investments. Profit motivation is a concept not understood or accepted by the majority of pastoralists in East Africa. Cattle production is not yet a business but a way of life.

Until conformation means more than the color of a cow and quality more than quantity, progress will be slow. The traditional grazing practices that have stagnated livestock production must be modernized through better but simple methods that provide for a gradual change. The Peckover Ranch is an example of how the art of range management can fill the gap for an improved pastoralism in East Africa (Fig. 5).

Literature Cited


Moving and Mixing Range Steers1

E. H. McILVAIN AND M. C. SHOOP

Highlight

Knowledge of the weight-change response caused by moving range steers to strange pastures and mixing them with strange cattle is needed to help develop and apply improved range rotation and other grazing management systems. A 3-year grazing study showed that yearling Hereford steers were not greatly disturbed by either change of pasture or associates. The steers adjusted rapidly to new conditions, and compensatory gain offset most of the slightly smaller weight gain that occurred when the steers were moved and mixed. Behavioral disturbances were small. A little fighting and fence-walking occurred when the steers were moved and mixed, but this lasted for only 1 or 2 days. The weight-change response from moving and mixing range steers does not appear to be an important factor in the development of range rotation grazing systems, or in making other range use decisions which involve moving and mixing.

The objectives of this study were to determine changes in weight gains and behavior of Hereford steers as affected by change of pasture and associates. This study is the first of a series being conducted specifically as a basis for developing more efficient grazing management systems.

It is inevitable that improved systems of grazing management will be developed in the next few years. The systems will probably include (1) moving cattle from pasture to pasture and (2) recombining cattle herds. In order to develop grazing and cattle management systems, and

1 Study conducted on the Southern Plains Experimental Range, Woodward, Oklahoma, by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the Oklahoma Agricultural Experiment Station. Received February 27, 1970; accepted for publication December 31, 1970.


fact that dominance order in animals has long been observed by man is illustrated by the Chinese proverb, "One hill cannot shelter two tigers."

Area, Cattle, Methods
The study was conducted from 1961 to 1964 in northwestern Oklahoma on the Southern Plains Experimental Range near Woodward. Annual precipitation averages 23 inches, but it varies from 10 to 41 inches. The climate is continental with great extremes of temperature, humidity, and wind.

Soils are mostly sands and loamy sands on and between rolling dunes now stabilized with sand sagebrush (Artemisia filifolia), blue grama (Bouteloua gracilis), sand dropseed (Sporobolus cryptandrus), little bluestem (Andropogon scoparius), sand bluestem (Andropogon hallii), several minor short, mid, and tall grasses, and a few forbs. About 18 acres of rangeland is usually needed to graze a cow-calf unit for 1 year.

The weaner Hereford steers used in this experiment were about 8 months old when obtained in October each year. They were used for 11 months and then replaced with sib-related steers from the same herd. The steers were weaned, hot-iron branded with individual numbers, vaccinated, allowed to recover gross weight at weaning, weighed on 2 successive days, and graded as to conformation and fleshing condition. Then they were allotted to experimental treatment at random within weight, grade, and condition classes. All steers were fed a daily ration of 1.5 lb. of 41% protein cottonseed pellets twice weekly during winter; and throughout the year they were given free access to grass, water, and salt.

Twelve 50-acre pastures were assigned to four productivity blocks on the basis of soil type, pasture forage production, and weight-gain history. The three treatments—(1) continuous yearlong grazing, (2) moved monthly, and (3) moved and mixed monthly—were then assigned at random within the four pasture blocks (replications).

Table 1. Gain (lb.) of weaner steers as affected by monthly change of pasture and associates, 1962-64.

<table>
<thead>
<tr>
<th>Grazing treatment</th>
<th>Nov-Jan</th>
<th>Feb-Apr</th>
<th>May-July</th>
<th>Aug-Sept</th>
<th>Yearlong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous yearlong</td>
<td>45a</td>
<td>80a</td>
<td>230a</td>
<td>99a</td>
<td>454a</td>
</tr>
<tr>
<td>Moved monthly</td>
<td>43a</td>
<td>75b</td>
<td>230a</td>
<td>99a</td>
<td>447ab</td>
</tr>
<tr>
<td>Moved and mixed monthly</td>
<td>41a</td>
<td>76b</td>
<td>231a</td>
<td>93a</td>
<td>441b</td>
</tr>
</tbody>
</table>

Each pasture was stocked with four steers. Those steers grazed continuously yearlong were never moved. Those moved monthly were rotated to a strange pasture that had been grazed each previous month. Those moved and mixed monthly were rotated to a strange but previously grazed pasture and mixed with all new associates.

All steers were weighed at the end of each month, and all were re-weighed 7 days later on 17 different occasions during the 3 years. Detailed observations were made of restlessness, fighting, contented walking, restless walking and trailering, grazing behavior (sporadic or active), standing, lying, ruminating, playing, drinking, and salting. Activities of all 12 herds were observed and recorded on: (1) the day before change; (2) the day of change; (3) the day after change; and (4) a week after change.

During the third year of the study, October 1963 to October 1964, treatments 1 and 3 were applied in 4 additional replications to 8-head lots of steers in 107-acre pastures. This was done to increase precision of weight-gain responses. The only change in methods was that steers in treatment 3 were moved and mixed at 2-week intervals instead of monthly.

Results and Discussion
The 3-year average gain per steer for: (1) yearlong grazing; (2) moved monthly; and (3) moved and mixed monthly was 454, 447, and 441 lb. per steer respectively (Table 1). Thus, a small reduction in gain resulting from each of the two disturbing factors was detected. Each disturbing factor, moving and mixing, reduced yearlong gains only about 6 lb. per steer. None of the differences were statistically (5% probability level) or economically significant.

The insignificant reduction in yearlong gain caused by change of pasture and associates is partially explained by the 7-day gains made after the steers were moved and mixed. As an average of the 17 periods, steers grazed yearlong in the same pasture gained 7 lb. during the 7 days; those moved monthly gained only 4 lb.; and those moved and mixed monthly also gained 4 lb. (Table 2). If compensatory gain had not occurred during the following 3 weeks of each month, those

Table 2. Seven-day gain (lb.) of weaner steers following change of pasture and associates, 1962-64.

<table>
<thead>
<tr>
<th>Grazing treatment</th>
<th>Dec-Jan</th>
<th>Feb-Apr</th>
<th>May-July</th>
<th>Aug-Sept</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous yearlong</td>
<td>7a</td>
<td>4a</td>
<td>10a</td>
<td>7a</td>
<td>7a</td>
</tr>
<tr>
<td>Moved monthly</td>
<td>4a</td>
<td>0a</td>
<td>9a</td>
<td>4ab</td>
<td>4a</td>
</tr>
<tr>
<td>Moved and mixed monthly</td>
<td>3a</td>
<td>2a</td>
<td>8a</td>
<td>3b</td>
<td>4a</td>
</tr>
</tbody>
</table>

1 Means within a column followed by the same letter are not significantly (P = 0.10) different.
steers rotated monthly should have gained about 33 lb. less during the year (3 lb. x 11 pasture changes) than the steers grazed yearlong.

In the expanded study conducted during 1963–64, the steers grazed continuously yearlong in the same pastures gained 470 lb. compared with 461 lb. for the steers which were moved and mixed each 2 weeks throughout the year. These data confirm and strengthen that obtained in the main study.

Behavioral responses also help explain the insignificant weight gain responses. In general, moving and mixing the steers disturbed them surprisingly little, and for only 1 to 2 days. The main disturbance effect on the steers moved monthly was that they walked and fought more—but only for 1 or 2 days. The main disturbance effect on the steers moved monthly was that they walked and fought more—but only for 1 or 2 days.

Apparently, Hereford steers adjust rapidly to strange pastures and strange associates. Even though they have a well-defined social organization, they seem to adjust readily and seem to be basically contented. Tulloh (1961b) found a significant weighing order in young Hereford cattle, but he suggested the weighing order was not related to social dominance but to another social factor—leadership. He also reported that steers were more docile than heifers. It is possible that cows and bulls would be disturbed more by moving and mixing than were our steers.

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THOMPSON AND GARTNER

Native Forage Response to Clearing Low Quality Ponderosa Pine

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Highlight

Clearing of low quality ponderosa pine in the foothills region of the Black Hills of South Dakota increased forage production 1,500 lb./acre on an east slope and 848 lb./acre on a west slope. Warm season grasses increased to a greater extent than did cool season grasses. If extensive areas were treated in this manner, management changes should be implemented to more efficiently use the increased production of warm season grasses. The increases in forage production plus the use or sale of removed timber should justify clearing low quality pine in this area. Pine reproduction will pose future management problems on cleared areas.

Ponderosa pine (Pinus ponderosa Laws.) stands in the Black Hills and in the drier, surrounding foothills have become strikingly more dense since the beginning of settlement in the 1870's. This change has been verified by comparing photographs taken by early explorers and settlers with current conditions. Before white men arrived, and for several decades thereafter, uncontrolled wildfires periodically swept through the higher hills and foothills. Recurrent fires played a major role in creating and maintaining the numerous open parks supporting rich, green carpets of grass that Colonel

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