Management by definition is the act or art of conducting for a purpose. In pasture or range management, one of the major objectives is the harvesting of an optimum of marketable product, usually either meat or milk, from an area of forage managed to provide a sustained or increasing level of production. Traditionally, pasture or range management involves both livestock and forages each of which must be treated individually. Yet the utilization of forage produced is totally dependent on livestock and vice versa.

The purpose of this paper is to summarize and present seven years of data concerning the relative efficiency with which forage is harvested by cattle in a cow-calf operation.

**Literature Review**

Until relatively recent years, cattle production in the southeast consisted of grazing native species on open ranges. Williams, et al., (1955) reported the nutritive value of such forages generally was highest between March 1 and July 1. During that time, most livestock gained weight. Between July 1 and September 15, most mature cattle maintained their weight. After September 15, all cattle lost weight until new grass growth started the next spring. They further reported that herds grazing ranges most of the year usually weaned 50 percent calf crops that weighed 250-300 pounds. Such poor performance was due to both inadequate quantity and low quality forage. By fertilizing Coastal Bermudagrass (Cynodon dactylon) or Pensacola bahiagrass (Paspalum notatum) sufficient quantities of forage with quality adequate to meet cow needs can be produced (Beaty et al 1961; Burton 1954). Williams et al (1955) suggested feeding protein concentrates to increase the nutrition of cows on ranges.

An additional reason for poor calf weights was that calves on range were dropped year long and were often sired by scrub bulls. Marlow and Gaines (1959) have shown that lack of calf growth is usually due to poor nutrition and can be partially offset by creep feeding. The use of superior bulls needs no justification.

**Procedure**

In 1955, 100 acres of Red Bay Loamy sand at the Americus Plant Materials Center were allotted to a forage-beef management enterprise. The area was stocked initially on March 10, 1955, with 30 pregnant mature grade Hereford beef cows with known fairly good production records. The cows were grazed on the area year long with supplemental hay that was grown on the area fed to them during times when grass was not available for grazing. Such periods were usually from November 15 to April 1 when Coastal Bermudagrass and Pensacola bahiagrass were not growing. Cotton seed meal was fed one pound per cow per day between November 20 and January 15, and two pounds per day from that time until April 15. The cows were bred to performance tested bulls from the Coastal Plain Experiment Station from about April 1 to July 1.

About January 15, after cows started calving, two pounds of ground snapped corn were also fed daily to each cow for approximately 90 days. The cows and calves were grazed together until calves were weaned and weighed, usually in September or October.

Sixty acres of Pensacola bahiagrass and 40 acres of Coastal Bermuda were split into four pastures, any of which was fertilized when additional forage was needed. Stocking rates averaged approximately one cow and calf per three acres and fertilizer applications averaged 25 pounds of nitrogen, 12 pounds of P and 24 pounds of K per acre annually. Pastures were kept clean by harvesting hay for winter use or by burning in March.

**Results and Discussion**

A forage-beef operation as a general rule is considered to be

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1. Journal Paper No. 1 of the Branch Experiment Stations of the University of Georgia, College of Agri. Expt. Stations.
Table 1. Average adjusted weight of calves as influenced by years 1956-1962

<table>
<thead>
<tr>
<th>Year</th>
<th>Average weaning weight</th>
<th>Percent of average</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>439.17</td>
<td>96.22</td>
<td>26</td>
</tr>
<tr>
<td>1957</td>
<td>455.75</td>
<td>99.85</td>
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<tr>
<td>1958</td>
<td>446.07</td>
<td>97.73</td>
<td>28</td>
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<tr>
<td>1959</td>
<td>431.23</td>
<td>94.48</td>
<td>29</td>
</tr>
<tr>
<td>1960</td>
<td>474.41</td>
<td>103.94</td>
<td>27</td>
</tr>
<tr>
<td>1961</td>
<td>462.25</td>
<td>101.36</td>
<td>27</td>
</tr>
<tr>
<td>1962</td>
<td>485.71</td>
<td>106.42</td>
<td>25</td>
</tr>
</tbody>
</table>

A high investment-low return business. Success often depends upon efficient management. In such an operation where animals are handled in groups, cash cost per cow per year is rather uniform. In this case, average cost was calculated at $58.85 per cow per year. These cash expenses per cow and calf per year consisted of the following: Veterinary and spray materials, $4.85; salt and minerals, $1.00; cottonseed meal and corn, $4.10; marketing, $0.80; pasture costs, $36.10. Fixed costs were depreciation, $13.17; taxes, $1.56; and insurance, $0.29; total $15.02.

Total costs were $73.87 per cow per year. Certain potential additional expenses such as interest on investment, hired labor and pasture renovation were not included since interest on investment may be considered income and net returns may be considered as returns to lands, labor, and management. Costs will vary some with size of operation. This particular unit was based on a 30 cow herd. It would require no more land, fences, scales, corrals, or pens to increase the herd to 60 cows. Some additional hay storage and rack space would be needed. Fixed cost per cow should be lowered with the larger numbers of animals. However, additional fertilizer, primarily 100 pounds of nitrogen per acre would need to be applied. Present phosphorus and potash applications are adequate for the higher nitrogen rate. An extra bull would be required and most other cash expenses would tend to remain about the same per cow.

Calf weaning weights were adjusted for age and sex of calf, age of dam and year of production using least squares co-variate analysis.

Considering the average adjusted calf weight of 456 pounds and an average price of $0.22 per pound, gross returns per calf of $100.32 were obtained. Returns to investment, land, labor and management were $26.25 per cow.

Returns were influenced by calving percentage, death losses, weaning weight, which was influenced by sex, age at weaning, age of dam, and by selling price.

Over the seven year period, the number of calves born to cows two years old or older averaged 94 percent of those bred and shows that a satisfactory calf crop can be produced on a predominantly grass ration where adequate quantities of reasonably good quality forage are provided. During the seven year period ten calves were either born dead or died at birth. This amounts to 5.2 percent of the 216 cows two years old or older in the herd. A total of 193 calves were weaned for an average of 88.8 percent calf crop. Of the 193 calves weaned two were twins and were eliminated from the statistical calculations to prevent possible bias of the data. Average age of the 191 calved at weaning was 233 days and average weight was 461.3 pounds. However, when the arithmetic mean was adjusted for year effect, age of dam, sex and age of calf, the calf weaning weight based on factors developed for this herd was 456.5 pounds.

Year to year variation in calf weaned weights is shown in Table 1. The total variation amounted to 11.3 percent and ranged from 5.52 percent below average in 1959 to 6.42 percent above average in 1962. Part of the year to year variation may be attributed to seasonal variation in grass quality, and for the last four years a rigid culling program removed the less productive cows from the herd. The increase in calf weaning weight indicates the value of performance records. Difference in calf weaning weights due to year effect was significant at the .05 level.

Age of dam had a considerable effect on calf weaning weight and data are included in Table 2. Calves from two-year-old cows were 16.1 percent below average in weight and an average of 95 pounds lighter.

Table 2. Effect of age of cow on adjusted weaning weight of calves.

<table>
<thead>
<tr>
<th>Age of cow (Years)</th>
<th>Average weaning weight (Pounds)</th>
<th>Percent of average (Number)</th>
<th>Observation (Number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>328.95</td>
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<tr>
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<td>92.02</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>481.85</td>
<td>105.57</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>479.82</td>
<td>105.51</td>
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<td>106.01</td>
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<td>104.78</td>
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<td>103.15</td>
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<td>11</td>
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<td>106.08</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>458.60</td>
<td>100.48</td>
<td>4</td>
</tr>
</tbody>
</table>
than the calves from cows five years and older. The calves of three-year-old cows grew very little faster than did the calves from two-year-old cows, and were 13.3 percent below average and approximately 85 pounds lighter than calves of the older cows. Four-year-old cows produced calves weighing up to 92 percent of the average but still 55 pounds lighter than calves of older cows. The small size of calves produced from two to four-year-old cows was due to light birth weights and reduced milk supply. Getting a heifer into full production requires four years by which time she should have produced three calves totaling 1,188 pounds in weight. During the next four years she could be expected to produce four calves totaling 1,924 pounds. Therefore, when a heifer replaces a cow in the herd, a reduction in calf production of 736 pounds should be expected. It is probable that maximum efficiency of forage utilization can be had where cows that are five to 12 years of age predominate in the herd.

In this study, calf size reached a peak with five-year-old cows. They maintained this level of production through the eleventh year. Had all original cows been kept the record would have been somewhat different. However, it does show that up to age 11 beef cows are capable of producing excellent calves provided they are adequately fed and kept in good health. The oldest cows in this group were 12 years old in 1962 and were still productive. Their calves weighed 460, 510, 520, and 550 pounds (unadjusted) when weaned. These cows were part of the original herd and were selected on the basis of high production. They probably were exceptions to the average (Henderson 1949). It should be recognized that at 12 years of age a cow is decreasing in value. However, if she is in good health and has a good production history, it may be desirable to keep her until she either fails to calve or shows decline in health.

Heifer calves averaged 434.6 pounds and steer calves, 478.3 pounds at weaning. The steers were 5.05 percent heavier than average and the heifers 5.05 percent lighter than average. Such data may have real value when one is estimating the productive potential of first or second calf heifers. A cow that drops a heifer calf her first and second years may have a poor lifetime production record. Calf weaning weights will be 134 pounds lower due to age and a further reduction of 46 pounds will trace to sex of the calves.

Calf weaning age had a highly significant effect on weaning weight. The adjusted weight for age showed that for each additional day of age calf weight increased 1.61 pounds. Therefore, on the average, the older a calf is at weaning the greater the efficiency of forage recovery is likely to be.

**Biology vs. Economics**

From the data presented, it can be determined that a five-year-old cow that weaned a steer calf weighing 580 pounds born January 1 and weaned on October 5 and a two-year-old cow that weaned a heifer calf weighing 288 pounds on the same date but born March 31 are both producing at comparable levels of biological expectation. However, in economic terms the first example would require a selling price of 12.7 cents per pound to cover costs of production while the second example would require a selling price of 25.6 cents per pound to cover production costs. The advantage of producing large calves at weaning is evident where increasing the efficiency of forage harvest is a major objective.

**Summary**

Over a seven year period records were kept on a bermuda-grass/bahia grass-beef cow management unit at the Americus Plant Material Center. During that time costs of keeping a brood cow for a year and her calf until weaned were estimated to be $73.87. Gross returns per calf were estimated to be $100.32. Returns for investment, land, labor and management were $26.25 per cow per year.

During the seven years biological data were obtained on 191 calves which showed that:

1. Better than a 90 percent calf crop can be weaned (94 percent dropped) from a herd on a predominately grass ration that is adequate in quantity and supplemented with additional feed in the winter and minerals year long.
2. Year to year fluctuations in calf weaning weights were relatively small, the largest deviation being 6.42 percent.
3. Calves from two-, three- and four-year-old cows were well below herd average in size. However, calves from cows five through 11 years of age were stable at approximately 5 percent above average herd weight.
4. At weaning heifer calves averaged 10.03 percent smaller than steer calves.
5. The average age at weaning for calves was 233 days and the adjusted weaning weight was 456 pounds. For each day over 233 days of age at weaning calves averaged 1.61 pounds heavier and for each day under 233 days they averaged 1.61 pounds less.

**LITERATURE CITED**


Brown, C. J. 1958. Heritability of weight and body dimensions of
Seeding Salt-Desert Shrub Ranges in Western Wyoming

A. C. Hull, Jr.

The demands for increased forage, reduced erosion, and control of undesirable plants indicate the need for improvement of salt-desert shrub ranges below their potential production. Most depleted areas can best be improved by better management. Where desirable plants are absent and favorable soil and moisture permit, seeding may speed up revegetation.

To determine the possibilities for revegetation, the Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, the Bureau of Land Management, and the University of Wyoming initiated 25 studies during 1948 to 1951 to evaluate species and methods of seeding Wyoming rangelands. With the departmental reorganization in 1954, this work was transferred to Agricultural Research Service.

Procedures

Each study area received one to three methods of seedbed preparation which included moldboard plowing, diskng, dragging, and grading. The grader blade cut the shrub roots just below the soil surface with as little soil disturbance as possible. Type of seedbed and some characteristics of the study areas are shown in Table 1. On all areas the native plants were sparse and small, typical of deteriorated range. Areas were grouped into vegetation types as follows:

1. Saltbush—almost pure Nutall saltbush (Atriplex nuttallii S. Wats.)
2. Mixed saltbush—Nutall saltbush with some or all of the following: Schadscale (A. confertifolia (Torr. & Frem.) Wats.); winterfat (Eurotia lanata (Pursh) Moq.); budsage (Artemisia spinescens D. C. Eat.); and birdfoot (A. pedatifida Nutt.), low (A. arbuscula Nutt.), and big sagebrush (A. tridentata Nutt.).
3. Big sagebrush—big sagebrush dominant.

Long-time average precipitation was estimated from the nearest weather stations. Spring has the most rain with 45 to 50 percent of the yearly total falling during April, May, and June. The winter is dry with 10 percent or less of the total falling during December, January, and February. During the years of stand establishment, precipitation was nearly normal.

Species were drilled at right angles to seedbed preparation strips with two replicates per study. Crested wheatgrass (Agropyron desertorum (Fisch.) Schult.) was seeded 
\frac{3}{4} inch deep at six pounds of seed per acre. Smaller seeded species were seeded \frac{1}{2} inch deep at four to six pounds per acre. Larger seeded species were seeded \frac{3}{4} inch deep at eight pounds per acre. Exceptions were western wheatgrass (A. smithii Rydb. and Indian ricegrass (Oryzopsis hymenoides (Roem. & Schult.) Ricker), which were seeded at 15 to 18 pounds per acre.

Seedings were rated yearly to 1952 or 1953 and again in 1960 and 1962. Numerical ratings of seeded stands are as follows: zero complete failure, one-two very poor, three-four poor, five-six fair, seven-eight good, and nine-ten excellent. Ratings in Table 2 are from prepared seedbeds.

Eighteen studies were on salt-desert shrub lands. By 1960, two areas, Monument and Dad, had been destroyed. The remaining 16 were rated for success of seeded stands. Two big sagebrush areas with low precipitation were included for comparison.

Results and Discussion

Seedling stands varied from poor to excellent. By 1962 most stands were poor or failures. Poor stands were attributed mainly to reinvasion by native vegetation and to seeded species not being adapted to dry, saline areas. Slow deterioration of 1948 seeded stands of eight species is shown at Kane, one of the older seedings and the one which has been rated most often. From 1949 to 1952 five species had good or excellent stands, one a fair stand, one a very poor stand, and one was a failure (Figure 1). In 1953 native plants commenced to invade the seeded strip. In 1953 and 1954 Russian wildrye (Ely-