Greater Profit from Livestock in the Intermountain West with Efficient Ranch Management¹

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Highlight

Livestock producers are in serious economic difficulty because forage and livestock management have changed very little over the years. If ranchers are to meet the challenge of the cost-price squeeze, they must integrate improved livestock management with more efficient use of their range and meadows. This consists of increasing the guality and guantity of forage to give larger rate of gain on more calves over a longer period of time. It is possible to achieve a severalfold increase in meat production per unit of land and livestock resources.

The livestock producer, in particular the cow-calf operator, must greatly increase his income to meet the challenge of the costprice squeeze. According to Colorado Agricultural Statistics, (1964) ". . . this was a difficult year for the Colorado stockmen. . . . gross income realized from the sale of livestock and livestock products declined 4% . . ." and "at the same time, production expenses climbed even higher." Ranchers have several alternatives - actually several "horns" to their dilemma. Some of the alternatives are vertical integration with feeders and retailers, government subsidy, sale of land and cattle, or more efficient management of their resources. The cattle industry has rejected direct subsidy. Vertical

²The senior author is also Associate Agronomist, Colorado Agricultural Experiment Station. integration has occurred on a very limited scale. With great reluctance many ranchers, especially the smaller ones, have been forced to sell. Operators who expand their holdings with the hope of improving their income, but retain the same level of efficiency, may find themselves in worse economic difficulties than before. The last alternative is increased efficiency in production — more salable meat per unit of land or livestock with a reasonable expenditure of capital. Many ranchers are unwilling to change because they feel that alternatives to present management practices are too difficult or costly.

The purpose of this paper is to present some alternatives and to show how present ranch management might be changed for greater profit from soil, water, and livestock resources. These are not the only alternatives and they may not be the most profitable. The discussion is directed toward cow-calf operators in the high-altitude areas of the West, but the principles are valid for any livestock producer. This paper was written to invite challenge from the people who actually produce livestock-the farmers and ranchers.

Current Ranch Management

Overall ranch management in the mountain meadow areas has changed little in the last 50 years. Practices are built around the pattern of nature which provides green grass in the spring for rapid growth of young animals. In general, livestock spend about 150 days (from June to October)

on summer range, mostly public domain, about 180 days on the home ranch on hay, and about 30 days on spring or aftermath pasture from hay meadows. Calves are usually dropped from April through May and are sold for feeders sometime between October and December. Some calves are carried over and sold as yearlings or are kept for replacements. Weaning percentages are probably about 80. A survey of the West made in 1954 (Ensminger et al., 1955), showed 77%of the cows giving birth and 67%of the cows weaning calves.

Cattle numbers in the mountain meadow areas are difficult to determine accurately, but are believed to have increased slightly on most ranches. Cattle allotments on public lands have declined over the years. Decreases in range allotments have been offset by increased forage production from newly irrigated lands and from "improved" native meadows. In 1935 the acreage of wild hay in Colorado was 354,000; in 1962 it was 282,000. Yields of wild hav have been about 1 ton/acre for many years, but yields from different kinds of "improved" meadows range from 1.5 to 2.5 tons (Colorado Agriculture Statistics, 1950, 1964). Increased use of fertilizer in recent years also has contributed to greater livestock numbers. Date of meadow harvest, depending on climatic conditions, ranges from late July to late September and has changed very little over the years. Many ranchers harvest from mid-August to mid-September and most find it necessary to use protein supplements to offset the poor quality forages that result from late harvest.

Result of Current Management Practices

Production through the years has remained rather constant as is shown by the average weight of weaner calves sold for feeders at Denver and Omaha from 1935

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to 1957. The values in Table 1 were calculated from numbers and total weights reported by the Denver Record Stockman and The Omaha Daily Journal Stockman. The sample represents about 5 to 10% of the total calves sold at these markets. Many calves undoubtedly were from plains and dryland areas but this in no way affects the points to be made in this paper. Average weights were essentially constant over the 23 years. As expected, weights slightly increased with late sale. The average weaner weight for the whole period was 348 and 372 lb at Denver and Omaha, respectively. Records of direct sales of 7,322 weaners at the Gunnison County Mountain Meadow Research Corporation from 1960 to 1964 show an average weight of 375 lb for October through December. Stevens and Agee (1962), working with 35 Wyoming ranchers with an average cow herd of 340, found an average weaning weight of 360 lb in 1959. Assuming a 65-lb birth weight on May 1 and an average date of sale on November 15, the weaners sold at Denver gained 1.4 lb and at

Omaha 1.5 lb/day (200 days). Calves from Gunnison gained 1.6 lb (partially due to less shrinkage than at central markets) and calves in Wyoming gained 1.5 lb/day. The range of average calf weights at Denver was from 336 to 371 lb and at Omaha 342 to 380 lb over the 23-year period. Very likely this weight range partially reflects range and moisture conditions. Over a large area, for a long period, management has established a constant gain of about 1.4 lb/day. Most ranchers are very pleased when their weaner calves average 400 lb, or 1.7 lb/day; yet Menter (1963) says, "I am forced to produce this heavier calf (500 lb), because I can no longer make a good profit on a 400 lb average."

Additional information that management has not been changed perceptibly was noted in the 1951 to 1960 weights of long-yearlings sold at Denver which were 690 and 620 lb for steers and heifers, respectively. Steer weights by years ranged from 670 to 712 and heifer weights ranged from 602 to 638 lb during this 10-year period. Average weight of all yearlings

Table 1. Average weight in pounds of weaner calves sold through the Denver and Omaha Central Markets from October through December from 1935 to 1957.

No. of					No. of				
	calves sampled		Ave. wt.			calves sampled		Ave. wt.	
Year	Denver	Omaha	Denver	Omaha	Year	Denver	Omaha	Denver	Omaha
1935	4155	1795	382	364	1947	8840	2720	346	379
1936	5956	2605	338	342	1948	10074	3099	348	369
1937	4115	3343	349	370	1949	9347	3608	342	356
1938	4899	4668	3 71	360	1950	11248	3605	350	389
1939	5503	6354	361	358	1951	3228	4632	354	379
1940	7928	6553	356	371	1952	5343	12911	352	370
1941	7535	4503	362	381	1953	5801	11377	343	373
1942	9004	5381	348	371	1954	5635	8665	336	373
1943	10201	2783	347	380	1955	3612	7387	360	377
1944	14495	3723	338	374	1956	2014	4253	360	376
1945	12577	4236	336	367	1957	2765	4253	355	382
1946	17931	3173	338	374	Avg. Years	7487	5362	348	372

	Octo	ober	Nover	nber	December	
Period	No. calves	Ave. wt.	No. calves	Ave. wt.	No. calves	Ave. wt.
1935-40	8829	336	14626	364	7624	374
1941-50	47547	338	50381	349	13324	350
1951-57	8438	340	13161	350	6902	354
All	64814	338	78168	352	27850	358

in all years was 670 lb on November 1. At Gunnison from 1961 through 1964, 1184 yearlings sold directly to feeders averaged 610 lb. The 35 ranchers considered by Stevens and Agee (1962) produced yearlings (mostly steers) with an average sale weight of 657 lb. Again assuming a 65-lb birth weight on May 1 and an average date of sale on November 15, average daily gain of the yearlings was essentially constant at 1.0 lb/day.

Since the number of cattle units per acre of land and weaning percentages have increased little, and rate of gain of calves and yearlings is essentially constant, beef production per unit of land or livestock has remained constant over the last 30 years. The analysis by Stevens and Agee (1962) of the ranchers in Wyoming shows that existing management practices resulted in a profit in 1959 less than \$9.00 per cattle unit for large ranches; small ranches actually lost \$1.13 per cattle unit. Return on investment was 6.5% from the large ranches and 4.9% from the small ranches, and for all ranches ranged from 13.4 to 2.8%. As they point out, "Cattle prices were favorable in 1959 compared with the past 10-year period." (Average price per pound of all beef sold was nearly 25ϕ in 1959.) With the low cattle prices and high operating costs of recent years, is it any wonder the cattle industry is in financial difficulty? According to Gronewoller. Colorado State University farm management specialist, about \$105 is needed today to produce a weaner calf worth \$75 to \$108 (Denver Post, November 14, 1965).

Solutions Suggested by Research

Forage Management.—Increasing hay and pasture production from present levels of 1 or 2 tons/acre to 4 to 6 tons can be accomplished by nearly all ranchers. The amount of increase depends on several factors, but

among the most important are water control and fertilizers. Water control is necessary and desirable for improving stands of desirable forage species, especially legumes. On most meadows water control implies some degree of land leveling, which must be followed by reseeding. Examples of 4 to 6 tons of hay produced on properly irrigated legume and grass-legume meadows have been reported, even at elevations of 6000 or 8000 ft. (Lewis, 1957; Willhite, 1963; Fulcher, 1960.) The total cost of meadow improvement may often be paid for by production of grain or cereal hays during the first two vears.

Assuming good stands of desirable species and a moderate degree of water control, fertilizers can be used effectively. Again, examples of 4- to 6-ton yields are available. At altitudes below 8000 ft two harvests per season plus frequent reapplication of fertilizer are necessary. Nitrogen fertilizers must be applied before each growing period. To obtain maximum yields at altitudes over 8000 ft, hay must be cut about August 1, which permits regrowth of about 0.5 ton/acre for late fall pasture. However, fertilizers are not a "cure-all" or magic wand. As shown by Willhite (1963), improper use of nitrogen fertilizer can result in reduced profit. This occurs because calf production per cow does not necessarily increase just because hay yield increases; twice as much lowquality, late-cut hay will carry twice as many cows, but at the same level of efficiency. Hence, ranchers who are losing money now likely will continue to lose money. Some gain in resource efficiency is possible in many cases with increased size (Stevens and Agee, 1962). Quality of forage, as well as quantity, must be increased for the cow-calf or yearling operators to derive full benefit from fertilizer.

For young growing animals forage quality primarily means crude protein content. Protein content declines steadily throughout the growing season, particularly after flowering of grasses and legumes. (Nearly all nutrient element and vitamin contents decline with maturity, and deficiencies are critical in certain areas.) Crude protein in grasses drops from about 16% at early leafy stage to 5% at maturity; clovers will contain somewhat greater levels. However, neither is good feed at full maturity. Therefore, the progressive decline in nutritive value of forages must be balanced against progressive increase in yield. As discussed by Willhite (1963), this can be accomplished without reduced yield, and at lower altitudes, with increased yield. Furthermore, changes in amount and quality of feed must be integrated with animal requirements for maximum gain. This is true whether referring to range, irrigated pastures, or hay.

Livestock Management.—How can producers improve livestock efficiency? People disagree on the solution. Ensminger et al. (1955) say, "Selection of breeding stock on the basis of production records is the only logical way to achieve this goal (greater efficiency of production)." Baker (1963), on the other hand, states, "Within the animal sciences themselves, nutrition and its application has played the most important role to date in improving cattle production practices. The limits of animal improvements are set by our knowledge of nutrition and its use." Without a doubt these individuals recognize the importance of both breeding and nutrition. However, improvements in breeding, consisting primarily of the use of bulls with "better" conformation, obviously has not increased daily rate of gain or beef production per unit of land or livestock in the area served by the Denver

and Omaha Markets. Therefore, "nutrition and its use" must be the limiting production factor for existing conditions. Referring to feedlot operations, Beeson (1963) states, "Over the past 50 years, the rate of gain in beef cattle has increased about 42% and feed efficiency 30% by improvement in cattle rations." This implies that calf and yearling performance on meadows and ranges can also be improved with better nutrition.

Research has shown the potential. In a 5-year experiment at Hayden, Colorado, on improved meadows and pastures producing 4 to 5 tons of forage/year, calves gained 2.1 lb/day from birth to weaning (550 lbs at 230 days). Cows and calves received only hay and pasture plus salt and minerals (Willhite and Grable, 1965). Others have shown that calves and yearlings are capable of gaining 2.0 lb/day with ample pasture or excellent quality hay (Burson et al., 1961; Bogard et al., 1963; Van Keuren and Heinemann, 1958). Robertson and Torell (1958) and Johnson (1953) obtained daily rates of gain of 2.0 lbs or more on range when quantity and quality of feed was not limiting. Obviously, cattle have great potential. In its simplest form, the problem of maximum production is how to maintain a maximum rate of gain over the longest possible time with the largest possible number of calves per unit of land and livestock. Livestock efficiency can be improved only with an increase in one or more of the three factors—rate of gain, duration of gain, and number of calves per cattle unit.

Early performance of calves is determined largely by milk flow of dams, which in turn is determined largely by nutrition. This is illustrated by data of Renbarger et al. (1964) who fed Hereford dams at 4 different nutritional levels. Milk production was 8.2, 9.4, 9.7, and 10.7 lb/day on the different rations. Daily rate of gain from birth (March) to weaning (October) for calves from the respective groups was 1.36, 1.47, 1.54, and 1.62 lb. Moreover, more dams fed on a high plane came into heat and bred back earlier than those on lower planes of nutrition. Birth weights of calves are greater when dams are well fed, increasing from about 65 lb with latecut hay to about 80 lbs with early-cut hay. Examples of nutritional differences in birth weights are given by Wiltbank et al. (1962) and Wallace and Raleigh (1964). However, dams should not be overly fat at parturition of calves.

Milk flow and calf size can be adjusted to forage quantity and quality to increase calf performance throughout the year. When calves are first dropped, many cannot use all the milk produced by their dams. With present management practices of calving in May and going on range in June, the milk flow from the dam, forage quality, and often quantity, are difficult to integrate. Generally, by the time the calf is big enough to use a large supply, flow of milk and quality of forage are far below requirements. The net result is daily gains similar to those reported for yearling heifers by Johnson (1963): 2.4 lbs in June, 1.8 lbs in August, 1.4 lbs in September, and 0 in October. Robertson and Torell (1958) reported even earlier declines in rate of gain of yearling steers and heifers. Calves are buffered to some extent against such sharp declines in gain by milk from their dams, but calf gain must drop sharply also. No data are available, but it is suspected that daily gain of calves and yearlings on aftermath growth of the native hay meadows during the late fall is also very low. The stubble remaining after harvest is usually harsh and sere; very few meadows are refertilized after harvest

and frequently no fall irrigation is practiced. In fact, good quality fall pasture is almost nonexistent and feeding of hay and supplements does not usually start until snowfall. Late calving, lowquality and, frequently, insufficient feed, account for low weaner and yearling weights shown previously.

The answer to this state of affairs is earlier calving and timely management of feed and livestock. Calves dropped in early spring usually have all the milk available that they can drink, even with late-cut hay, and by May or June they are large enough to eat early pasture and consume the greater milk flow that coincides with the first green feed. In addition, calves will be larger and hence better able to survive when turned onto range in June. Calf mortality between birth and weaning in the West is about 12%(Ensminger et al., 1955).

Earlier calving in the highaltitude areas will require more shelter and labor. However. shelters need not be elaborate or costly and the labor demand for early calving practices will occur during a slack season. Simple pole-type structures that can be easily moved from place to place may be used for hay and calf shelters. Four or five extra calves and a saving of 10% of the forage will buy considerable shelter. These costs will be offset by the need for fewer bulls. Since breeding season would occur while cattle are in breeding pastures on the home ranch, 1 bull per 40 or 50 sows would be sufficient whereas 1 bull per 20 or 25 cows is needed on the range.

Pregnancy testing and calving records will also pay dividends. In 1954 only 25% of the barren cows in the U. S. were culled and replaced (Ensminger et al., 1955) which means 15% of all the mature cows were "free boarders."

To halt the decline in rate of gain that occurs in late summer

and fall, additional quality feed must be supplied. This can be accomplished by feeding supplements to livestock on the range, earlier roundup, and late fall pasture on the ranch, or some combination of these practices. However, summer range is often inaccessible, and livestock are widely dispersed, so supplementation may not be feasible. Range improvements such as reseeding and rotational grazing provide more forage, but little can be done to halt forage maturation and decline in crude protein content. Therefore, to prevent declining rate of gain, livestock must be gathered earlier. Meadows on the ranch can provide pasture (or hay) to maintain high growth rates of the calves and yearlings.

Thus, research suggests a program of improvement based on earlier calving and sustained growth rate of young animals coupled with improved forage management. The net result is more calves and yearlings per cow unit and longer periods of rapid growth. In addition, greater yields of forage will permit increasing herd size, but this generally should come only after obtaining greater efficiency. Research shows that improvements are possible. The economic situation dictates that they must come. How much longer can the industry support 15% free boarders and 80% calf crop, zero production for 10 to 20% of the year, and in many cases a net loss on every unit of production?

Integrated Forage and Livestock Management.—Many combinations of management practices may be used to improve livestock performance and resource use. Perhaps the simplest way to demonstrate the value of some of these practices is to show results of combinations that might be used. Four examples are shown in Table 2. Others could be used. Calculations are based on net hay consumption of

 Table 2. Examples of four different management combinations for cow-calf operations on high-altitude meadows and associated range.

	Management Practices ¹					
	1	2	3	4		
Lb. of hay and pasture/acre	2600	9600	9600	9600		
Acres of meadow/cow	2.33	0.92	1.03	1.16		
Days on hay	183	183	199	199		
Days on range	151	0 or 151	0 or 75	0		
Days on meadow pasture	31	182 or 31	166 or 91	166		
Lb. of weaner/cow	278	278	540	570		
Lb. of weaner/acre of meadow	119	302	524	492		

¹One refers to existing management practices.

Two assumes only an increase in forage production.

Three assumes an increase in forage production plus earlier calving, longer feeding, earlier roundup from range, and greater weaning percentage.

Four is the same as three except no range is available and weaning percentage increases further.

22 lbs dry weight/day and pasture and/or range consumption of 29 lb/day for each mature cow or cow-calf combination. In calculating the pounds of weaner beef produced annually per acre of meadow, the quantity of forage needed to produce a dam as well as the forage consumed by the cow-calf pair must be considered. Using the above values for forage consumption and assuming (1) a dam first calves as a 1000-lb, 2-year old, (2) dams produce 10 calves, and (3) a bull services 20 cows, it is estimated that about 2000 lbs of forage/year must be charged to each calf for production of its dam.

Practice No. 1 illustrates the result of existing management. Dams consume 4000 lbs of latecut hay from November 15 to May 15 and 900 lbs of aftermath pasture from October 16 to November 15. Therefore, after prorating a share of the 2000-lb correction for production of the dam (1170 lbs), 2.33 acres of meadow are needed for each cow. From May 16 to October 15, cattle are on range. It is assumed that sufficient range is available to match meadow production (65 animal unit days/acre of ranch meadow). Together, ranch and range will carry 43 cows and 2 bulls for each 100 acres of meadow. Average calving date is May 1; 200 days later, 80% of the cows

wean 347-lb calves for a production level of 278 lb of beef/cow and 119 lb/acre of hay meadow.

Practice No. 2 assumes no change in management except use of commerical fertilizer or legumes to increase yields of late-cut hay from 2600 to 9600 lb/acre. Range resources are fixed at the same level as in Practice No. 1, so some of the increased forage production on the ranch can be used for 151 days of summer pasture for extra cows (66 head/100 acres of meadow). Net pounds of weaner per cow does not change but production of beef per acre increases from 119 to 302. (Actually, production per cow will increase slightly because legumes and fertilizer will increase the quality of late-cut as well as early-cut forages, but the increase in quality is much smaller with late-cut harvest.)

Practice No. 3 incorporates both improved forage and livestock management. Forage production is increased as in Practice 2, but hay is cut earlier to improve quality. Regrowth is used for hay or late pasture. Cows are fed hay for 199 days to maintain high growth rates of calves in the fall. Part of the herd goes to range at the same stocking rate, but only for 75 days, so that irrigated pasture on the ranch is needed for either 91 or 166 days for cows on range and pasture, respectively; daily gain remains at or near 2.0 lb. Cows are bred 60 days earlier than in Practices 1 and 2 to more nearly match the calves' protein needs with forage production and quality. Calves are weaned at 260 days at a weight of 600 lbs (80-lb birth weight). Weaning percentage is 90 instead of 80 because all calves are born before going to range and are on range only half as long as with the first two practices. Beef production increases to 540 lb/cow and 524 lb/acre of meadow.

Practice No. 4 is exactly as in 3, except no range is available. Weaning percentage increases to 95% because livestock are under close scrutiny at all times. Production per cow increases slightly because of greater weaning percentage but production per acre drops slightly because no range is available.

Is Efficient Ranch Management Practical?

The examples above show that production of forage and beef can be greatly increased. Similar increases have been obtained experimentally and could be obtained in all ranch operations. Gross returns from various practices are easy to evaluate-simply multiply market price by saleable product. On the other hand, determining the costs of efficient management is difficult. Economic data are limited. Every ranch presents a new set of variables. However, some economic analysis is possible.

Comparison of practices 1 and 2 shows only the effect of increasing forage yields. Production per animal unit did not increase. Some ranchers can increase forage production by 6000 or 7000 lb/acre by water control and 200 lb/acre of N per year (about \$24), or by introducing adapted legumes in well-drained land (about \$15/acre). Irrigation can often be improved by more

frequent changing of water. Haying costs will nearly double because of a second harvest but cost per ton will decrease (Fulcher, 1960, p.22). If these are the only costs, 183 lb/acre of additional beef is certainly economical with present cattle prices. However, most ranchers will need an initial investment of at least \$50/acre, and possibly twice that much, plus annual costs, to put their land in shape for controlled irrigation and fertilization (Fulcher, 1960; Sitler and Rehnberg, 1954). Now the margin of 183 lbs of beef looks smaller, although still profitable. If, on the other hand, all practices are integrated as in Practices 3 and 4, the margin is about 400 lb/acre of extra beef per year. Even if calves sell for 20 e/lb and increases in forage yields are only half of those projected, capital investments on meadow improvements appear to be economically feasible. A more complete analysis is needed to evaluate all facets of efficient management.

The preceding discussion shows that improved management results in heavier weaners and yearlings. Some ranchers express reluctance to produce heavier calves because feeders discriminate against them with lower prices. The cow-calf and yearling operators feel they must continue to produce light calves with low-quality forage and inefficient management so that feeders can show greater efficiency with high-quality forages and concentrates. Riggs (1958) cites evidence "that cattle which make a continuous maximum gain to a given weight are more efficient converters of nutrients than those fed at levels which do not permit such rapid development." He later states, "Weights of 100 lbs for each month of age at weaning are being achieved though not too commonly. This type of production probably represents the ultimate economy in

converting low cost feeds to highly desirable human food."

Many ranchers who raise yearlings feel that high growth rates for calves and yearlings during winter are uneconomical because gain during the next summer grazing period might be low. This is not necessarily true. For overwintering calves, Wallace et al. (1962) found that gain increased with crude protein intake, and gain on pasture or range the following summer was not reduced until winter gain exceeded 1.6 lb/day. Even then the decline was not great. Moreover, net profits were greater from calves wintered on a high nutritional plane than from those on low-quality meadow hay. With average daily gains of 2.0 lbs, a yearling can be produced in 12 instead of 18 months, thus, saving the feed necessary to carry these animals for 180 days. No protein supplements are needed with early-cut forage management, a considerable saving for many ranchers.

Who is to reap the benefits from growth potential of young beef cattle? Carroll et al. (1964) discuss the question: "The cattle feeder can expect more profit from retarded cattle that exhibit compensatory growth and he frequently will pay more for them; however, the cattle producer generally cannot produce retarded cattle just for the higher price. Unless the producer intends to reap the benefits of compensatory growth himself, he should consider supplementing weaned calves for continuous growth, because at no later period in their lives will they respond with larger live-weight gains in return for the feed."

Perhaps feeders should encourage ranchers as a means of protecting their supply of raw product and also a means of improving their own efficiency. The recent change by the U.S.D.A. to permit younger, leaner animals to reach a higher grade may have a profound influence on the outcome of this problem. With proper management of water, forage, and livestock, and maybe a short period of feeding homegrown concentrates, ranchers can produce a 750- to 800-lb steer for slaughter at one year of age.

All available evidence indicates that the increases in efficiency of beef production projected in Table 2 are possible. Economic analyses of ranches and discussions with bankers and ranchers indicate increased efficiency is necessary. The examples were developed to show the potential of land and water resources for livestock production-to show that resources are not the limiting factor for greater profit. Each individual will achieve according to his managerial ability and his desire to meet the challenge of progress.

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