# PRODUCTION OF SLAUGHTER STEERS FROM FORAGES IN THE ARID WEST[1,2]

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## SUMMARY

A 4-year study was initiated in 1965 to test the feasibility of supplementing yearling steers on range to finish at an acceptable slaughter grade and compare this to other finishing regimes. Two hundred and twenty yearling Hereford steers were involved in these studies and stratified by weight to five treatments. Finishing phase treatments were: (1) supplemented on range for 90 days (2) feedlot for 90 days (3) supplemented on range for 90 days then to the feedlot for 65 days (4) feedlot for 155 days and (5) irrigated pasture for 40 days and feedlot for 115 days. All animals were supplemented and handled alike during the preceding summer grazing period.

Continuous growth was necessary from birth to slaughter for range supplemented animals to reach desired slaughter weights. Weaning time, winter feed levels and supplementation on range during the growing period had to be considered to provide for this growth.

Steers slaughtered off range weighed less, gained less, and graded lower than steers on the various feedlot systems. However, their total concentrate intake was 34 to 76% of that of the feedlot steers and they returned more per dollar invested in feed. Adding yardage, interest on money, equipment and environmental preservation costs would put the range fattened steers in an even stronger position.

Chemical curing of grasses for late season grazing offers a potential alternative that could produce highly acceptable carcasses from range with only 10% of the grain intake under normal feedlot situations. Other ramifications and alternatives for producing slaughter steers from forages are discussed.

**(Key Words:** Cattle, Forage, Grass-Fat, Nutrition, Supplementation, Range.)

## INTRODUCTION

World population increases continue to put a greater demand on beef production and to put man and beast on a more competitive basis for cereal grains. Cattle feeding, by necessity, may become more dependent upon range and pasture forage, and rangelands may again be looked to as an area for production of slaughter cattle.

The vast majority of the semiarid and arid rangelands of the West have no alternate use for food production other than through grazing. It becomes important that we utilize our ranges and meadowlands to the fullest extent for meat production to conserve feedstuffs that could be consumed directly by man.

At one time animals were slaughtered directly off forage. We then went through a period of surplus grain throughout the United States, and concentrates became a cheap source of animal feed. Now that grain surpluses are diminishing, we are faced with producing beef with less concentrates.

Considering the energy cost of producing fat, which is considerably more than required for producing lean, and the concern over obesity in the United States, we may have to produce trimmer carcasses. Excluding energy, lean beef is as nutritious, or more so, than fat beef. From a nutritional standpoint, excess animal fat is an inefficient method of providing energy, even in energy deficient parts of the world.

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With high grain prices and a poor grain to beef cost ratio, it is desirable to evaluate management methods and systems that fully utilize roughage and minimize grain for a large part of the feeding program. Data reported in this paper were collected on the Squaw Butte Experiment Station. The Squaw Butte range, located 25 km west of Burns, Oregon, is a semiarid high desert range consisting of crested wheatgrass seedings, sagebrush sprayed range and native sagebrush-bunchgrass range which covers some 25 sections. The range is typical of much of the area in the intermountain West, however, the conditions with respect to forage quality are very similar to those found throughout the United States and the world.

The winter headquarters is a section of flood meadowland located near Burns. Cattle are maintained here from November through early April with the principal feed being a low quality meadow hay. Annual precipitation for the total area is about 28 centimeters. Feedlots were located on the Malheur Experiment Station near Ontario, Oregon.

Experimental animals were spring born steers from the Squaw Butte herd, which has been subjected to a closed breeding system, with enough outside breeding to reduce inbreeding. The brood cow herd numbers about 350 head.

## PRE-WEANING AND WEANING PERIODS

Management considerations to provide for continuous growth need to be employed from birth to slaughter if animals are to reach an acceptable slaughter weight on range. The majority of calves are dropped in March and April in the rangeland areas. Suckling calves on desert ranges will gain about .8 kg during May and June, .6 kg during July, less than .4 kg per day during August and relatively no gain after the first of September (Raleigh, 1970). Hence calves weaned at 135 to 170 kg at 7 to 8 months of age. Wallace *et al.* (1962), concluded that these calves should be weaned about September 1. Livestock operators at higher elevations or having forested ranges with later maturing forage can leave their suckling calves on range later into the fall and still provide adequate growth. When calf gains reach .4 kg or lower these animals should be weaned and placed on feed that will provide for gains of .4 to .8 kg per day.

## WINTERING PERIOD

Most studies reporting the effect of winter gain on summer gain have been conducted to obtain inexpensive gains on grass and to sell yearling feeders in the fall. Castle *et al.* (1961) found that rate of winter gain together with number of days on winter feed had a significant negative effect on subsequent summer gain. However, calves restricted to limited winter gains were considerably lighter at the end of the summer grazing period. Total digestible nutrients required during the winter per kilogram of gain accumulated during both winter and summer periods were minimum when animals gained .55 kg per day during winter, with the greatest return over feed costs occurring at .73 kilograms. These data indicated steers should be fed to gain .73 to .82 kg per day when feed cost—cattle price relationships appear favorable and .55 to .64 kg per day under less favorable conditions. Raleigh and Foster (1972) concluded that yearlings can gain up to .80 kg per day during winter without substantially affecting summer gains as long as animals are supplemented for high gains. To provide animals for slaughter off range, higher winter gains of about .80 kg per day are desirable.

## RANGE GROWING PERIOD

Unsupplemented yearling steers will gain .9 kg or more per day during May and June, about .7 kg during July, less than .5 kg in August, with little or no gain after September 1. A supplemental feeding program for yearlings on range was developed over a period of several years on the Squaw Butte Station (Raleigh, 1970). Digestible protein and energy intake of yearling cattle on range were measured and compared with nutrients required to gain about 1.15 kg per day. The difference between the two was then calculated and a supplement designed to make up the difference. Supplement levels fed during the growing phase are shown in table 1. Supplements were hand fed on a daily basis. Data from these studies indicated that due to decreasing forage quality it was impractical to supplement for economic production beyond mid-August. Beyond this point an increased supplement level inhibited forage intake.

Table 2 presents results of the growing period including daily gain, supplements fed, costs and total grain consumed per head for the entire period. Steers went onto range weighing

TABLE 1. DAILY SUPPLEMENTAL NUTRIENT INTAKE

| Period | Supplemental nutrient[a] | |
|---|---|---|
| | Nitrogen | Digestible energy |
| | g | kcal |
| 5/6-5/21 | 7.8 | 1404 |
| 5/22-5/29 | 4.9 | 936 |
| 5/30-6/5 | 3.8 | 702 |
| 6/6-6/12 | 3.2 | 645 |
| 6/13-6/19 | 14.4 | 840 |
| 6/20-6/26 | 17.2 | 1120 |
| 6/27-7/3 | 23.2 | 1420 |
| 7/4-7/10 | 28.5 | 1800 |
| 7/11-7/17 | 34.0 | 2200 |
| 7/18-7/24 | 38.4 | 2460 |
| 7/25-8/3 | 44.2 | 3550 |
| 8/4-8/9 | 47.3 | 4000 |

[a]Cottonseed meal and barley were used as supplemental sources of N and DE. While extra N was not considered necessary between 5/10 and 6/12 the barley provided small amounts as indicated.

259 kg and gained 1.16 kg per day on .58 kg of daily supplements. Total supplemental intake was only 50 kg per head for the entire 87-day period.

## FINISHING STUDY

The Squaw Butte Experiment Station initiated a 4-year study in 1965 to determine if yearling steers could be supplemented on range to finish at a slaughter grade of high good to low choice and to compare these costs with cattle finished in the feedlot and other alternate systems. Two hundred and twenty steers were involved over the 4 years in these studies, with all of them being handled alike during the growing period.

TABLE 2. AVERAGE DAILY GAIN, SUPPLEMENTAL INTAKE, COSTS AND TOTAL SUPPLEMENTS CONSUMED DURING THE GROWING PERIOD

| Item | Value |
|---|---|
| Number of animals | 220 |
| Initial weight, kg | 259 |
| Number of days | 87 |
| Daily gain, kg | 1.16 |
| Daily barley, kg | .35 |
| Daily cottonseed meal, kg | .23 |
| Daily feed cost, $[a] | .05 |
| Cost per kg gain, $ | .04 |
| Total feed costs, $ | 4.35 |
| Total concentrates consumed, kg | 50 |

[a]Costs are those of the period from 1965 to 1969 and includes range feed @ $.30 per A.U.M., barley @ $.055 per kilogram, CSM @ $.099 per kilogram, and hay @ $.022 per kilogram.

At the end of the growing phase, steers averaged about 360 kg and were assigned to one of five treatments. Treatments were as follows: (1) supplement on range for 90 days, (2) feedlot for 90 days, (3) supplement on range for 90 days and feedlot for 65 days, (4) feedlot for 155 days, (5) irrigated pasture for 40 days and feedlot for 115 days. All animals were slaughtered and carcass data collected.

Gain and feed data during the finishing period are presented in table 3. There were 40 steers on each treatment except the range treatment (1) in which there were 60 head. Average daily gain on range was 1.00 kg as compared to 1.32 to 1.45 kg for the other treatments. Actual daily intake values for the roughages and concentrates are presented, except for forage intake on range which was not measured. Animals on all treatments were given supplemental salt, minerals and vitamins. Total concentrate intake on range was 533 kg and 799 to 1,564 kg for the other treatments. Total feed costs and costs per kilogram of gain are also presented.

Carcass data in table 4 shows warm carcass weights of 256 to 355 kg and dressing percentages varying by as much as 5% between treatments. Carcasses from range fattened animals (treatment 1) were lighter, graded lower and dressing percentages were lower than those from the other treatments. How much of this dressing percent difference is due to carcass weight and how much to ration cannot be determined from this data. Yield grades would have undoubtedly favored the animals from treatment 1. Both of these factors, dressing percent and yield grades, are important when interpreting gain data. Value of the cold carcasses varied from 80.3 to 92.4¢ per kilogram depending on grade, weight of carcass and time of year slaughtered. There was never more than a 3.3¢ per kilogram spread between choice and good grades. Cold carcass values on the short fed animals slaughtered in November were about 5.5¢ per kilogram less than animals of a similar grade in January.

A summary of data from turnout date on range to slaughter is presented in table 5.

TABLE 3. GAIN AND FEED DATA DURING THE FINISHING PERIOD

| Item | Treatment[a] 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of animals | 60 | 40 | 40 | 40 | 40 |
| Days on full feed[b] | 93 | 85 | 65[d] | 155 | 115[c] |
| Initial weight, kg | 360 | 370 | 452 | 371 | 407 |
| Final weight, kg | 452 | 491 | 543 | 576 | 565 |
| Avg daily gain, kg | 1.00 | 1.42 | 1.40 | 1.32 | 1.45 |
| Daily feed intake | | | | | |
| Hay[e], kg | .5 | 1.0 | .3 | .6 | 1.0 |
| Barley, kg | 5.0 | 4.5 | 5.2 | 5.0 | 5.0 |
| Beet pulp, kg | .1 | 2.6 | 1.2 | 2.6 | 2.7 |
| Ground ear corn, kg | ... | 2.3 | 1.1 | 2.5 | 2.5 |
| Cottonseed meal, kg | .7 | ... | .4 | ... | ... |
| Total concentrate intake, kg | 533 | 799 | 1245 | 1564 | 1176 |
| Feed costs[f], $ | 35.34 | 43.12 | 71.90 | 81.90 | 62.58 |
| Feed cost per kg gain, ¢ | 40 | 35 | 40 | 40 | 37 |

[a](1)Range to mid-November (2) Feedlot to mid-November (3) Range to mid-November then feedlot to first part of January (4) Feedlot to first part of January (5) Irrigated pasture to mid-September then feedlot to first part of January.

[b]Gain data does not include periods of 8 days for treatments 2, 4 and 5, and 5 days on treatment 3 during which roughage was decreased and grain increased until animals were on full feed.

[c]Steers were on irrigated pasture for a 40-day period prior to going on full feed in which they gained an average of .82 kg per day.

[d]Steers were supplemented on range for 93 days prior to going into the feedlot and gained 1.00 kg per day. Feed data includes this period.

[e]Alfalfa hay was fed to adjust animals to full feed on treatments 2, 3, 4 and 5, and limited meadow hay had to be fed during 1 year of treatment 1.

[f]Costs are those of the period from 1965 to 1969 and includes range feed @ $.30 per A.U.M., barley @ $.055, CSM @ $.099, meadow hay @ $.022, alfalfa @ $.026, beet pulp @ $.047 and ground ear corn @ $.044 per kilogram.

Taking total feed costs from actual carcass value, the net varied from 170 to 234 dollars between treatments. However, these values can be somewhat misleading. This method of computation does not consider the value of the steers going onto range which would reduce the net considerably, but does permit comparisons between different feeding systems. Yardage fees, interest on money, equipment, environmental preservation costs, labor, etc., are not included and would reduce profit on all treatments, but not as much for range fattened animals as those in the feedlot. These values vary considerably between operations. Range fattened animals returned more per dollar invested in feeds even disregarding the above considerations and using 1965 to 1969 values. Profit would be increased by feeding more steers on range or for a short period in the feedlot rather than fewer steers on feed longer. This turns the investment over faster and reduces interest costs. In terms of grain savings, table 5 shows range fattened animals consumed 34 to 76% of the grain in other treatments. Treatment 1 produced more carcass per kilogram of grain.

Today's vastly higher feed costs coupled with a much less increase in carcass values, has dramatically reduced return per dollar invested in feed for all treatments. However, range fattened steers in treatment 1 and short fed animals in treatments 2 would return more per dollar invested in feed today, as they did under previous conditions. High feed costs have increased costs of the long fed steers so that it offsets the wider spread between choice and good grade beef prices. Both slaughter prices and feed costs are in a very dynamic state and it is difficult to predict what effect year, time of year and grade of animal will have on future markets. Economic evaluations are only valid for a given market and need to be calculated for

TABLE 4. CARCASS DATA

| Item | Treatment 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Warm carcass weight, kg | 256 | 288 | 323 | 355 | 330 |
| Dressing, % | 56.7 | 58.6 | 59.5 | 61.7 | 58.4 |
| U.S.D.A. Grade | | | | | |
| Choice, % | 10 | 83 | 70 | 83 | 63 |
| Good, % | 85 | 17 | 30 | 17 | 37 |
| Standard, % | 5 | 0 | 0 | 0 | 0 |
| Cold carcass value/kg[a] | | | | | |
| Choice, ¢ | 86.9 | 86.9 | 92.4 | 92.4 | 92.4 |
| Good, ¢ | 83.6 | 83.6 | 89.1 | 91.3 | 89.1 |
| Standard, ¢ | 80.3 | ... | ... | ... | ... |

[a]A 2½% pencil shrink was taken on warm carcass weights to derive cold carcass weights.

the price structure or time frame that exists.

Additional carcass data are presented by Raleigh *et al.* (1967) on range fattened steers. It was concluded that it is possible to feed cattle on range to produce a desirable carcass at an economical level. Lighter carcasses from range fattened animals with less fat were observed to be in greater demand by buyers who were making their selections in the cooler room. This was especially true of low choice and high good carcasses all of which were carrying a minimum of fat. Brady (1957) reported on studies of consumer preference in which it was found that the public prefers beef of U.S.D.A. good grade and would buy more of it, as compared to choice and prime grades, if it were available. There is also a great deal of doubt in the literature as to how much influence carcass grade has on taste and acceptance of meat. If choice and good labels were removed from cuts of meat, consumers would probably select leaner good cuts the majority of the time.

## OTHER ALTERNATIVES

There are many other alternate systems and management schemes of producing slaughter cattle including use of irrigated or improved pastures. A short feeding period at the end or fairly high grain supplement while still on pasture may be desirable to change color and taste of fat and still provide a substantial savings of grain.

One of the most exciting possibilities in terms of producing a highly acceptable carcass with a small amount of grain is by chemical curing of grasses for late season grazing. Paraquat, a bipyridium herbicide, can be used to cure grass while it is high in nutritive value without a detrimental effect on herbage yield in

TABLE 5. SUMMARY FROM TURNOUT TO SLAUGHTER

| Item | Treatment 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Carcass value, $ | 210 | 242 | 288 | 320 | 294 |
| Total feed cost, $[a] | 40 | 47 | 76 | 86 | 71 |
| Net over feed cost, $ | 170 | 195 | 212 | 234 | 223 |
| Return per $ invested in feed[b] | 5.25 | 5.15 | 3.79 | 3.72 | 4.14 |
| Total grain intake, kg | 583 | 849 | 1295 | 1614 | 1226 |
| Carcass/kg of grain, kg | .44 | .34 | .25 | .22 | .27 |

[a]Including cost of range and irrigated pasture prior to finishing period.

[b]Excludes yardage fees, interest on money, equipment, etc., all of which would reduce the net profit on all treatments, but be highly favorable to range animals.

subsequent years even under continuous treatment (Sneva, 1967). However, yield is reduced during wet summers or if sprayed at an early date. Nitrogen fertilizer can be used to increase yield or make up for loss in yield of chemically cured forage (Sneva, 1973). Intake studies have shown no palatability problems with paraquat treated forages and in fact, have shown a greater intake than on naturally cured forage (Raleigh *et al.*, 1968). Sneva *et al.* (1973) reported yearling heifer gains over a 3-year period were increased .27 kg per day above those grazing naturally cured crested wheatgrass in the fall without supplements. Pastures were sprayed between June 16 and 23. From mid-August to mid-September gains averaged above .63 kg on chemically-cured range and steadily decreased to about .24 kg per day during the next 60 days. Addition of a daily supplement containing .23 kg of barley and .34 kg of CSM increased gains by .24 kg per day during mid-August to mid-October, but had somewhat of a negative effect during the next 30 days. During the later period grass may have been reduced in both quality and quantity by selective grazing so animals became less dependent on forage and more dependent on supplement and thereby reducing forage intake.

The potential for maintaining gains of yearling steers at around .9 kg per day of chemically cured forage is high, possibly by employing supplemental systems described earlier where supplement levels were correlated with nutrient intake from the forage as they relate to animal requirements for a specific level of performance. Projecting a program of this nature, it should be possible to slaughter animals with acceptable carcasses directly off range with only 150 kg of concentrate intake per head from turnout on range in May through mid-November. This would represent about 10% of the grain intake under a normal feedlot situation.

Carcass fat may be higher quality in terms of color and acceptability from animals slaughtered off chemically cured forage rather than green grass or irrigated pastures since paraquat leaches out the carotene content of the plant. High carotene in green grasses which results in yellow or off color fat has been one of the major criticisms of grass fat beef.

Time of calving is another consideration for an animal-forage system for producing slaughter beef. Raleigh *et al.* (1970) reported that fall calving was well adapted to semiarid range conditions. These calves were large enough when placed on range to not only utilize their dams milk but also to take advantage of high quality range forage in May, June and part of July. Fall calves were able to remain on their dams longer and wean at 228 kg as opposed to a 150 kg weaning weight for spring calves. These calves could be finished as light grass fat animals at about 360 kg or above at just over a year of age by feeding on range or possibly a low supplemental level with chemically cured forage. Another alternative would be to carry these calves on through the fall and next winter on a high quality roughage and finish them early in the next grazing season. By adjusting calving date and finishing time, slaughter animals could be produced from June through November to help distribute short fed beef production out over the year to provide a more continuous market. Other parts of the country, particularly the southern states, could fill in the remaining months.

*Discussion*

There are a number of inherent advantages to fattening steers on range or pastures. Because of the low density of cattle in comparison to feedlots, range feeding, in many situations, does not contribute to water and air pollution problems. Less confined conditions also provide for drier, healthier feeding conditions and eliminates the need for manure removal, which may mean a savings in veterinary costs and labor. Range feeding also has less expense in permanent feedbunks and handling equipment. Hauling expense, overhead costs of middlemen and selling expenses may also be less because of retained ownership and keeping cattle at the same location.

There are some factors that need to be considered if range finishing becomes a large scale industry. One is carrying capacity of available ranges. The previously reported study was conducted on crested wheat-grass ranges with a carrying capacity of about 1 ha per AUM. On ranges with a carrying capacity of less than 2 or more ha per AUM, distance cattle have to travel for feed could have an adverse effect on rate of gain. Average carrying capacity of semiarid ranges is about 4 ha per AUM. Thus opportunities are somewhat limited.

Another consideration to keep in mind is that these ranges are in general best suited for cow-calf production. It seems unlikely that

production of slaughter animals off range would, or should, increase to the extent that it would adversely affect number of brood cows that can be carried. Also limited supplies of grain are produced in these arid regions. Slaughter beef production should probably be limited to higher quality ranges and somewhat to grains readily available.

The possibility that production of slaughter grade cattle from range or grass will replace the feedlot is remote. On the contrary it provides another marketing channel for cattle producers and another choice of meat for consumers. We will undoubtedly always have feedlot beef in this country. A market will probably always exist for highly finished beef for certain clientele, such as restaurants, hotels, banquets and for a portion of the population that simply prefers, and can afford, beef with a high degree of finish. However, a tremendous market also exists for those who want a leaner cut of beef, prefer the taste of short fed animals or would like to buy a cheaper grade of beef. Consumption of imported beef is an indication of preference for this type of product, and we should be competing stronger for a share of this market. One reason these countries can undersell us is that they depend heavily on forages rather than more expensive concentrates for production. However, low land and labor costs also enter in.

In summary, data suggests that range or pasture supplemented steers can be adequately finished by any one of several systems, dependent on many factors including a market for the grade of cattle produced. The overall beef system which is used ultimately migrates to the one paid for in the market place and to the one which is most profitable.

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