Agricultural Gypsum as a Regulator for Self-Feeding Cottonseed Meal to Cattle on the Range

KENNETH A. WAGNON
Specialist, Department of Animal Husbandry, University of California, Davis, California

Salt is widely used in beef-producing areas to regulate feed intake when range supplements are self-fed. Pregnant and lactating cows can ingest excess salt without harm as long as water supplies are adequate (Cardon et al., 1951), but when stock water is in short supply there is danger of deaths occurring from salt poisoning. Thus, other substances, especially slowly soluble ones, appeared to deserve tests as regulators of feed intake.

In February, 1951, agricultural gypsum was suggested as a regulator of feed intake after it had been spread on range as a sulfur fertilizer (Bentley et al., 1958).

In the absence of rain, the gypsum remained upon the vegetation for about a month. Palatability of the forage appeared to be reduced and weight gains were lower than in a comparable group of steers on unfertilized range.

Barrentine and Ruffin (1958) found that both salt and gypsum in cottonseed meal mixtures limited consumption of the feed by beef heifers. Less gypsum was required than salt.

Experimental Procedure

Preliminary studies were made to see if gypsum produced noticeable toxic effects. Feeding mixtures of gypsum (25 and 30 percent) with cottonseed meal (with 33 percent rolled barley in some cases) were fed to a few cows, and later to a group of replacement heifers previously fed a cottonseed meal-salt mixture.

Studies in 1953, 1954, and 1955 each involved three groups of 10 weaner heifers, and in the latter two years 11 or 12 cows (Table 1). The heifers were available each year from about July first, until the fore part of December. Those months included most of the dry season and the initiation of new growth in late fall and early winter. The cows were available through the entire feeding periods. These studies were to compare gypsum with salt as a regulator of supplement intake and to observe the gypsum-fed group for evidence of toxicity.

Attempts were made to maintain supplement consumption at levels that had been shown necessary in previous studies to promote average daily gains of

Table 1. Weight gains of weaner heifers self-fed supplements mixed with salt or agricultural gypsum.

<table>
<thead>
<tr>
<th>Period</th>
<th>Range Supplement</th>
<th>Salt CSM</th>
<th>Gypsum CSM</th>
<th>None</th>
<th>Salt CSM</th>
<th>Gypsum CSM</th>
<th>None</th>
<th>Salt CSM</th>
<th>Gypsum CSM</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-25-531 to 12-1-53</td>
<td>Group No.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>159 days</td>
<td>Number heifers3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Av. initial wt., lbs.</td>
<td>490</td>
<td>404</td>
<td>404</td>
<td>406</td>
<td>406</td>
<td>406</td>
<td>406</td>
<td>406</td>
<td>406</td>
<td>406</td>
</tr>
<tr>
<td>Av. gain or loss, lbs.</td>
<td>+65</td>
<td>+31</td>
<td>-81</td>
<td>+24</td>
<td>+25</td>
<td>-86</td>
<td>+89</td>
<td>+68</td>
<td>-12</td>
<td></td>
</tr>
<tr>
<td>Av. supplements per head daily</td>
<td>Cottonseed meal, lbs.2</td>
<td>1.18</td>
<td>1.12</td>
<td>None</td>
<td>1.15</td>
<td>1.15</td>
<td>None</td>
<td>1.19</td>
<td>1.17</td>
<td>None</td>
</tr>
<tr>
<td>Salt, lbs.</td>
<td>0.37</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>0.37</td>
<td>None</td>
<td>None</td>
<td>0.38</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Gypsum, lbs.</td>
<td>None</td>
<td>0.29</td>
<td>None</td>
<td>None</td>
<td>0.29</td>
<td>None</td>
<td>None</td>
<td>0.33</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>7-7-541 to 12-14-54</td>
<td>160 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-7-551 to 11-3-55</td>
<td>119 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Weaning dates, groups placed in pastures 7-3-53, 7-15-54 and 7-15-55 respectively.
2 Small amount rolled barley included in 1953 and 1954.
3 One extra heifer maintained in each group, in 1955, to be used for periodic 24-hour collections of feces and urine.
0.5 to 0.66 pounds in weaner calves and to maintain breeding cows in a thrifty condition (Wagnon et al., 1959). Cottonseed meal was self-fed on dry range. Following the first fall rain and the start of new growth, the ration was changed to two-thirds cottonseed meal and one-third rolled barley. In 1953 the ranges in which gypsum and salt mixtures were fed were considered uncomparable, but in following years were judged to be comparable.

Weaning weights were used as initial weights of the heifer groups (Table 1) and subsequent weights were taken at about monthly intervals. The cows were weighed at the start and at the close of the feeding period. Except for weaning weights, all weight records were taken following an overnight shrink in dry lot.

These studies were conducted at the San Joaquin Experimental Range, (U. S. Forest Service), O'Neals, California.

**Results**

In the preliminary studies gypsum appeared to effectively regulate daily intake of range supplements. Four cows given a 25 percent gypsum-75 percent cottonseed meal mixture consumed 1.14 pounds of meal and 0.40 pounds of gypsum per head daily over an 81-day period. Four cows that had not been receiving supplemental feed were then added to the group and 200 pounds of a mixture containing 50 percent cottonseed meal, 25 percent rolled barley, and 25 percent gypsum placed in their self-feeder. These eight cows completely consumed this feed within a 2-day period, giving an average daily consumption of 3.12 pounds per head. At least two of the cows added to the group were indisposed for a short time indicating that overeating may occur with gypsum in the mixture as a regulator. Following this heavy use, average daily consumption of the same mixture dropped to 1.39 pounds per head.

With the replacement heifers, gypsum appeared just as effective as salt in regulating feed intake.

**1953 Study**

Again gypsum appeared just as effective as salt in regulating the daily intake of supplements of self-fed weaner heifers.
Feed consumption averaged 1.18 pounds of concentrate and 0.37 pound of salt daily per animal in group I, compared to 1.12 pounds of concentrate and 0.29 pound of gypsum per heifer in group 2 (Table 1). Gypsum use varied from 0.15 to 0.50 pound per head per day against 0.23 to 1.00 pound of salt. No ill-effects were seen in the gypsum group.

1954 Study

This study gave the same favorable results with both heifer and cow groups (Figures 1 and 2). The heifers took 1.15 pounds of the supplemental feed daily. The amount of gypsum taken varied from 0.12 to 0.80 pound per head. Salt consumption varied from 0.21 to 0.67 pound. These cattle gained about 0.16 pound per head per day regardless of which regulator was in their feed. Cows in the F herd, on a range supplement, self-fed, using gypsum as a regulator took 2.19 pounds of the mixture containing 0.98 pound of gypsum per head throughout the 211 day period. Amounts of gypsum taken daily varied from 0.60 to 1.37 pounds per head (Figure 2). There was no evidence of toxicity.

Breeding Group II, self-fed the same supplement but mixed with salt for 140 days, took 2.01 pounds of the concentrate and 0.95 pound of salt per head per day.

1955 Study

Up to November 15 results in this study were similar to those obtained the previous two years. The heifers in group 8 took 1.20 pounds of cottonseed meal and 0.32 pound of gypsum per head daily compared to 1.19 pounds of cottonseed meal and 0.38 pound of salt for group 7. The average total weight gains (119-day period) were 21 pounds greater in the salt-regulated group than in the gypsum-regulated group. This difference was significant at the 5 percent level. Cows in the F herd took 1.90 pounds cottonseed meal and 0.96 pound gypsum per head per day whereas the daily intake in breeding group II was 1.31 pounds of cottonseed meal and 0.69 pound of salt. Thus, in all studies to this point breeding cows required as much or slightly more gypsum than salt as an effective feed regulator but weaner heifers required less gypsum than salt.

Following 1.56 inches rain on the morning of November 14, and a heavy frost that night the self-feeders were charged with a mixture containing 50 percent cottonseed meal, 25 percent rolled barley and 25 percent salt or gypsum (see Figs. 1 and 2).
Group 8 consumed their 200 pounds of feed mix within a 3-day period, but the same amount lasted group 7 for 7 days. This meant an average daily consumption per head of 6.67 pounds (5.00 pounds feed and 1.67 pounds gypsum) for group 8, and 2.60 pounds (1.95 pounds feed and 0.65 pound salt) for group 7. When the self-feeders were recharged with the same quantities of the same mixtures, average daily consumption per head dropped to 1.75 pounds in group 8 and to 1.30 pounds in group 7.

Supplement consumption trends of the breeding herds followed those of the heifer groups. Starting November 15, daily intake of the mixture in the F herd rose to 15.15 pounds per head (11.36 pounds feed and 3.79 pounds gypsum) for a 3-day period. When another mixture with gypsum content increased to 30 percent was placed in the self-feeder, daily consumption dropped to 3.13 pound per head. Coincident with this increase in the F herd, breeding group II increased daily consumption to 7.09 pounds (5.32 pounds feed and 1.77 pounds salt) for the same 3-day period. The two succeeding batches of feed mixtures had salt content increased to 29 and 32 percent, respectively, but daily consumption was 5.31 and 5.21 pounds per head, respectively.

By November 23 some sickness was noted in the F herd. One cow was gaunt, weak, wobbly and constipated and three other cows were affected to a lesser extent. When alfalfa hay was made available, the sick animals showed little interest.

One heifer died in group 8, another was seriously affected and two others became indisposed. The reaction of the group 8 heifers to alfalfa hay was the same as in the F herd.

The feed mixtures containing gypsum were removed from group 8 and the F herd, and alfalfa hay was fed for a few days. Later these groups were self-fed supplements mixed with salt. The two most seriously affected animals were confined and fed alfalfahay and a grain mix free of salt or gypsum. After five days the confined animals were returned to their respective groups. All ill animals, except the heifer most afflicted, quickly returned to normal. This heifer had not returned to what was considered a normal condition two years later, when she was sold. Her coordination remained slightly disorganized, but it was not known if this was a result of her illness or if she had had the affliction earlier and it was not noticed.

Discussion

These results show that gypsum was effective in regulating intake of self-fed supplements under rather severe range conditions but that it was not as efficacious as salt under adverse range conditions. It is not known how soon ill-effects were first manifest after high daily intake of the feed mixtures were reached in 1955. Since there was a marked variation in the degree of affliction of the animals, it appears evident that some animals used the self-feeders more than others.

Previous experience with supplement salt mixtures, during adverse periods like those in 1955, has shown that ill-effects from high salt consumption were only a scouring condition. Here again, not all animals were affected.

In 1957 attempts were made to starve three yearling heifers into consuming enough cottonseed meal mixed with gypsum to reproduce the illness observed on the range in 1955. The animals were fed individually—one over a three-week period and the other two over a four-week period. In addition, a heifer was fed cottonseed meal mixed with salt and another was fed cottonseed meal without either salt or gypsum. None of the animals receiving gypsum became ill, even though gypsum consumption was above 2.00 pounds for a day or more. It was also noted that the heifer fed cottonseed meal mixed with salt ate the mixture each day, whereas those fed the meal mixed with gypsum refused to eat the mixture on some days, even though they were confined to individual stalls for several hours with the feed before them. The heifer on trial over a 22-day period refused the feed mixture six days, and ate less than a pound on seven other days.

Blood analyses for the five heifers before and at the end of the feed period showed no differences in inorganic phosphorus, calcium, magnesium, sodium or potassium content.

Summary

Agricultural gypsum was as effective as salt in regulating the daily intake of supplements self-fed, under range conditions, to weaner heifers and breeding cows until range conditions became very adverse. At that time, daily consumption of the gypsum mixtures rose to excessive levels, resulting in the illness of several animals and the death of one heifer. Gypsum is not considered a satisfactory regulator for the self-feeding of supplements to range cattle.

Literature Cited


