Agriculture Information Bulletin No. 268

Improving MOUNTAIN MEADOW PRODUCTION in the West

UNITED STATES DEPARTMENT OF AGRICULTURE

For many years the mountain rancher pursued his vocation as an easy, pleasant "way of life." His working tools were his horse, his saddle, and his rope. His herd thrived on the vast areas of grazing land that were at his disposal. The natural resources of a bountiful land provided him with a comfortable income.

Gradually this picture changed. Homesteading increased. The herds of many more ranchers grazed the same area. Through use, the soil became less productive.

The rancher came to realize that to prosper he must adopt a new business philosophy: In order that he might take from the soil, he must give to it—efficient irrigation, cultivation, and fertilization. To his herd he must give proper care, and to his overall operation, good management. He invited science and research to help him.

Today, the potentials for prosperous mountain ranching are greater than they ever were. Science and research are working side by side with the rancher who will add the plow, the reaper, the seeder, the shovel, and efficient management to his inventory of working tools.

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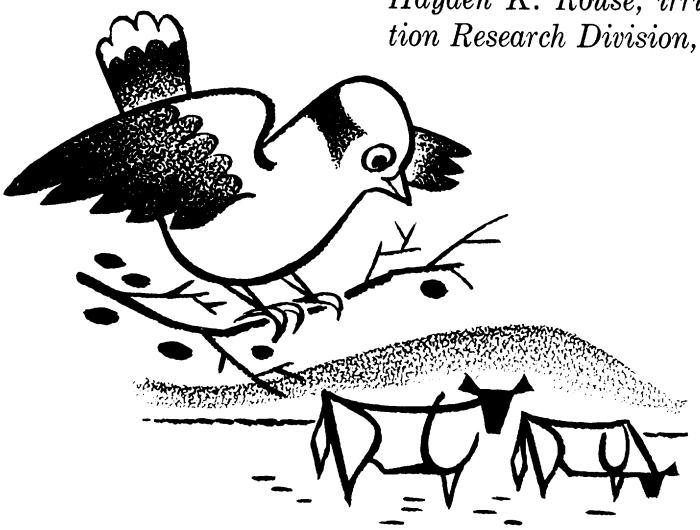
Improving MOUNTAIN MEADOW PRODUCTION in the West

By Forrest M. Willhite and Rulon D. Lewis, soil scientists, and Hayden K. Rouse, irrigation engineer, Soil and Water Conservation Research Division, Agricultural Research Service [1]



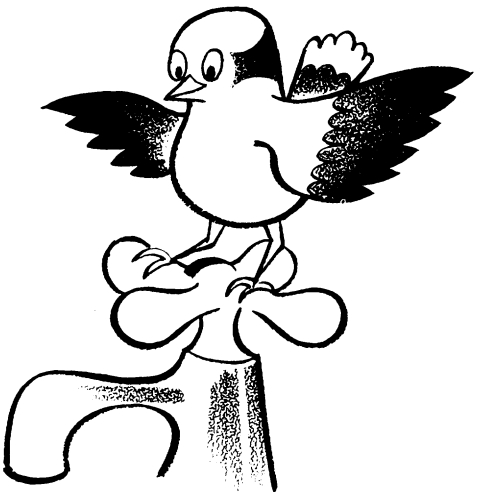
APPLYING RESEARCH FINDINGS FOR INCREASED PRODUCTION

Ranching practices on mountain meadows in the Western United States have been under research since 1950. Comparisons have been made between ranches operated by traditional procedures and those on which modern research findings were applied. This publication gives some facts and figures, and reports the important conclusions drawn from these comparisons.

A survey showed that information acquired through research was being applied mostly by ranchers who lived near experimental sites or who attended field-day demonstrations. *Some of these ranchers were able to increase their production as much as 600 percent.* They learned how to conserve water by applying less to the meadow and using the surplus on new lands. They learned how to grow about 5 tons of hay where 1 grew before, and how to produce about 6 times as much beef on the acreage they owned.

These ranchers centered their efforts on the improvement of *water efficiency, area efficiency, soil efficiency, crop adaptation, forage management,* and *livestock management.* They regarded the cost of many of the improvements as capital investment.

[1] *Forrest M. Willhite is also associate agronomist, Colorado Agricultural Experiment Station. Numerous persons associated with the Colorado and Wyoming Agricultural Experiment Stations contributed to the information contained in this publication.*



WATER EFFICIENCY

You may greatly increase the efficiency of your applied water by changing from outmoded irrigation practices to modern methods. You may reduce by as much as 90 percent the amount of water required to produce each pound of beef.

High, sustained production on mountain meadows requires efficient water control—ample *storage*, good *conveyance*, proper *application*, and adequate *drainage*.

Eliminate these faults:

- Shortage of water in summer.
- Overflow flooding from streams.
- Leaking conveyance ditches.
- Unstable diversion structures.
- Uneven land surfaces.
- Inadequate drainage of excess water.
- Wild-flooding irrigation practices.

Provide these improvements:

- *Storage facilities* that prevent downstream flooding, supply water when it is needed, control stream erosion, protect stream diversion structures, and assist in water-table control.
- *Conveyance facilities* that move water from storage to ranch with minimum loss, and deliver enough water for good rotational use among ranchers.
- *Irrigation facilities* that provide soil surfaces on which water may be properly distributed, length of run that will prevent deep percolation and excessive runoff, and a delivery system that will reduce the amount of labor required.
- *Drainage facilities* that intercept excess water and help control the water table.

When you provide these modern devices that increase water efficiency, you can put more land into production, make water available for late-season use, and produce more beef per unit of water used.

Water Control

THIS IS ALL WET!

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WRONG: Wild flooding wastes water and endangers diversion structures; it erodes the channel and the productive land. Water so wasted could be used to good advantage for late irrigation.

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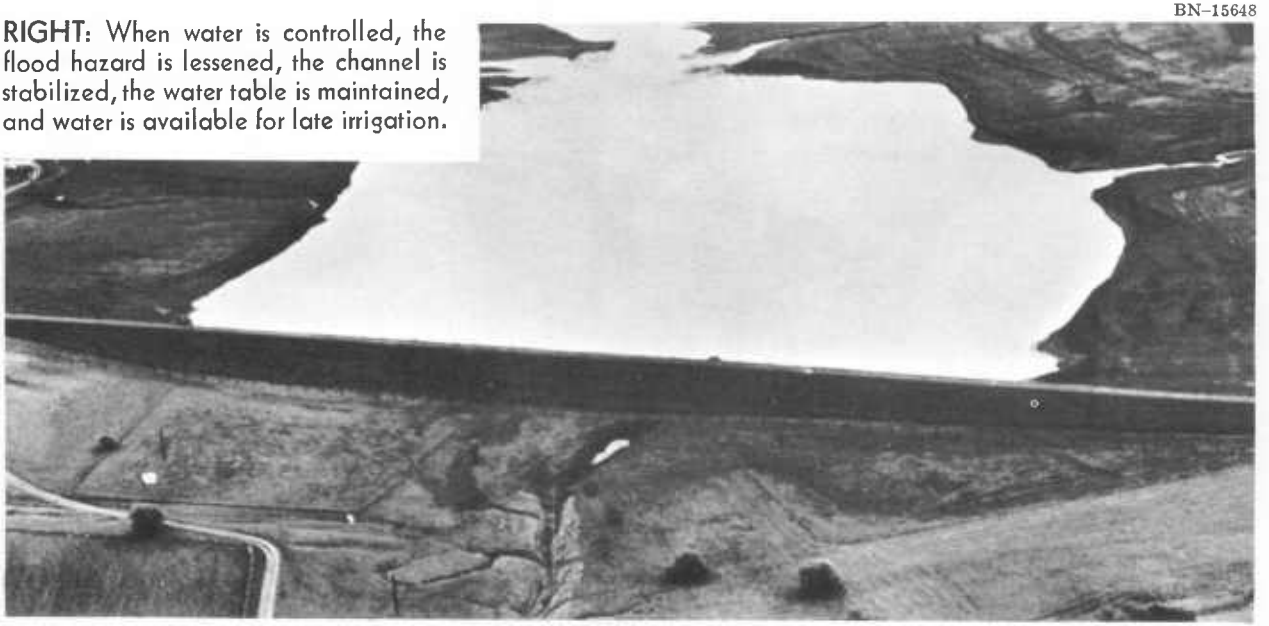
RIGHT: When water is controlled, the flood hazard is lessened, the channel is stabilized, the water table is maintained, and water is available for late irrigation.



Water Conveyance

WRONG: Poor ditches seep, thereby increasing drainage problems. They are difficult to maintain, and may wash out. Often poor ditches are not designed to carry sufficient water, and do not carry the stream size needed for the efficient use of labor.

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RIGHT: Good ditches are designed to carry enough water for efficient irrigation and deliver it where it is needed. They are easy to maintain, reduce the amount of labor involved, and do not increase drainage problems.

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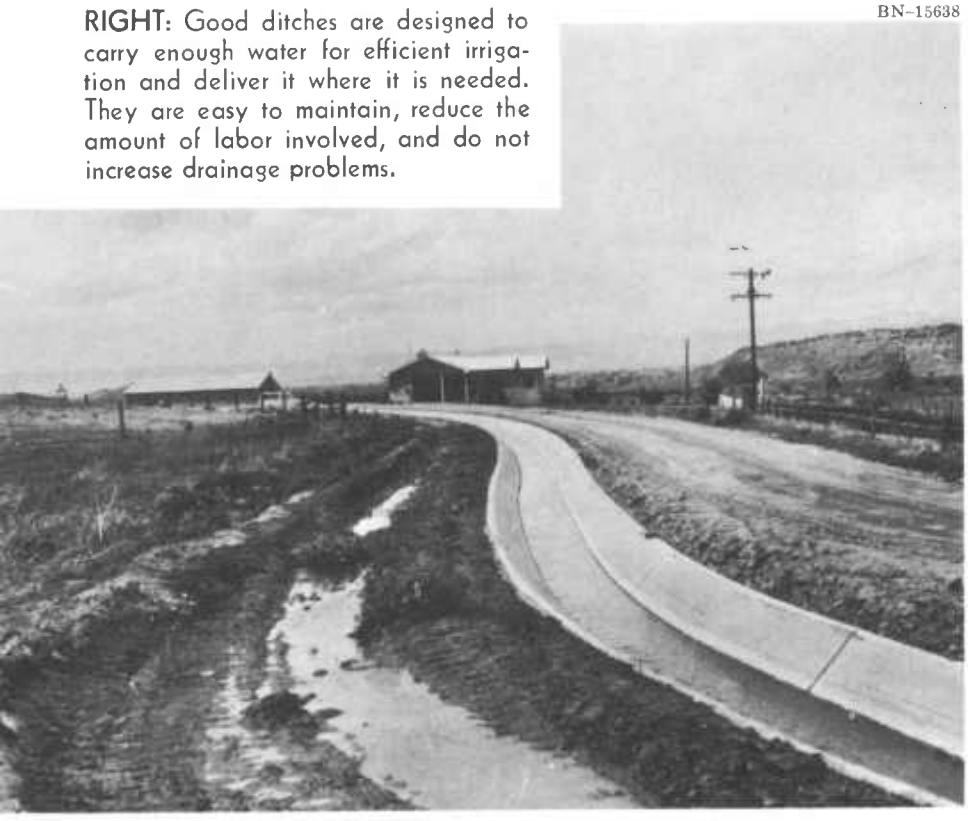

PUT THE WATER
WHERE YOU NEED IT

Water Application

DON'T WASTE IT!

WRONG: Poor irrigation may waste 20 times as much water as the crop needs. Often, it must flood part of the land to make all of it wet. It leaches plant nutrients, reduces fertilizer efficiency, and moves salts to the high spots in the field. It encourages the growth of low-yielding, water-loving plants, and the formation of a sod mat.

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RIGHT: Good irrigation puts water uniformly on the land. It encourages the growth of legumes and high-producing grasses, and increases the efficiency of fertilizers. It does not overload soil drainage facilities, leach plant nutrients, or cause rapid formation of sod mat. Properly designed irrigation facilities permit irrigation of meadows without interfering with other operations.

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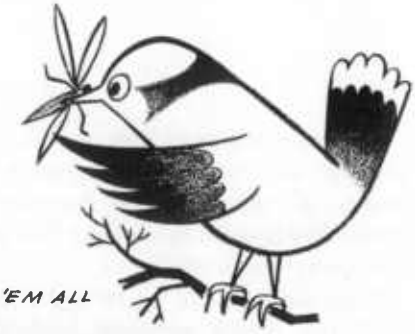
Water Removal

WRONG: Poor drainage breeds mosquitoes, spreads disease, and bogs down equipment. Usually, high-quality forage is not produced on poorly drained land.



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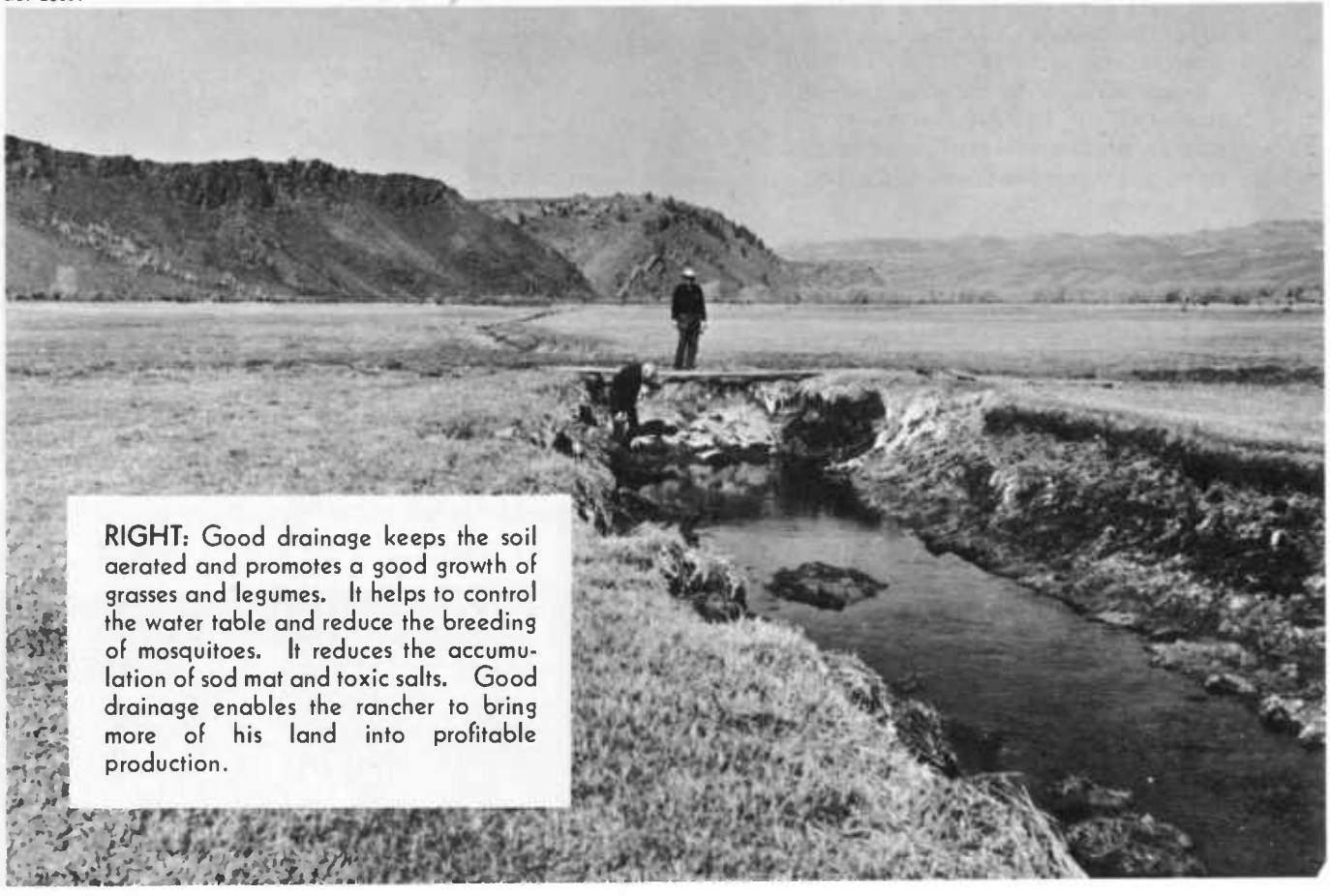
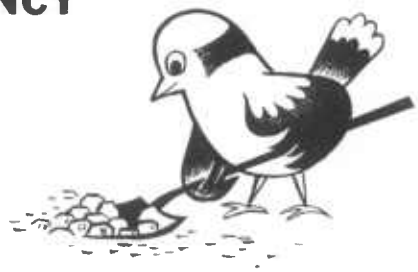


RIGHT: Good drainage keeps the soil aerated and promotes a good growth of grasses and legumes. It helps to control the water table and reduce the breeding of mosquitoes. It reduces the accumulation of sod mat and toxic salts. Good drainage enables the rancher to bring more of his land into profitable production.

AREA EFFICIENCY



You may increase area productiveness through efficient soil-surface management and redistribution of water. One rancher expanded his productive area to more than five times its original acreage by these means.

More acreage can be brought under production when the land's physical features are changed by straightening channels, filling oxbows, removing willows, and transferring excess irrigation water to dryland sites. The changes usually are difficult because of extreme soil variations, but they are essential for the establishment of proper soil-water-plant-animal relationships. Also, getting water to dryland sites presents some problems because these sites are usually above the ditch, and water must either be diverted from the stream at higher elevation or pumped from the existing canal to the higher level.

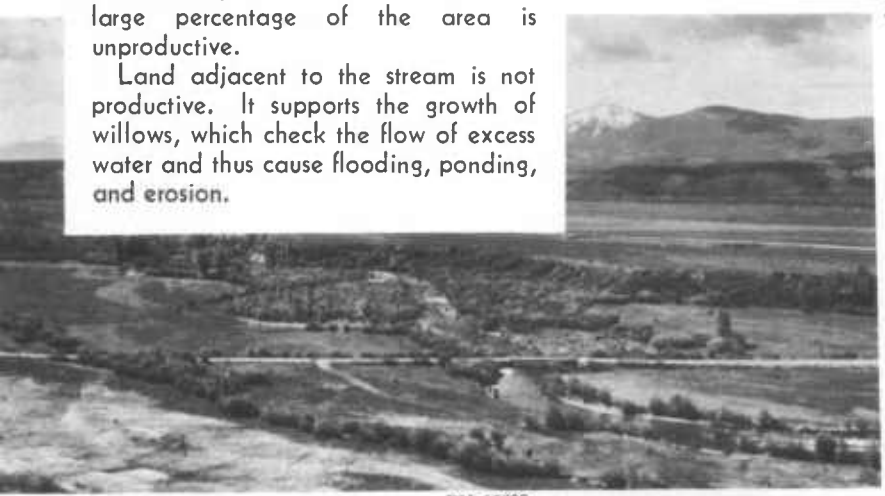
It is important that you have a knowledge of your soil and the treatment it needs. Consult your county agricultural agent or Soil Conservation Service technician for information pertaining to your ranch. If you have acreage that is producing little, corrective measures may enable it to give maximum returns.

Normal Area

FOLLOWING THIS STREAM MAKES ME DIZZY

WRONG: Many problems are illustrated in this picture. The stream meanders, changes course frequently, and develops oxbows. As a result, a large percentage of the area is unproductive.

Land adjacent to the stream is not productive. It supports the growth of willows, which check the flow of excess water and thus cause flooding, ponding, and erosion.



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RIGHT: The rancher can profit by correcting the problems that occur from natural causes. This picture shows a stream that has been straightened, controlled, and confined to its minimum area requirement. Oxbows and willows have been eliminated. Productive area has been increased 50 percent.

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Expanded Area

WRONG: Area shown in the background is low producing because of excess water. Area in foreground is low producing because of insufficient water; brush has taken it over from grass.

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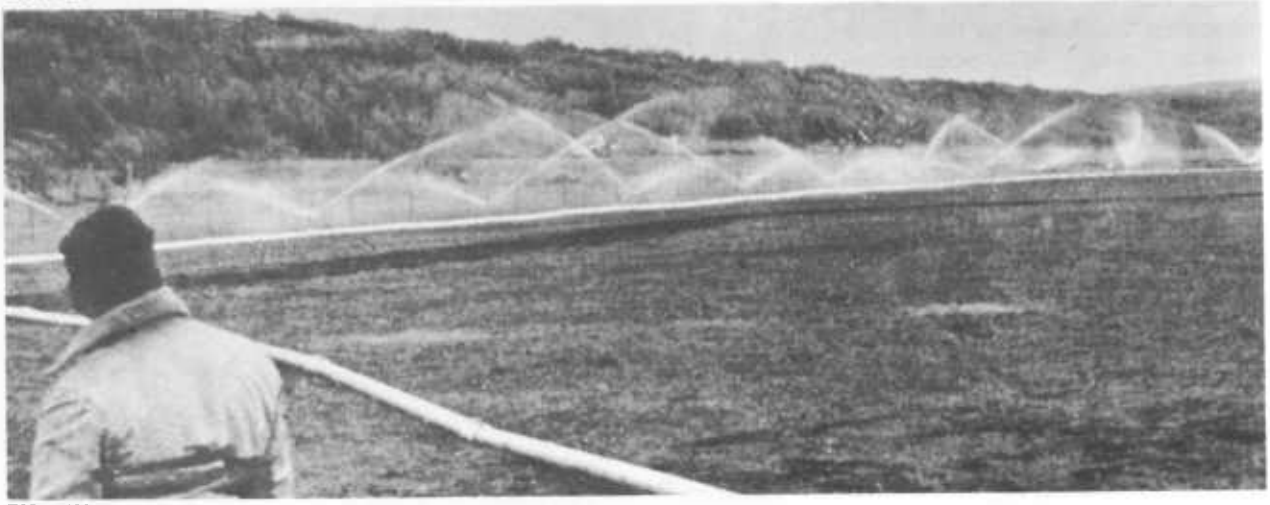

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RIGHT: On this meadow, excess water has been transferred from the low to the high areas, making both productive. Often, the yield of an area can be increased manyfold by reducing the amount of water applied to the wet meadow and applying the conserved water to dryland sites.

GET YOUR AREA
EVENLY WET ALL OVER

Ease of Operation

WRONG: This meadow has an uneven surface that may often bog down or even break machinery. Sometimes it is necessary to move harvesting equipment several times in order to cut the meadow; some of the meadow may be difficult if not impossible to harvest. Crops must be stored in small stacks that expose more of the forage to the weather.

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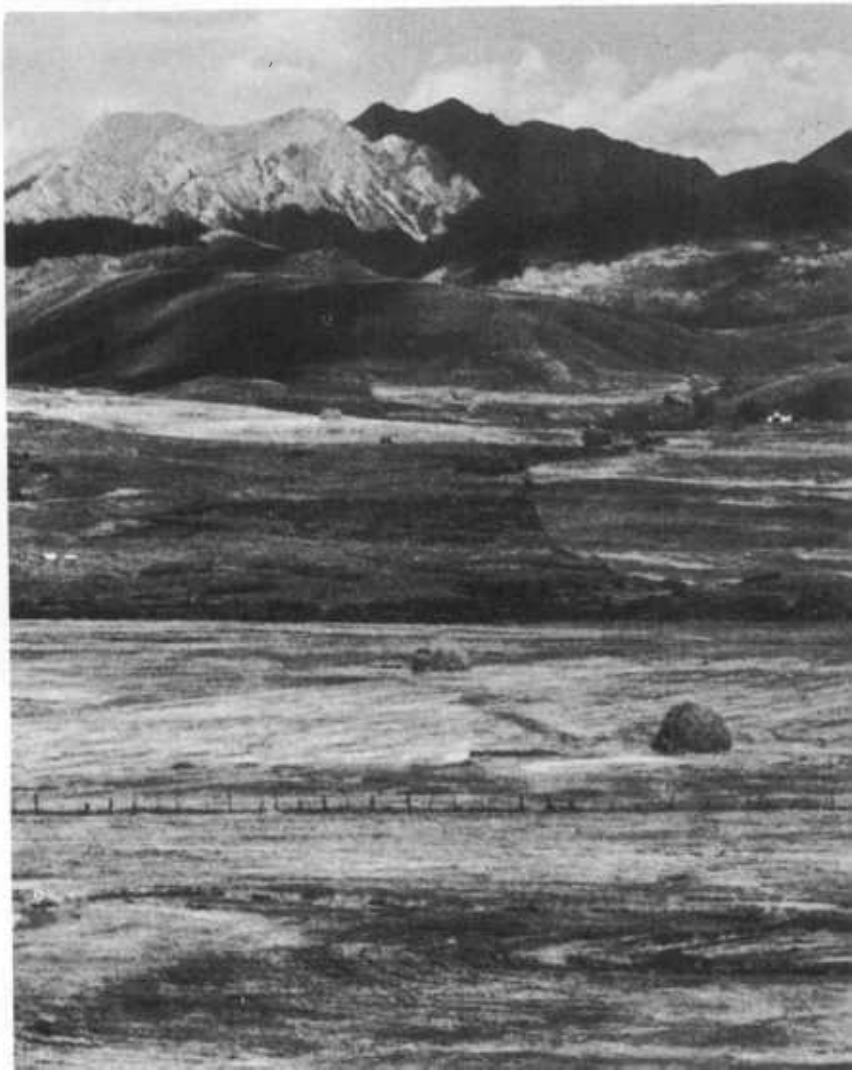
RIGHT: A level surface insures minimum machinery wear, and makes harvesting easier and faster. It reduces costly breakdowns. This meadow can be harvested in one sweep. Its crop can be stored in large stacks that expose less forage to the weather. Irrigation may be accomplished without interrupting harvesting operations in other areas of the field.

ON THE LEVEL, YOUR MACHINERY WILL LAST LONGER!



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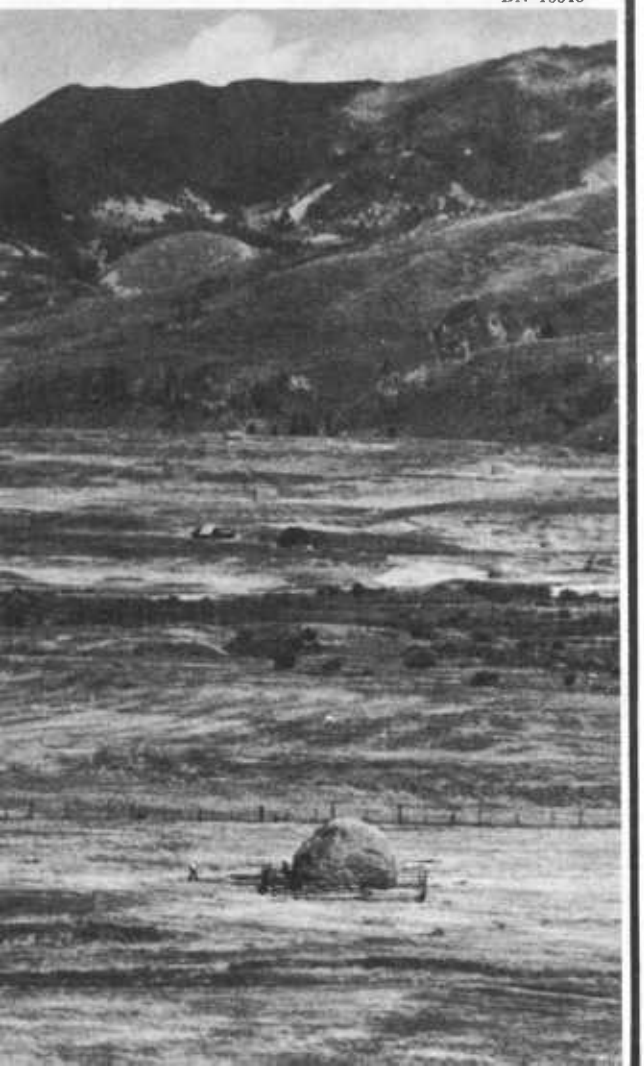

SOIL EFFICIENCY

To increase fertility and achieve optimum yields, you must provide the soil with nitrogen from legumes or commercial fertilizers. Nitrogen can increase yields of forage as much as 5 tons per acre.

Improved irrigation that promotes better aeration and causes less leaching will increase the availability of native soil nitrogen; it will also increase the efficiency of both legume and fertilizer nitrogen.

Phosphorus must be maintained in the soil at a high level to support the growth of legumes and insure the quality of forage produced.

Soil Surface

WHEN THE SURFACE IS ROUGH THE PRODUCTION IS LOW

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WRONG: Raugh sail surfaces make it impossible ta irrigate praperly by gravity, althaugh sprinkler irrigatian cauld do an adequate jab. Where gravity irrigation is used an raugh surfaces, nitrogen efficiency is low, legumes will nat graw, and toxic salts are depasited an the high spats. Overirrigatian is aften needed to wet a field that has raugh surfaces, but it may reduce sail aeration and prevent the sail fram becaming warm enaugh far the grawth af desirable forage plants.

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RIGHT: Smaoth surfaces can be irrigated easily and effectively. They contribute greatly to nitragen efficiency, gaad legume grawth, sail aeratian, and the praductian af desirable farage. Where irrigatian is efficient and drainage is effective, taxic salts da nat accumulate on smooth surfaces.

Soil Tilth

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WHY SENTENCE YOUR-
SELF TO HARD LABOR?

WRONG: This soil is in poor tilth. It has formed a thick sod mat. It will yield about 1 ton of forage per acre. Many years of poor water management are responsible for its condition. Much effort will be required to plow up the sod and develop a satisfactory seedbed.

BN-15646

RIGHT: This soil is in good tilth. It will respond to the application of fertilizer. Sustained yields of 6 tons of forage per acre are possible if the soil is properly fertilized; the yields are also contingent on the proper use of water and on good crop management.

CROP ADAPTATION

You should select forage crops that will thrive under the variable climatic conditions that prevail in mountain meadow areas. Seed them in combinations suited to the extremes of deep or shallow soils and the wide variations in water-table conditions often found on mountain meadows. Be guided in your selection by the particular requirements of your area.

Brome, orchard, meadow foxtail, timothy, and reed canary grasses are adapted to mountain meadow climates. So are alfalfa, red clover, and alsike clover legumes. Brome and alfalfa are suited to well-drained sites, orchard and red clover to moderately drained sites, and timothy and alsike clover to poorly drained sites.

When low-yielding, water-loving, grasslike plants (sedge-rush complex) are replaced with grasses and legumes (after establishment of water control and fertilization), yields are increased up to 5 tons per acre.

GRASSES AND LEGUMES

Establishment and maintenance of high-producing grasses and legumes are essential to insure satisfactory returns on the capital investment for water control and other area improvements. The rancher may choose from many species of grasses and legumes in selecting those that will fit the wide differences in climate, soil, and moisture found on mountain meadows.

Climate

THEY'RE RUGGED!

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GRASSES: Varieties of grass should be selected that thrive in a cool season, are not injured by frost, and are drought resistant.

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LEGUMES: Good legumes, like good grasses, must be cold-hardy and have high resistance to frost and drought. Resistance to disease also is desirable.

Soil and Water

GRASSES: The varieties of grasses you choose should be compatible with each other so they may be used in mixtures that will withstand variances in soil and moisture. Their rooting characteristics should enable them to use the moisture in the soil profile efficiently and thus reduce the number of irrigations required.

LEGUMES: *Clovers* need frequent light irrigations; they may be grown in shallow, wet soils. *Alfalfa* is deep rooted, can take water from greater depth in soils, and therefore requires fewer irrigations than do clovers. Deep soils store more water than shallow soils.

Compatibility

To maintain a good, healthy meadow over the years, select grasses and legumes that have about the same date of blooming. They should start growth about the same time in spring, and should have about the same rate of recovery after harvest.

Select a grass or grasses that are suited to both hay and pasture use. They should have palatability and growth habits similar to those of their companion legume. The resultant mixture will reduce the bloat incidence ascribed to legumes.

THEY SHOULD HAVE THE SAME HABITS

Legumes increase the food value of the crop; they also supply the grasses in the mixture with nitrogen, which makes the grasses produce more. The combination of legumes and grasses provides a more nutritious forage for livestock.

FORAGE MANAGEMENT

Profitable production of livestock on mountain meadows depends on the yield, quality, and preservation of forage. It is important to harvest forage at peak quality and to preserve the quality by proper storage.

By the application of modern practices, some ranchers have been able to increase forage production as much as 500 percent, and crop quality (measured by crude protein content) as much as 1,000 percent. They accomplished these increases by the improvement of water control, soil fertility, and crop selection, and by changing from late to early harvest.

If you harvest your crop at its top-quality stage, usually in early boot stage, you may greatly reduce the amount of feed required to produce beef. When forage is harvested in early boot stage, 10 pounds usually will produce 1 pound of gain in weaner calves. When it is harvested in seed-dough stage, 30 pounds or more may be required to produce 1 pound of gain.

Comparative experiments have shown that, as an average, when 380-pound weaner calves are fed all the late-cut forage they will eat, they will weigh 430 pounds the following spring (0.3 pound daily gain); when they are fed all the early-cut forage they will eat, they will weigh 590 pounds (1.2 pounds daily gain).

Yield

Forage yields are lower where growing seasons are shorter (see table). Where seasons have 40 to 60 frost-free days, yield of early-cut forage plus aftermath (regrowth following early-cut harvest) is about 70 percent of the midseason cut. Where seasons have 60 to 80 frost-free days, yields are about the same. Where seasons have 80 to 100 frost-free days, the two-cut harvest (early and aftermath) may yield 30 percent more than the midseason cut.

Relative Yield of Forage as Influenced by Time of Harvest and Number of Frost-Free Days in the Growing Season [1]

Time of harvest	Percent of yield		
	40 to 60 frost-free days	60 to 80 frost-free days	80 to 100 frost-free days
Late	95	95	95
Midseason	100	100	100
Early	50	70	70
Aftermath (regrowth following early harvest)	20	30	60
Combined early and aftermath	70	100	130

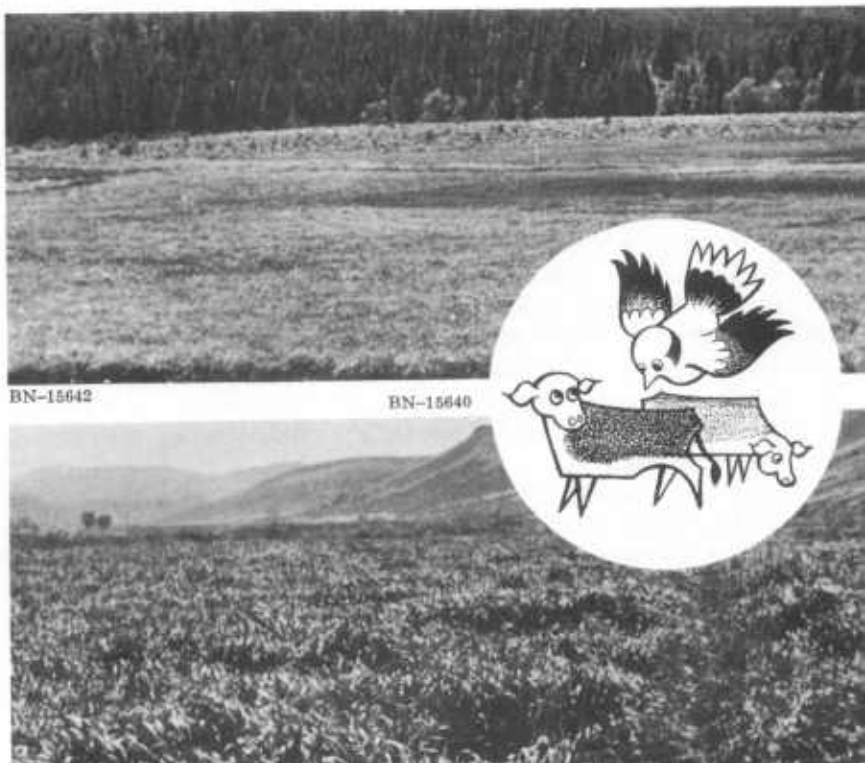
[1] *For comparison, midseason yields are shown as 100 percent; yields of other harvests are shown in their relative percentages.*

Quality

WRONG: About 3 tons of late-cut brome are produced per acre on this field. The crop has a crude-protein content of 7 percent. It is satisfactory for maintenance of a herd when fed at the rate of about 25 pounds per cow per day. It is not satisfactory for yearlings, even if they are fed all they will eat. A yearling fed on this forage will gain less than 0.2 pound per day.

RIGHT: About 3 tons of early-cut forage and 2 tons of aftermath are produced per acre on this field. Both cuttings have a crude-protein content of 12 percent. The crops are satisfactory for maintenance of a herd when fed at the rate of 18 pounds per cow per day. These forages are very satisfactory for yearlings. A yearling fed on this hay will gain from 1.2 to 1.4 pounds per day.

THE BIG ONE WAS FED THE RIGHT FORAGE



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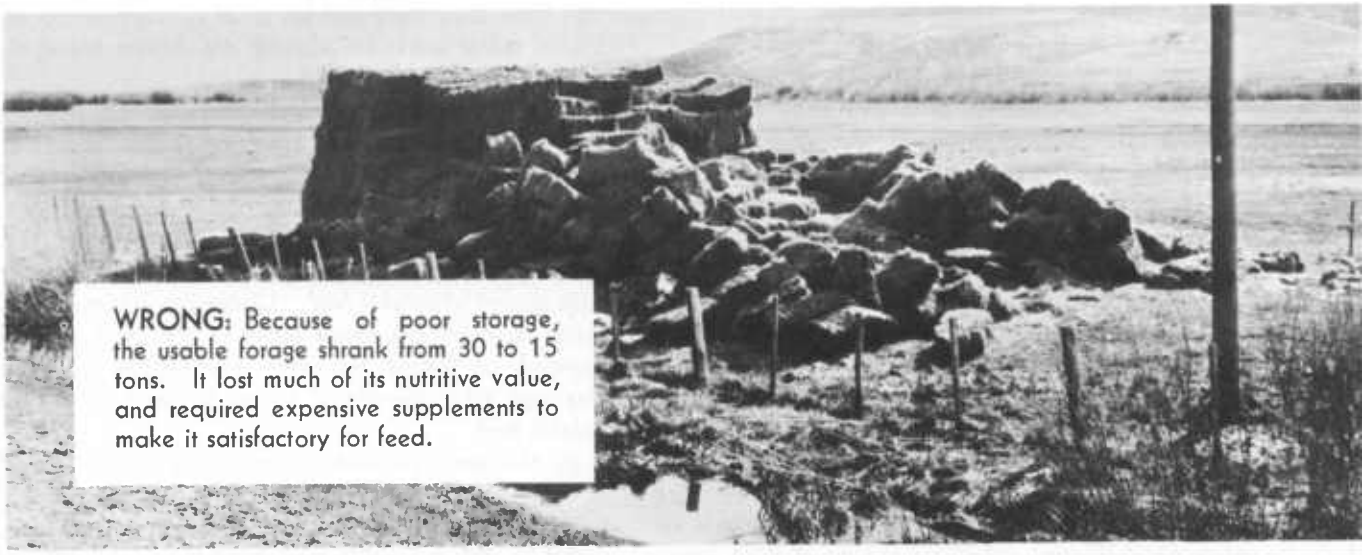
QUALITY COMPARISON

Properly stored, early-cut forage has the highest beef-producing quality. If a yearling is fed 2.2 pounds of forage per day for each 100 pounds of its live weight (approximately all it will eat), it will gain per day according to the quality of the forage as follows: Late cut, 0.25 pound; midseason cut, 0.5 pound; early cut, 1.2 pounds. A gain of 0.5 pound per day may be had from early-cut forage, if desired, by reducing the daily feed one-half.

Storage



WRONG: Because of poor storage, the usable forage shrank from 30 to 15 tons. It lost much of its nutritive value, and required expensive supplements to make it satisfactory for feed.

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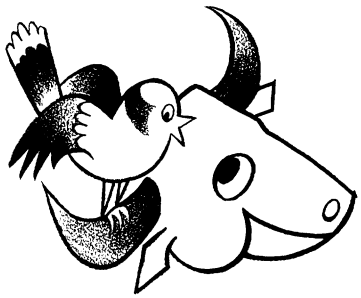
GOOD STORAGE SAVES MONEY

RIGHT: This carefully stacked forage retained its bulk and its nutritive value. It needed no supplements.

LIVESTOCK MANAGEMENT



WHAT'S NEW IN GOOD MANAGEMENT?

Modern management practices save feed and time in the production of beef. Also, greater profits are realized from well-bred animals. You can increase production by giving your animals good feed and proper care, and by grading up the quality of your stock.

Here are the findings from one experiment:

1. A well-bred herd of beef cows (herd *A*) was provided with ample, good-quality pasture while the calves were on the cows. *Average weight of the calves when weaned at 210 days was 545 pounds.* In comparison, a grade herd of cows (herd *B*) was supplied with ample, good-quality, early pasture or range until midsummer, then poor pasture or range until winter. *Average weight of these calves when weaned at 210 days was 380 pounds.*

2. After weaning, the 545-pound calves in herd *A* were put on high-quality feed (early cut) and given shelter. *When 10 months old, they had become 650-pound feeders.* In comparison, the 380-pound calves in herd *B* were put on sufficient low-quality feed (late cut) and given shelter through the winter; then they were put on good pasture or range. *These calves were 18 months old before becoming 650-pound feeders.*

3. Daily gains from birth averaged 1.8 pounds per calf for herd *A*, and 1.1 pounds for herd *B*.

4. Under herd-*A* management, the amount of forage required to produce a 650-pound feeder, including dam maintenance for 12 months, was 9,400 pounds; *this was 14.5 pounds of forage for each pound of salable beef.* Under herd-*B* management, and on the same basis as for herd *A*, the amount of forage required was 13,100 pounds; *this was 20.2 pounds of forage for each pound of salable beef.*

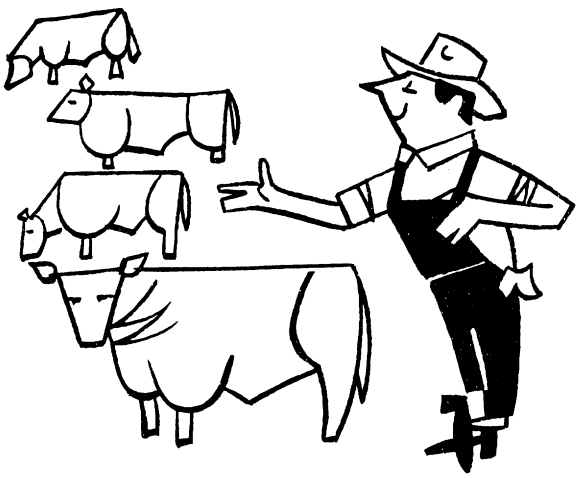
5. Modern management practices enabled herd *A* to produce the same amount of beef as herd *B* in 44 percent less time, using 28 percent less feed. Herd *A* did not need spring pasture or range to produce yearling beef.

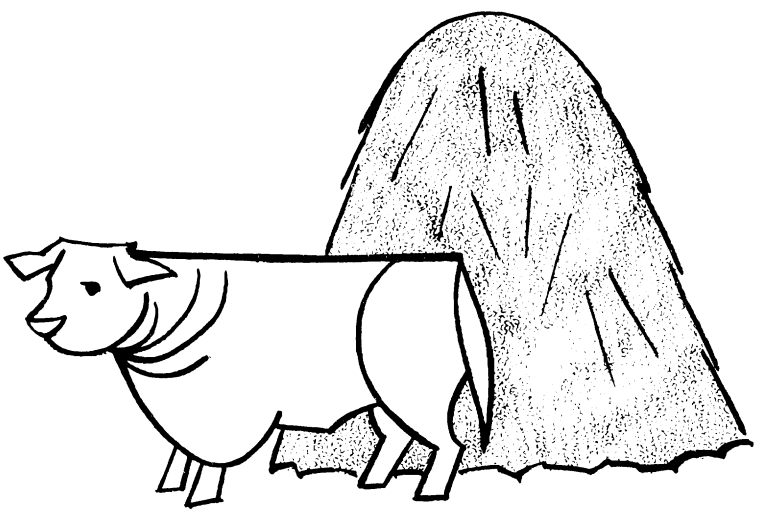
EFFICIENCY STORY

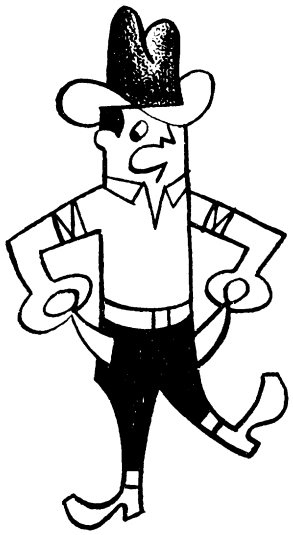
Once upon a time there was a rancher who had an average commercial herd and mountain-meadow land in a region that had 60 to 80 frost-free days each year. He was a hard worker, but took a dim view of newfangled efficiency practices. Each 100 acres of his land—

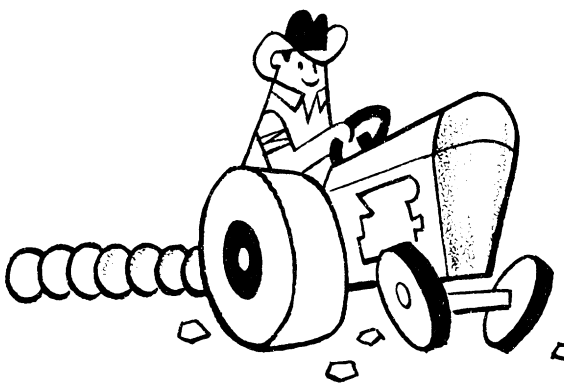
- Yielded 100 tons of forage;
- Used 1,200 acre-feet of water; and
- Produced 10,000 pounds of stocker beef.

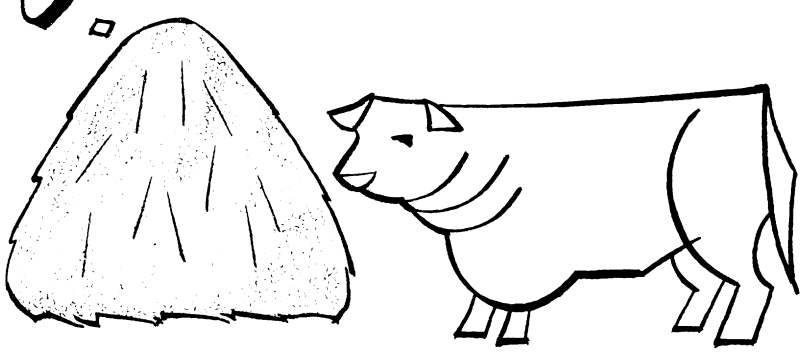
It required 20 pounds of feed to produce 1 pound of stocker beef.











Then, operating costs began to rise, but the price of beef didn't keep pace. The rancher reached the point where his income failed to meet his expenses. He went to his banker, who loaned him money and gave him this counsel:

"Here are publications from our Federal-State research program and from our rancher research corporations. They discuss ways and means of applying improved ranching practices. Take them home, study them, and discuss them with your rancher friends."

The rancher did as his banker advised. He enlisted the aid of his county agricultural agent and local representatives of the Soil Conservation Service. He gradually changed to modern, efficient ranching practices. Then, each 100 acres of his land—

- Yielded 450 tons of forage;
- Used only 225 acre-feet of water; and
- Produced 62,000 pounds of stocker beef.

It required only 14.5 pounds of feed to produce 1 pound of stocker beef.

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