper irrigation practices cannot be followed on many mountain meadows because the irrigation-distribution system is poor or the surface of the meadow is rough. Therefore, the first question to be answered is, Can a particular meadow surface or its irrigation system be improved at reasonable cost to obtain good control of water?

The type of soil and its profile affect the cost and effectiveness of improved forage-management techniques. The clay soils usually retain moisture and nutrients within their root zone for longer periods than the sandy soils. In general, sandy soils have better soil temperatures and aeration. Ordinarily, nitrogen is more readily available in sandy than in heavier soils. However, frequent or continuous irrigation of sandy soils may reduce or eliminate these advantages.

These variables, along with such items as depth of topsoil, type of subsoil (if any), available water supply, length of growing season, and temperatures during the growing season, affect the response obtained from any management technique. Before a particular management technique at a specific location can be evaluated, the effect of local variables must be taken into account.

Sufficient information is available on three meadow-improvement practices, in addition to water control, to permit study of their relative merits. These practices are: (1) nitrogen fertilization, (2) phosphate fertilization and periodic reseeding of legumes, and (3) land leveling. These practices are examined and discussed singly and in various combinations.

Throughout this report only the usual or one-cut method of harvesting hay is considered. In the report issued in 1959[3], the two-cut method of harvesting was also analyzed. The two-cut technique was shown to be potentially profitable on a very limited acreage. In most instances, this method of hay harvesting was found to be profitable only when the hay so harvested was used as a supplement feed for weaner calves. The fact that the second cut is produced as a supplement limits its production. Economically it would be limited to 5 acres or less out of the 200 acres of our typical ranch's meadowland.

### Nitrogen Fertilization

The cattle-ranch operator who plans to use a nitrogen-fertilization program to increase his production of forage must ask himself, How much nitrogen should I apply per acre? It is essential to know the approximate yield response to nitrogen before this question can be answered. The expected increases in yields resulting from annual nitrogen application on clay soils are given in table 1. The yield shown for native

TABLE 1.--Estimated increase in yield of hay resulting from nitrogen fertilization with good water control, Colorado native meadows

| Nitrogen applied per acre | Yield per acre | Increase over previous application[1] |
|---|---|---|
| | Tons | Tons |
| None..... | 1.50 | 0 |
| 40 pounds. | 2.01 | .51 |
| 80 pounds. | 2.29 | .28 |
| 120 pounds. | 2.44 | .15 |
| 160 pounds. | 2.53 | .09 |
| 200 pounds. | 2.58 | .05 |
| 240 pounds | 2.61 | .03 |

[1] Economics of Forage Production in the Mountain Meadow Areas of Colorado. See footnote 2.

[2] Hunter, E. C. Economics of Forage Production in the Mountain Meadow Areas of Colorado. U.S. Agr. Res. Serv. ARS 43-99, 54 pp., illus., 1959.

[3] Cited in footnote 2, p. 2.

meadows receiving no nitrogen is estimated at 1.50 tons per acre. In the previous publication[4] land receiving no nitrogen was shown to produce 2.08 tons per acre. However, few ranchers obtain yields that average more than 1.50 tons per acre unless one of the improved practices under investigation here is followed. The State Agricultural Statistician's records show that the average production from Colorado's meadowlands seldom exceeds 1.0 ton per acre. Data gathered as a part of the study reported indicate that under favorable irrigation conditions, 1.50 tons per acre could be obtained as a ranch average. For these reasons, the base yield reported in the previous work was not used but the increments in yield resulting from fertilization are applicable.

Table 1 indicates the expected average increases in yield resulting from nitrogen fertilization. One must remember that these are "average" yields and may not necessarily be obtained from any one field, ranch, or area. Deviations from expected yields could be due to "nonaverage" weather, irrigation supplies, and so on.

With the yield response shown, what would be the most profitable rate of nitrogen application? If hay is valued at $20 a ton, and nitrogen costs $0.15 a pound, the most profitable rate would be 50 pounds of nitrogen per acre. Production would increase from 1.50 to 2.10 tons per acre.

Yield variations on a single field may be due to (1) year-to-year changes in weather and water supplies, or (2) variations in management. The variations in weather may affect the current year's yield, but ordinarily they do not affect greatly the most profitable rate of application. With adequate moisture, the response to nitrogen is somewhat above average, but probably the value of hay is somewhat below average. With limited moisture, the converse is true. Thus the most profitable rate for nitrogen will be close to that of an average year.

Variations in yield arising from differences in management (irrigation practices, nitrogen applications, and so on) are our chief concern. Under a nitrogen-fertilization program, the meadow diverted from production of hay to pasture would also receive some nitrogen. The most profitable rate for pasture is usually somewhat smaller than for hay production. The chief reason for this is that meadows used for pasture are usually the roughest and least productive. The land in these meadows responds less to nitrogen than the land used for hay. Also, the inability of cattle to "harvest" all that is produced during lush growing periods reduces the value of increased production from fertilization. For this reason, when 50 pounds of nitrogen is the most profitable rate for hay production, approximately 40 pounds is adequate for pasture.

[4] See footnote 2, p. 2.

## Phosphate Fertilization and Periodic Reseeding of Legumes

When little or no commercial nitrogen fertilizer is used, high yields of mountain-meadow hay are often associated with good stands of clover. However, clover stands are relatively unstable--one year they may be abundant and the next year almost absent. A clover stand can be maintained and yield per acre increased by periodic seeding of legumes into the existing sod. If phosphate fertilizer is also applied, the yield is increased further.

Meadow yields can be increased by 0.33 ton per acre or more by seeding legumes every 2 years and applying phosphate fertilizer. However, this practice is feasible only on those portions of the meadow on which water-soil combinations are favorable. Too much water is the major obstacle to the success of this practice.

This practice requires applying 30 pounds of phosphate each year, and seeding 8 pounds of legume seed into the existing sod every other year. Because phosphate fertilizer is not particularly susceptible to leaching, a single application can be large enough to last several years.

## Rough Land Leveling

Land leveling has not been used extensively in the mountain-meadow areas to improve water control, but it is becoming more popular as a method of doing so. Ideally, land leveling brings the field surface to a single gently sloping plane. This means that the cross slope of the field is uniform, and that the slope between irrigation ditches is the same. Most meadowland cannot be brought to a single plane as visualized in land leveling. The depth of the topsoil and roughness of the surface generally limit the amount of soil that can be removed from any one part of the meadow. However, rough leveling, which

eliminates the extreme low and high spots in a field, can be done on about 50 percent of Colorado's meadowlands. This reduces the water requirement per acre and the labor required to do a good job of irrigating. It may also reduce the costs of harvesting hay.

The cost of rough leveling and reseeding meadows is estimated at about $83 per acre (table 2). This cost, however, applies only to bottom and bench-type lands. Through the Agricultural Conservation Program's cost-sharing program, it is possible to obtain up to $22.65 per acre by rough leveling and reseeding meadows. This payment would reduce the estimated cost to $60.50 per acre. In addition, about $10.80 of the cost is labor, which is frequently done by the operator's normal labor force. Operators who have the necessary equipment and do their own plowing, disking, harrowing, land smoothing, seeding, and fertilizing could reduce out-of-pocket costs to approximately $50 per acre. Conditions vary between ranches; therefore in the analysis, all labor and equipment used were considered as costs.

Renovating a meadow takes about 3 years. While a reasonably good job can be done in 1 or 2 years, it is preferable to allow 3 years, so maximum decay of the former sod mat can take place. This will help to reduce the number and size of potholes in the field. Five dollars is allowed for chemical spraying, which presently is not a general practice. Using chemicals, however, will speed up the decay of the old sod mat and make for a better kill of the sward being plowed under.

Is it profitable to rough level and reseed mountain meadows? An analysis of the costs is shown in table 3.

In the analysis, the meadow before leveling was estimated to produce 1.50 tons of hay per acre at an average production cost of $16.27 per ton. The estimated yield per acre is conservative. On good land,

Table 2.--Estimated payments and costs to rough level 1 acre of mountain meadow and reseed[1]

| Practice | ACP payment[3] | Cost per acre[2] | | | |
|---|---|---|---|---|---|
| | | 1st year | 2d year | 3d year | Net cost |
| | Dollars | Dollars | Dollars | Dollars | Dollars |
| Leveling..... | 15.00 | 30.00 | 0 | 0 | 15.00 |
| Chemicals..... | 0 | 5.00 | 0 | 0 | 5.00 |
| Plowing..... | 0 | 5.25 | 4.00 | 4.00 | 13.25 |
| Seedbed preparation | 0 | 2.50 | 2.50 | 2.50 | 7.50 |
| Smoothing..... | 0 | 1.00 | 1.00 | 1.00 | 3.00 |
| Seeding..... | 0 | .95 | .95 | 1.70 | 3.60 |
| Oat seed[4]..... | 0 | 2.65 | 2.65 | 1.40 | 6.70 |
| Grass seed[5]..... | 3.75 | 0 | 0 | 7.00 | 3.25 |
| Fertilizer[6]..... | 3.90 | 0 | 0 | 7.10 | 3.20 |
| Total..... | 22.65 | 47.35 | 11.10 | 24.70 | 60.50 |

[1] Estimated costs based on information obtained from Colorado and Wyoming ranchers, Agricultural Conservation Program offices, and "Technical Guide for Improvement and Management of Mountain and Wet Meadows," U.S. Soil Conservation Service M-2855, Portland, Oreg., 1959.

[2] These costs include labor that can be done by the operator: $3.50 the first year, $3.30 the second year, and $4.00 the third year, or a total of $10.80.

[3] Possible payments based on "Colorado Agriculture Conservation Program, Handbook for 1960," and its appendixes.

[4] 75 pounds the first 2 years and 40 pounds the third year.

[5] Grass and legumes seeded will vary from area to area but probably will include some of the following: smooth brome, orchard, tallwheat, intermediate wheat, alfalfa, redtop clover, strawberry clover, and meadow fescue. Seeding rates vary from 15 to 24 pounds per acre.

[6] 30 pounds of nitrogen plus 40 pounds phosphate.

Table 3.--Estimated yield and costs of producing hay, rough-leveled Colorado mountain meadows

| Year[1] | Yield per acre[2] | Costs per acre | | | Average cost per ton |
|---|---|---|---|---|---|
| | | Level and reseed[3] | Other[4] | Total | |
| | Tons | Dollars | Dollars | Dollars | Dollars |
| 0 | 1.50 | 0 | 24.40 | 24.40 | 16.27 |
| 1 | [5] 2.00 | 47.35 | 25.00 | 72.35 | 36.18 |
| 2 | [5] 2.00 | 11.10 | 25.00 | 36.10 | 18.05 |
| 3 | [5] 1.70 | 24.70 | 24.65 | 49.35 | 29.03 |
| 4 | 2.00 | 0 | 25.00 | 25.00 | 12.50 |
| 5 | 2.50 | 0 | 25.50 | 25.50 | 10.20 |
| 6 | 2.40 | 0 | 25.40 | 25.40 | 10.58 |
| 7 | 2.25 | 0 | 25.30 | 25.30 | 11.24 |
| 8 | 2.25 | 0 | 25.30 | 25.30 | 11.24 |
| 9 | 2.20 | 0 | 25.20 | 25.20 | 11.45 |
| 10 | 2.15 | 0 | 25.15 | 25.15 | 11.70 |
| Total | 21.45 | 83.15 | 251.50 | 334.65 | --- |
| Average | 2.14 | 8.32 | 25.15 | 33.46 | 15.64 |

[1] The 12-month period September 1 to August 31.
[2] Conservative estimates. Frequently on good land, production per acre in the first and second years will exceed 2.5 tons per acre, and in the sixth and seventh years, 3.25 tons or more per acre.
[3] From table 2.
[4] Hay harvesting cost data from Hunter, p. 29. (See footnote 2, p. 2.). Costs include taxes, labor, interest on investment, depreciation, and operation.
[5] The hay produced during the first 3 years is oat hay. In the third year, potential production probably is 1.90 tons per acre, but early cutting to help insure a good hay stand reduces the hay production to 1.70 tons per acre.

production of oat hay in the first 2 years, for instance, frequently exceeds 2.5 tons per acre; 2.0 tons were used in the analysis. Over a 10-year period using our conservative estimates, the average cost of producing hay under normal conditions could be reduced to $15.64 per ton. If the rancher applied for and received the Agricultural Conservation Program payments indicated in table 2, the average cost would be $14.58 per ton.

In addition to increasing hay production and reducing the average cost per ton, some increase in aftermath growth should occur. For ranchers who need additional fall pasture, this would mean an additional incentive to use the practice on the meadows suited to its application.

Rough leveling would be profitable if the cost-price relationships and other conditions are comparable to those of meadows from which the data were obtained (table 3). Listed below are some of the important conditions found on meadows from which the data were gathered:

I. Basic considerations:
   A. Soil depth averaged at least 12 inches, above a gravel or cobble layer.
   B. The amount of soil moved did not exceed 200 yards per acre.
   C. The field had few or no drainage problems if prudent irrigation practices were followed.
   D. Average field slopes were 6 percent or less.
   E. The frost-free period equaled 65 days or more.
   F. Irrigation of fields higher on the slope did not flood out the leveled field.

II. Other considerations:
   A. The charge for a D-6 caterpillar tractor (or its equivalent) and a 10-yard carryall did not exceed $12.50 per hour.
   B. Hay was valued at $20 per ton.

If a meadow generally meets these criteria, it approximates the conditions under which the data were gathered. If the conditions were more favorable, the advantage of rough leveling and reseeding would be greater than shown by this analysis. Conversely, if the fields did not meet these criteria, the advantage may be less than shown.

About 50 to 60 percent of Colorado's estimated 707,000 acres of meadowland is estimated to meet the criteria mentioned above. Therefore, rough leveling can be used on a considerable acreage.

## Rough Leveling and Nitrogen Fertilization

When combined with nitrogen fertilization, rough leveling increases the forage produced by more than the sum of the increased production from the two practices separately. That is to say, leveling and nitrogen fertilizer are complementary.

The estimated increase in production resulting from nitrogen fertilizer is considerably greater on land that has been rough leveled than on native meadows, as shown in figure 1. Base yields per acre used in this figure are 1.50 tons of hay for unfertilized native meadow and 2.25 tons for unfertilized rough-leveled meadow.

The greater response on rough-leveled meadows is due to two different complementary relationships. First, leveling provides improved physical conditions so that better water management can be practiced. Second, leveling tears up and destroys most of the old sward, which can then be replaced by a combination of grasses and legumes that are more responsive to nitrogen and proper irrigation. These two factors account for the complementary yield response when leveling and nitrogen are used together.

For example, when 40 pounds of nitrogen is applied to land that has been rough leveled, the estimated production is 3 tons per acre. This is an increase of 1.5 tons per acre over unfertilized native meadows. Of this, approximately 0.5 ton per acre is accountable directly to nitrogen, 0.75 ton to rough leveling, and 0.25 ton due to their complementary nature. This makes it profitable to

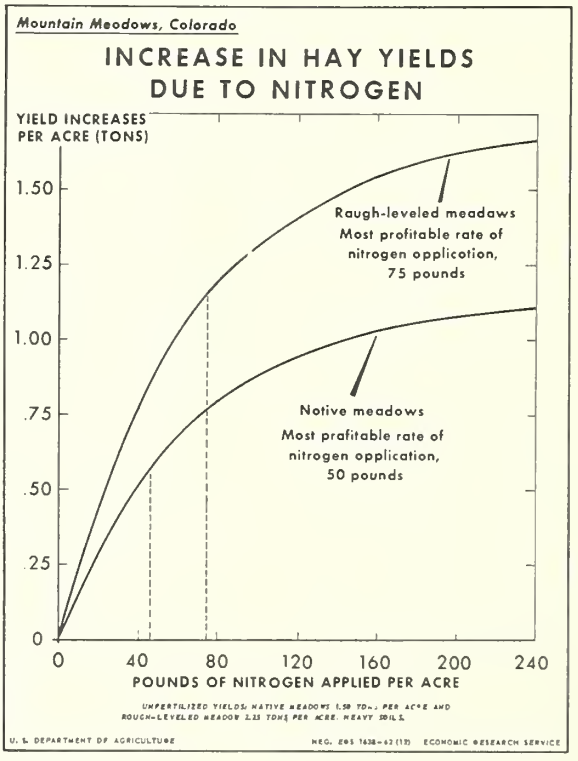


Figure 1

Table 4.--Estimated yield and costs of producing hay under a nitrogen-fertilization program, rough-leveled Colorado mountain meadows

| Year[1] | Yield per acre | Costs per acre | | | | Average cost per ton |
|---|---|---|---|---|---|---|
| | | Level and reseed[2] | Fertilizer[3] | Other[4] | Total | |
| | Tons | Dollars | Dollars | Dollars | Dollars | Dollars |
| 0..... | 1.50 | 0 | 0 | 24.40 | 24.40 | 16.27 |
| 1..... | 2.60 | 47.35 | 7.50 | 25.53 | 80.38 | 30.92 |
| 2..... | 2.60 | 11.10 | 7.50 | 25.53 | 44.13 | 16.97 |
| 3..... | 2.10 | [5] 17.60 | [5] 10.20 | 25.10 | 52.90 | 25.19 |
| 4..... | 3.09 | 0 | 11.25 | 25.93 | 37.18 | 12.03 |
| 5..... | 3.59 | 0 | 11.25 | 26.24 | 37.49 | 10.44 |
| 6..... | 3.42 | 0 | 11.25 | 26.13 | 37.38 | 10.93 |
| 7..... | 3.34 | 0 | 11.25 | 26.09 | 37.34 | 11.18 |
| 8..... | 3.34 | 0 | 11.25 | 26.09 | 37.34 | 11.18 |
| 9..... | 3.30 | 0 | 11.25 | 26.07 | 37.32 | 11.31 |
| 10..... | 3.30 | 0 | 11.25 | 26.07 | 37.32 | 11.31 |
| Total... | 30.68 | 76.05 | 103.95 | 258.78 | 438.78 | ----- |
| Average. | 3.07 | 7.60 | 10.40 | 25.88 | 43.88 | [6] 14.29 |

[1] The 12-month period September 1 to August 31.
[2] From table 2.
[3] First, second, and third years, 50 pounds of available nitrogen is applied annually, and in the fourth through the tenth years, 75 pounds is used. Included in the fertilizer costs for the third year is 40 pounds of phosphate.
[4] Hay harvesting cost data from Hunter, p. 29. (See footnote 2, p. 2.) Costs include taxes, labor, interest on investment, depreciation, and operation.
[5] Fertilizer costs for reseeding (table 2) are shown in the fertilizer column.
[6] If ACP payments are obtained, the average cost per ton would be $13.56.

apply larger amounts of nitrogen fertilizer. The optimum application of nitrogen on rough-leveled land is 75 pounds and on native meadows 50 pounds.

The estimated breakdown of costs and production over a 10-year period for meadows rough leveled with nitrogen fertilization is shown in table 4. The effect of rough leveling, under good management, could last for 15 years rather than the 10 years indicated in the table. For our purposes, however, the 10-year period is long enough to illustrate the costs and yield for these two practices.

## Rough Leveling, Phosphate Fertilizer, and Periodic Seeding of Legumes

The combination of rough leveling, phosphate fertilizer, and periodic seeding of legumes is complementary, and the production responses are frequently large. Better water control and the higher potential production of the legumes (as compared with grasses) with phosphate fertilization makes a productive forage combination. The interaction between grasses and legumes plays an important part in this increase in production.

This combination of practices should increase production of hay by about 1.3 tons per acre.[5] The breakdown of costs and production over a 10-year period for these practices is shown in table 5. As mentioned previously, the effects of rough leveling should last longer than the 10 years indicated, under good management.

This combination shows as much promise as any of the practices analyzed, but it is

[5] Willhite, F. M. Mountain Meadow Fertilization. Paper presented at the First Intermountain Meadow and Range Fertilization Conference, February 19, 1960, Agr. Res. Serv. Fort Collins, Colo.

Table 5.--Estimated yield and costs of producing hay under a phosphate-fertilization and periodic legume-reseeding program, rough-leveled Colorado mountain meadows

| Year[1] | Yield per acre | Costs per acre | | | | Average cost per ton |
|---|---|---|---|---|---|---|
| | | Level and reseed[2] | Fertilizer[3] | Other[4] | Total | |
| | Tons | Dollars | Dollars | Dollars | Dollars | Dollars |
| 0..... | 1.5 | 0 | 0 | 24.40 | 24.40 | 16.27 |
| 1..... | 2.6 | 47.35 | 7.50 | 25.53 | 80.38 | 30.92 |
| 2..... | 2.6 | 11.10 | 7.50 | 25.53 | 44.13 | 16.97 |
| 3..... | 2.1 | [5] 17.60 | [5] 10.20 | 25.10 | 52.90 | 25.19 |
| 4..... | 3.0 | 0 | 2.70 | 25.86 | 28.56 | 9.52 |
| 5..... | 3.3 | [6] 1.65 | 2.70 | 26.07 | 30.42 | 9.22 |
| 6..... | 3.1 | 0 | 2.70 | 25.93 | 28.63 | 9.24 |
| 7..... | 3.1 | [6] 1.65 | 2.70 | 25.93 | 30.28 | 9.77 |
| 8..... | 3.0 | 0 | 2.70 | 25.86 | 28.56 | 9.52 |
| 9..... | 2.7 | [6] 1.65 | 2.70 | 25.62 | 29.97 | 11.10 |
| 10..... | 2.7 | 0 | 2.70 | 25.62 | 28.32 | 10.49 |
| Total..... | 28.20 | 81.00 | 44.10 | 257.05 | 382.15 | ----- |
| Average..... | 2.82 | 8.10 | 4.41 | 25.71 | 38.22 | [7] 13.55 |

[1] The 12-month period September 1 to August 31.
[2] From table 2.
[3] First, second, and third years, 50 pounds of available nitrogen is applied. In the third year, phosphate is applied at the rate of 40 pounds per acre, and 30 pounds is applied each year after.
[4] Hay harvesting cost data from Hunter, p. 29. (See footnote 2, p.2.) Costs include taxes, labor, interest on investment, depreciation, and operation.
[5] Fertilizer costs for reseeding (table 2) are shown in the fertilizer column.
[6] Cost of biennial legume reseeding.
[7] If ACP payments are obtained, the average cost per ton would be $12.75.

limited. Soil, moisture, and climate are more limiting for this combination than for the rough leveling and nitrogen combination. Most ranches have some acreage that can be managed in this way. On some ranches, the practice can be applied to a considerable portion of the meadows. Only at elevations above 9,000 feet does climate tend to be a real limiting factor.

## Adaptability of Practices

Each of the practices considered, individually and in combination, can increase the output and reduce the average cost per ton of forage produced (table 6).

One could reasonably ask if it might not be profitable to apply more nitrogen with practices 2 and 5 under the conditions cited. The answer is no. In practice 2--the nitrogen-fertilization program--10 additional pounds of nitrogen would increase the hay yield from 2.10 to approximately 2.17 tons per acre. If we consider only fertilizer costs, the nitrogen needed to obtain an increase in yield of 0.07 ton would cost approximately $1.50. This is the equivalent of $21.43 per ton. There would be additional harvesting costs of approximately $1 per ton of increased production. Therefore, when 10 additional pounds of nitrogen are applied, the increase in the quantity of hay produced would cost approximately $22.50 per ton. This is more than the average price of hay in most areas. The costs and increases would be comparable for practice 5--rough leveling and nitrogen fertilization.

In areas in which hay prices averaged substantially above $20 per ton, additional quantities of fertilizer could be applied

Table 6.--Cost of producing hay under specified forage programs, a typical 200-acre mountain meadow

| Method of managing meadows | Production | | Costs per acre | | | Cost per ton |
|---|---|---|---|---|---|---|
| | Per acre | Increase | Normal | Practice | Total | |
| | Tons | Tons | Dollars | Dollars | Dollars | Dollars |
| 1. Usual method | 1.50 | 0 | 24.40 | 0 | 24.40 | 16.27 |
| 2. Annual application of nitrogen fertilizer | 2.10 | .60 | 25.10 | 7.50 | 32.60 | 15.52 |
| 3. Annual application of 30 pounds of phosphate and periodic legume seeding | 1.83 | .33 | 24.80 | 4.35 | 29.15 | 15.93 |
| 4. Rough leveling and reseeding | 2.14 | .64 | 25.15 | 8.32 | 33.47 | 15.64 |
| 5. Combination of methods 2 and 4 | 3.07 | 1.57 | 25.88 | 18.00 | 43.88 | 14.29 |
| 6. Combination of methods 3 and 4 | 2.82 | 1.32 | 25.70 | 12.51 | 38.21 | 13.55 |

profitably. For instance, if hay prices averaged $25 per ton, about 70 pounds of nitrogen could be applied profitably under practice 2 and 100 pounds under practice 5.

If nitrogen fertilizer is used on the meadows over a long period of time, undoubtedly phosphate fertilizer will need to be added to maintain the estimated yields. While phosphate would add to the overall cost, in the long run, it would not materially alter our analysis. Phosphate is relatively inexpensive, and the amount needed would be small.

Rough leveling alone or in combination with nitrogen fertilization or phosphate fertilization and periodic legume seeding shows considerable promise as a method of increasing forage production and decreasing costs per ton of hay. Where rough leveling of the meadows is feasible, a prudent manager will not consider either of the simple fertilizer practices except as an intermediate step or "stop gap" program. Where it is not feasible to rough level meadows because of physical limitations, then the simple fertilizer practices frequently will help increase production at a reduced cost.

Practice 5, rough leveling and nitrogen fertilization, also shows considerable promise. While its cost per ton of hay produced is higher than under practice 6, it has two advantages: Its requirements are less with respect to water control, and it produces a higher yield of hay. Greater hay production may allow the cattle herd to be larger. Consequently, the higher cost per ton of hay may be offset by reduced costs per unit of cattle resulting from the larger numbers.

Practice 6--rough leveling, phosphate fertilization, and periodic seeding of legumes--produces hay at least cost. However, this practice has greater limitations than practice 5--the next least-cost situation. The major limitation is that this practice requires the highest degree of water control. Costwise, however, its advantages are great enough so that it should be considered when changes in forage management of meadowlands are contemplated.

When rough leveling is not feasible, then the practices 2 and 3, nitrogen fertilization and phosphate fertilization with legumes, should be considered. Where these practices are applicable, they increase production of hay and reduce the cost per ton.

## CATTLE SYSTEMS

The cattle systems that might be the most profitable on a typical cattle ranch using improved forage practices are investigated in the rest of the publication. The typical mountain meadow ranch is assumed to have 2,000 acres, including 200 acres of irrigated meadow, and a summer grazing permit for approximately 150 head of cattle on Federal lands.[6] At 1959 prices this ranch would have approximately $44,250 invested in land and improvements and $6,100 in machinery. The investment in livestock will vary, depending upon the type of livestock system used.

Thus an appraisal is made of the following livestock systems for this typical ranch:

With a summer Federal grazing permit for 150 head of cattle:

1. Cow-calf
2. Cow-yearling

Without the Federal grazing permit:

3. Cow-yearling
4. Purchased calves - wintered and grazed
5. Purchased yearlings - summer grazed

Regardless of the livestock system, one man is assumed to be hired for the summer. In all systems, except for the purchased yearling - summer grazed, a second man is hired for about a month--primarily to assist with the hay harvesting. For the cow operations, calving starts in April and except for a few late calves is completed by the end of May.

For the cattle systems on ranches with grazing permits, most of the cows and calves are moved onto public lands around June 15 for summer grazing. They are taken off these lands sometime between the 1st and the 15th of October. The cattle to be sold are marketed between October 15 and December 15. The exact date is determined by the operator's estimate of the market, the amount of feed available (hay and pasture) on the ranch, and the condition of the cattle.

Hay meadows are managed under a rough-leveling and nitrogen-fertilization program. It is assumed that because of physical limitations only 100 acres of the meadow can be leveled. The remaining meadowland, whether used to produce hay or as irrigated

[6] Acreage and investments used here are based on survey data obtained for this study and data available from the 1959 Census of Agriculture.

pasture, also is fertilized with nitrogen. The application rates for nitrogen are as follows: rough-leveled land receives 75 pounds of nitrogen annually, unleveled native meadows used for hay production 50 pounds, and meadow used as pasture 40 pounds.

Assumed cattle sale weights and prices are as follows:

| | Weight | Price per cwt. |
|---|---|---|
| | Pounds | Dollars |
| Weaner calves, fall price | 375 | 25.00 |
| Yearlings purchased in spring | 456 | 26.60 |
| Yearlings sold in fall | [1] 700 | 22.15 |
| Cows sold | 1,000 | 14.00 |
| Bulls sold | 1,250 | 16.00 |

[1] Weights would be heavier if yearlings are grazed on irrigated meadow.

Prices are based on average prices for livestock produced and sold from the mountain meadow areas of Colorado during 1950-59. Sale weights are based on the average of the better managed ranches surveyed for this study.

## With Federal Grazing Permit

Ranches with Federal grazing permits have more summer forage available than comparable ranches without permits. However, additional costs are associated with the grazing permits.

Cash costs associated with Federal permits include fees paid to the Federal agency, hire of a range rider (cowboy), necessary investment in fence and cabins on the range, and so on. Non-cash costs include lower calving and weaning rates and lower sale weights than those normally obtained with cattle run on privately owned lands. Calf weanings for cows on Federal rangelands are about 85 percent, and cows on irrigated pastures in conjunction with other private lands wean approximately 5 percent more calves, or 90 percent.

The ranch operator frequently has another type of non-cash cost. He must belong to a cattle association or pool made up of ranchers who run cattle on a particular range. Within limits, the ranchers in the pool manage the range, and all decisions are made by the group. These decisions may not necessarily fit into any particular operator's scheme of operation. Frequently, they result in higher costs, lower production, or both, to an individual ranch operator.

### Cow-Calf System

Most cattle ranches in the mountain-meadow areas of Colorado operate under a cow-calf system. Under this system, the chief source of income is the sale of calves each fall.

By using a rough-leveling, nitrogen-fertilization meadow program, our typical ranch could winter a breeding herd of 185 cows and 28 replacement heifers. The wintering of the livestock would require 390 tons of hay or the production from 140 acres of meadowland. The remaining 60 acres of meadowland would be fertilized and used for irrigated pasture. Most of the cows (144 head) and 6 bulls would be placed on Federal lands for summer grazing. The remaining livestock (41 cows, 28 yearlings, 2 bulls, horses, and milk cows) would remain on the ranch during the summer.

In a normal year, this system would market 131 calves, 22 cows, and 3 range bulls. The gross sale weight of these animals would average 749 hundredweight and at the prices assumed would be valued at $15,960. Calf sales would account for 491 hundredweight and $12,280 of these totals. The cash operating expenses would be $8,325, with depreciation and interest on the investment in land, machinery, and livestock adding $5,900 to the estimated cost for a total of $14,225. Therefore, the money available to pay the operator for his labor and management would be $1,735.

### Cow-Yearling System

The next most common type of cattle operation in the mountain meadow area is the cow-yearling system. The number of cattle wintered under this system would exceed that of the cow-calf operation. Under the same meadow-management program, a breeding herd of 130 cows and 110 yearlings would be wintered. The winter hay requirement would be 380 tons or the production from 134 acres of meadow. Sixty-six acres would be fertilized and used as irrigated pasture for summer grazing. Together with the other grazing available on the ranch, this would provide sufficient forage for 95 yearlings, 1 bull, horses, and milk cows. All of the cows, 15 yearlings, and 5 bulls would be pastured on Federal lands during the summer.

In a normal year, this system would market 88 yearlings, 16 cows, and 3 range bulls. The gross sale weight of the livestock

sold would be 829 hundredweight valued at $16,820. This is about 8 percent more than under a cow-calf system. The yearlings would account for 631 hundredweight and $13,980 of the sales.

The cash expenses of this operation would be $8,285, approximately the same as for a cow-calf operation. Other estimated costs, depreciation, and interest on the investment in land, machinery, and livestock would be about $5,795. The total of all costs would be $14,080. Thus the operator would earn $2,740 for his labor and management.

## Without Federal Grazing Permit

If the typical ranch did not have a Federal grazing permit, would there be major differences in the ranch's profit position? Which cattle system would offer the greatest profit potential? In order to answer these questions, three cattle systems are analyzed for the typical ranch, each without a Federal grazing permit: (1) the cow-yearling, (2) purchased calves - wintered and grazed, and (3) purchased yearlings - summer grazed. In the analysis that follows it has been assumed that the ranch investment is the same as the ranch analyzed with the permit.

When a beef herd stays at home during the summer, it normally produces more beef per animal than herds grazing on Federal lands. The calving percentage is higher as more cows are bred because of the closer confinement of the breeding herd. This confinement permits closer supervision of the herd by the owner, which usually results in fewer deaths. The net result is an increase in calf weanings, which average about 5 percent higher than for herds grazing on Federal lands. Also, reduced traveling of the herd and better grazing control result in slightly higher daily gains. For the additional yearlings grazed at home, the sale weights are increased about 24 pounds per head for the summer grazing season.

### Cow-Yearling System

The typical ranch operated under the cow-yearling system could winter a breeding herd of 100 cows and 90 yearlings. The winter hay requirement for all livestock would be 295 tons produced on 96 acres of rough-leveled meadowland receiving annual nitrogen applications (table 7). The remaining meadowland--104 acres--would be fertilized and used for irrigated pasture.

This system would market 73 or 74 yearlings, 13 cows, and 2 bulls annually. The gross sale weight of these animals would average 683 hundredweight valued at $13,915 (table 8). The yearlings would account for 528 hundredweight and $11,695 of the sales.

The cash operating expense would approximate $7,085 annually. Other costs, such as depreciation and interest on the investment in land, machinery, and livestock, would amount to $5,375. The total of all costs would be $12,460. The operator would receive a return of $1,455 for his labor and management. This is $1,285 less than the returns for the same ranch with a permit under the cow-yearling system.

### Purchased Calves - Wintered and Grazed

Under the wintered and grazed purchased calves system, the operator would purchase 250 weaner calves averaging 375 pounds in the fall. They would be wintered on hay, grazed on the ranch during the summer, and sold approximately a year after they were purchased. To winter the ranch's livestock, 275 tons of hay produced on 89 acres of rough-leveled meadowland receiving nitrogen fertilizer would be required. The remaining meadow would be fertilized and used as irrigated pasture (table 7).

The investment in land and machinery would be the same for this operation as the three previous cattle systems discussed. However, the average investment in livestock is less for this system than for any other. In an average year, this investment in the 250 head of calves purchased would be $23,440.

In a normal year, 245 yearlings would be sold. The gross sale weight would be 1,767 hundredweight. As 938 hundredweight were purchased, the net production would be 829 hundredweight, and the net value (sales less purchase) $15,700 (table 8). The annual cash expenses other than for calves purchased would be $6,835. Other costs including depreciation and interest on the investment would account for another $5,320. Total annual costs would be $12,155, which would leave the operator $3,545 for his labor and management.

Table 7.--Organization and investment under different livestock systems, typical Colorado mountain-meadow cattle ranch[1]

| Item | Unit | Grazing permit | | Without grazing permit | | |
|---|---|---|---|---|---|---|
| | | Cow-calf | Cow-yearlings | Cow-yearlings | Yearling-grazing | |
| | | | | | Fall purchases | Spring purchases |
| Organization | | | | | | |
| Land in ranch | Acre | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Irrigated meadow | do. | 200 | 200 | 200 | 200 | 200 |
| Used: For hay | do. | 140 | 134 | 96 | 89 | 30 |
| For pasture | do. | 60 | 66 | 104 | 111 | 170 |
| Hay produced | Ton | 390 | 380 | 295 | 275 | 75 |
| Grazing unit permit | Animal unit | 150 | 150 | 0 | 0 | 0 |
| Cows | Number | 185 | 130 | 100 | 0 | 0 |
| Yearlings | do. | 28 | 110 | 90 | 250 | 350 |
| Investment | | | | | | |
| Land and improvements[2] | Dollar | 44,250 | 44,250 | 44,250 | 44,250 | 44,250 |
| Machinery | do. | 6,100 | 6,100 | 6,100 | 6,100 | 4,060 |
| Livestock | do. | 33,100 | 30,950 | 24,325 | 23,440 | [3] 42,455 |
| Total | do. | 83,450 | 81,300 | 74,675 | 73,790 | 90,765 |

[1] With half the meadow area rough-leveled and a nitrogen-fertilization program followed. Rough-leveled meadow used for hay production receives 75 pounds of nitrogen per acre annually and 40 pounds when used for irrigated pasture. Comparable figures for native meadow are 50 and 40 pounds of nitrogen.

[2] Assumed value of the ranch is the same with or without a cattle permit.

[3] Investment in cattle is for a period of approximately 7 months.

### Purchased Yearlings - Summer Grazed

The rancher who summer grazes purchased yearlings would buy 350 calves averaging 456 pounds each spring (table 7). These animals would be grazed on the ranch during the summer and sold in the fall. No hay would be required to winter them, but a small amount would be needed to winter the ranch's horses and milk cows. More than enough hay would be produced on the part of the meadow that is in process of being rough leveled or reseeded. This part should not be grazed during the growing season, so it normally will be harvested for hay. During a 10-year period approximately 30 acres, on an average, will be in either one or both of these stages. Normally this acreage will produce a little more than 75 tons of hay. At least half of the hay could be sold each year. The rest of the meadow--170 acres--would be fertilized and used as irrigated pasture.

Some of the machinery normally found on a mountain-meadow cattle ranch would not be necessary if this system were followed. Such items as hay balers could be eliminated, and one tractor would do instead of the two usually found on similar ranches. Thus the investment in machinery could be reduced by approximately a third. The purchase of 350 calves would require a short-term investment of $42,455.

In an average year, 343 yearlings would be sold. The gross sales weight of these animals would be 2,474 hundredweight. Net production of beef would be 878 hundredweight (2,474 sold minus 1,596 purchased) and the net value (sales minus purchases) would be $12,340 including the hay sold. Annual cash expenses other than for calves purchased would be $6,490. Additional costs, such as depreciation and interest on the investment, would account for another $4,295. Therefore, the total costs would be $10,785, which would leave the operator $2,275 for his labor and management.

Table 8.--Costs and returns under different livestock systems, typical Colorado mountain-meadow cattle ranch[1]

| Item | Grazing permit | | Without grazing permit | | |
|---|---|---|---|---|---|
| | Cow-calf | Cow-yearlings | Cow-yearlings | Yearling-grazing | |
| | | | | Fall purchases | Spring purchases |
| Gross income | Cwt. | Cwt. | Cwt. | Cwt. | Cwt. |
| Cattle sold, net weight... | 749 | 829 | 683 | 829 | 878 |
| | Dollars | Dollars | Dollars | Dollars | Dollars |
| Cattle sold, net value... | 15,960 | 16,820 | 13,915 | 15,700 | 12,340 |
| Hay..... | 0 | 0 | 0 | 0 | 720 |
| Costs | | | | | |
| Cash: | | | | | |
| Range expenses..... | 625 | 625 | 0 | 0 | 0 |
| Labor hired..... | 1,535 | 1,515 | 1,465 | 1,445 | 1,300 |
| Taxes..... | 955 | 945 | 870 | 855 | 755 |
| Gas and oil..... | 685 | 680 | 650 | 650 | 440 |
| Veterinary and medical. | 125 | 125 | 100 | 125 | 175 |
| Repairs: | | | | | |
| Machinery..... | 300 | 300 | 300 | 300 | 200 |
| Fences, etc..... | 200 | 200 | 200 | 200 | 225 |
| Fertilizer..... | 1,700 | 1,685 | 1,620 | 1,590 | 1,200 |
| Leveling..... | 760 | 760 | 760 | 760 | 760 |
| Other..... | 690 | 700 | 620 | 910 | 1,435 |
| Bulls purchased..... | 750 | 750 | 500 | 0 | 0 |
| Total cash costs... | 8,325 | 8,285 | 7,085 | 6,835 | 6,490 |
| Other | | | | | |
| Machinery, depreciation | 1,340 | 1,340 | 1,340 | 1,340 | 405 |
| Interest on investment: | | | | | |
| Land @ 5%[2]..... | 2,210 | 2,210 | 2,210 | 2,210 | 2,210 |
| Machinery @6%..... | 365 | 365 | 365 | 365 | 245 |
| Livestock @6%..... | 1,985 | 1,880 | 1,460 | 1,405 | 1,435 |
| Total other costs... | 5,900 | 5,795 | 5,375 | 5,320 | 4,295 |
| Total costs..... | 14,225 | 14,080 | 12,460 | 12,155 | 10,785 |
| Return to operator and family for labor and management..... | 1,735 | 2,740 | 1,455 | 3,545 | 2,275 |

[1] Costs are based on 20 ranch records for 1957 and 1958. Cattle prices are based on average prices received for 1950-59, with half the meadow area rough-leveled and a nitrogen-fertilization program followed. Rough-leveled meadow used for hay production receives 75 pounds of nitrogen per acre annually and 40 pounds when used for irrigated pasture. Comparable figures for native meadow are 50 and 40 pounds of nitrogen.

[2] Assumed value of the ranch is the same with or without a cattle permit.

## Comparison of the Livestock Systems

Under the price-cost relationships and production conditions assumed, the cow-yearling operation is the more profitable of the two systems considered using a Federal grazing permit. More beef is produced than in a cow-calf operation, and a lower percentage of the beef sold is made up of the less valuable cow and bull sales (table 8).

The sale price assumed for calves was $25, and for yearlings $22.15 per hundredweight. For profits of the cow-calf and cow-yearling systems to be equal, calves would need to sell for $27.05 when yearlings were selling for $22.15 per hundredweight. If calves sold for $25 per hundredweight, the yearlings would need to sell for $20.55 per hundredweight before the cow-yearling operation would provide the same return to the operator. The price spreads indicated, $4.90 ($27.05 minus $22.15) and $4.45 ($25 minus $20.55), are seldom this large even when cattle prices are considerably higher.

Looking at it another way, the increase in weight from purchase in the fall to sale of the yearlings the following fall could drop to 275 pounds from the expected 325, without the yearling operation becoming less profitable than the calf operation. Except in unusual circumstances, the average rate of gain for calves wintered and grazed through the summer should exceed 275 pounds.

Under the conditions assumed, one may conclude that a cow-yearling system will have a profit advantage over the cow-calf system. Also, the cow-yearling system is more flexible. If forage production is less than normal, the sale of yearlings in spring or early summer would disrupt the basic breeding herd relatively little, if any. But, for the cow-calf operation when forage supplies are short, a reduction in the size of the breeding herd may be the only alternative. In many instances, this means selling some cows prematurely at considerable sacrifice as well as the effort and expense of replacing when forage supplies return to normal. Also, it may take some time to locate or develop replacement cows of the same quality as those prematurely culled from the herd. Therefore, reduced forage supplies adversely affect the income of a cow-calf operation for a longer time than that of a cow-yearling operation.

The system of purchased calves, wintered and grazed, without a Federal grazing permit, will produce higher returns for the ranch operator than the other systems analyzed here. It does not produce as much beef as the purchased yearling, summer grazed system. Normally, however, the latter system is not as profitable, because it has a larger negative price spread--$4.45 per hundredweight ($26.60 less $22.15) compared to $2.85 ($25.00 less $22.15). (See tabulation on page 11.) The operator who buys yearlings in the spring usually buys more pounds of beef than the operator who buys calves in the fall, on which the loss of $4.45 per hundredweight is taken. These two factors outweigh the greater production of beef.

Both purchased-yearling systems have an advantage over the other systems: it is easier to balance livestock numbers with the current outlook for forage production.

These two purchase systems have a higher annual price risk than any of the other operations, a factor of special import when a ranching operation is financed primarily on credit. The price risk (or variability of income) is even greater if annual sale prices for the period 1950-60 are used, instead of the average prices assumed in the study (table 9). Figure 2 indicates the variation in annual incomes for the five cattle systems analyzed. The difference in returns for years of high prices and low prices is largest for the two purchased cattle systems, exceeding that of the comparable cow-yearling system (without a cattle grazing permit), $8,000. In figure 2 the spread for the cow-calf system, with a cattle permit on public lands, is about the same as the two purchased systems, without permits. If an analysis had been made for a cow-calf system without a cattle permit the spread would be less than that indicated.

Another factor to consider in the purchased-yearling systems is the ability of the operator to purchase cattle at the "average going price." Realized profits could be greater or less than those calculated. However, these extra gains or losses should be credited to the skill or lack of skill in buying rather than type of operation.

In the analysis of these five systems, equally competent management was assumed for each system. This assumption may not be justified when a particular individual is deciding which system would

Table 9.--Estimated price per hundredweight of various classes of Colorado cattle, 1950-60[1]

| Season, and cattle class | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FALL[2] | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars |
| Calves: | | | | | | | | | | | |
| Steers..... | 36.75 | 40.50 | 27.10 | 18.35 | 20.60 | 20.00 | 19.45 | 25.95 | 34.65 | 31.20 | 26.55 |
| Heifers..... | 35.50 | 39.45 | 25.05 | 15.95 | 17.95 | 17.65 | 17.55 | 23.40 | 33.05 | 28.40 | 24.70 |
| Yearlings: | | | | | | | | | | | |
| Steers..... | 31.40 | 33.65 | 25.10 | 17.75 | 19.10 | [3]18.00 | 17.45 | 21.60 | 26.75 | 26.15 | 23.45 |
| Heifers..... | 28.85 | 30.25 | 22.00 | 15.50 | 17.15 | 16.20 | 15.60 | 19.80 | 26.60 | 24.60 | 22.10 |
| Cows..... | [4]18.75 | [4] 21.70 | [4] 13.90 | 9.70 | 8.90 | 9.30 | [4] 9.25 | [4]13.00 | [4]17.40 | [4]13.35 | 12.35 |
| SPRING[5] | | | | | | | | | | | |
| Yearlings: | | | | | | | | | | | |
| Steers..... | 0 | 37.50 | 36.50 | 21.50 | 21.50 | 19.60 | 20.50 | 22.50 | 33.75 | 32.20 | 30.00 |
| Heifers..... | 0 | 36.30 | 35.00 | 20.50 | 20.00 | 18.50 | 19.50 | 20.00 | 30.10 | 29.30 | 27.00 |

[1] Based upon prices received for the various classes of cattle by the Crow Valley Association, as reported by Crop Research Division, ARS, unless indicated otherwise.

[2] Prices as of approximately November 1 each year.

[3] Prices estimated. Yearling steers comparable to sales in other years were not sold this particular year.

[4] Data not available on cow prices in these years. Prices based upon comparable cow prices in Denver.

[5] Estimated price that the preceding year's calves could have been sold for during May.

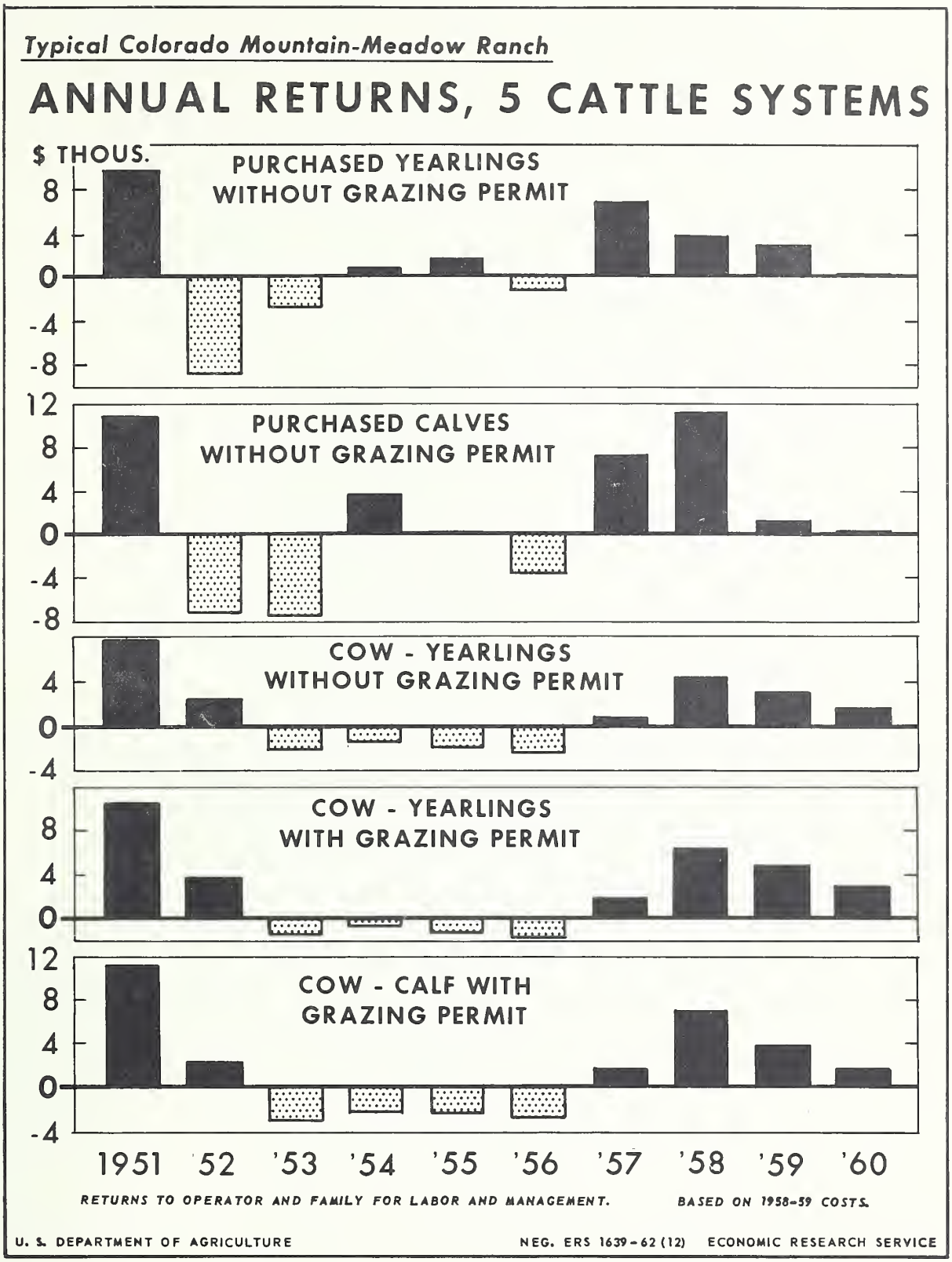
Typical Colorado Mountain-Meadow Ranch
ANNUAL RETURNS, 5 CATTLE SYSTEMS
$ THOUS.
PURCHASED YEARLINGS WITHOUT GRAZING PERMIT
PURCHASED CALVES WITHOUT GRAZING PERMIT
COW - YEARLINGS WITHOUT GRAZING PERMIT
COW - YEARLINGS WITH GRAZING PERMIT
COW - CALF WITH GRAZING PERMIT
1951 '52 '53 '54 '55 '56 '57 '58 '59 '60
RETURNS TO OPERATOR AND FAMILY FOR LABOR AND MANAGEMENT.
BASED ON 1958-59 COSTS.
U. S. DEPARTMENT OF AGRICULTURE
NEG. ERS 1639-62 (12) ECONOMIC RESEARCH SERVICE

Figure 2

be the best for him to use. The particular rancher may be a successful manager of a cow herd and a "poor" cattle buyer, which might influence him to stay out of a purchased yearling program. Of course, he might hire this service, which would reduce the return he receives, but still improve his profit potential.

There is also the possibility of combining two or more systems to increase the flexibility over that of any single system. Such a combination might be that of combining a cow-yearling with a purchase-yearling program or a partial cow-calf, cow-yearling operation.