# Comparison of Supplementation Methods for Cow Herds Grazing Pine-Bluestem Range[1]

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## Highlight

**Range cows furnished cottonseed cake on alternate days in winter weighed more and had higher calving percentages than cows fed daily. Calf weights at weaning were similar. Cost of distributing cake every other day was almost 40% less than for the daily schedule. Cows self-fed cottonseed meal adulterated with salt weighed as much as those fed cake daily, but both calf crop and weaning weight averaged less than for daily or alternate-day feeding. Although expense of distributing supplement was least with self-feeding, cost-return relationship was unfavorable compared to other methods.**

From late fall until spring, herbage on southern pine-bluestem range furnishes far less protein than breeding cattle need (Duncan and Epps, 1958). This deficit seriously impairs production, unless supplemental protein is supplied in large quantity (Cassady and Whitaker, 1957; Duvall and Whitaker, 1963).

Several cottonseed cake rations compared in Louisiana remedied the protein deficiency (Duvall and Hansard, 1967), and the minimal feeding level consistent with satisfactory performance proved generally conducive to profitable production (Halls and Duvall, 1961). Cost of distributing the supplement appeared unnecessarily high, however, as cattle had been hand-fed daily during winter. Dispensing cake by easier means might have sufficed and reduced expense considerably, but this possibility was not explored until quantity and feeding-period requirements were defined. Otherwise, experimental designs would have been unduly complex.

A study was subsequently initiated to evaluate two feeding methods designed to minimize distribution costs. In one method, cows were fed on alternate days during winter; in the second, consumption of supplement was controlled by adulteration with salt. Cows fed daily during winter comprised the control. This paper describes responses of cattle to treatments. Quantity furnished and feeding period were the same for all herds.

## Procedure

The experiment was conducted from August 1963 until November 1967 on the Palustris Experimental Forest in

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central Louisiana. The study area consisted of three fenced range units—two of 570 acres each and one of 480 acres.

Overstory varied from sparse second-growth longleaf pine to fully stocked stands of splash pine from 1 to 3 years old. Understory vegetation was similar for all units. Herbage average about 1600 lb/acre (air-dry); bluestems (*Andropogon* spp.) and panicums (*Panicum* spp.) were the main grasses (Duvall and Linnartz, 1967).

Before the study started, part of each range unit had been burned each year in either a 3- or 4-year rotation (Duvall and Whitaker, 1964). Burning was suspended during the first 2 years, when young pines were susceptible to damage. By early 1966, the oldest slash pines were large enough to tolerate prescribed fire, and burning was resumed in a 4-year rotation.

All units were grazed moderately. The utilization objective was 40 to 45% of current herbage; 23 acres were allowed per adult animal-year. Thus, the 570-acre units were stocked with 24 cows each and the 480-acre unit with 20 cows. Each unit also provided 131 days of grazing per year for a bull.

Cows were typical "native" stock. About 70% showed evidence of Brahman breeding. The remainder were mainly mixtures of British beef breeds and Jersey. In August 1963 cows were assigned to range units as equitably as possible according to age, size, and breeding. Each year, they were mated to either purebred Angus or Shorthorn bulls between February 20 and July 1. Calves, dropped from about December 1 to April 10, were marketed directly off the cows in mid-August.

In November 1964 and annually thereafter, non-pregnant cows that had not calved the previous year were culled. Cows with serious physical defects were removed as detected. Two cows died during the study. Replacements of breeding age were introduced as needed.

In each unit, steamed bonemeal and loose salt were supplied continuously in separate compartments of a covered feeder. The bonemeal was furnished for its phosphorus content (10%), as forage analyses had revealed a deficiency of this nutrient at all seasons (Campbell et al., 1954; Duncan and Epps, 1958). Supplies of salt and bonemeal, weighed oven-dry, were dispensed weekly. Each time, remainders were collected, oven-dried, and weighed. To calculate consumption, quantities recovered were subtracted from those dispensed.

In all units, each cow was allotted 418 lb of either cottonseed cake or cottonseed meal (41% crude protein) annually, fed between November 1 and May 31. Average daily intake of cake or meal was as follows:

| Period | Cottonseed meal or cake per cow-day (lb) |
|---|---|
| November 1–30 | 1.0 |
| December 1–31 | 2.5 |
| January 1–March 10 | 3.0 |
| March 11–31 | 2.0 |
| April 1–May 31 | 1.0 |

Previous study on the Palustris had shown that cattle fed cottonseed cake daily grazed little during cold, wet periods. In the current trial, therefore, supplemental forage augmented the range diet during late winter. About 6 lb of grass hay were furnished each cow on alternate days from mid-January to late March. Annual allowance totaled about 200 lb/head.

Treatments consisted of methods and frequencies of dispensing cottonseed cake or meal. The control was designated as daily feeding because cows were hand-fed cottonseed cake each day during the critical winter period, from December 1 through March 31. They were fed on alternate days during November, April, and May. The schedule, outlined below, was similar to that for the medium treatment described by Duvall and Hansard (1967), but with feeding during October omitted.

| Period | Feeding frequency (days) | Cottonseed cake per cow per feeding (lb) |
|---|---|---|
| November 1–30 | 2 | 2.0 |
| December 1–31 | 1 | 2.5 |
| January 1–March 10 | 1 | 3.0 |
| March 11–31 | 1 | 2.0 |
| April 1–May 31 | 2 | 2.0 |

In the alternate-day feeding treatment, cottonseed cake was distributed every other day from December 1 through March 10 and every third day during November and from March 11 through May 31. Intervals between feedings were 1 day longer than for the control during all periods except March 11 through 31, when 2 days were added. Frequency was decreased on March 11; by that date in prior studies green herbage had usually been available in limited quantity. The alternate-day schedule was as follows:

| Period | Feeding frequency (days) | Cottonseed cake per cow per feeding (lb) |
|---|---|---|
| November 1–30 | 3 | 3 |
| December 1–31 | 2 | 5 |
| January 1–March 10 | 2 | 6 |
| March 11–31 | 3 | 6 |
| April 1–May 31 | 3 | 3 |

In a preliminary test, cows rapidly ate 6 lb of cottonseed cake per head. Protecting the feed from rain was therefore unnecessary. Consequently, both daily and alternate-day feeding were in open troughs; space was sufficient for all cows to eat simultaneously.

For salt-meal self-feeding a mixture of cottonseed meal and finely ground salt was provided continuously. Daily consumption of meal was maintained at approximately the prescribed level by manipulating proportions of ingredients (Table 1).

Riggs et al. (1953) found that cows ate less and less mixed feed as salt content was increased gradually from 9 to 14%; at 15%, intake decreased sharply. In the Southwest, this principle has been employed successfully to govern intake of concentrates self-fed to cattle, thereby minimizing labor and transportation for distributing feed (Nelson et al., 1954; Pistor et al., 1950; Savage and McIlvain, 1954). Self-feeding of salt-concentrate mixtures has also been adopted to some extent for breeding herds on southern forest range; results, according to stockmen, vary from excellent to unsatisfactory.

Salt-meal was fed in roofed bunks to protect the mixture from rain. About 60% of the cows could eat at a time, as Savage and McIlvain (1954) had questioned the adequacy of bunks accommodating only half of the herd. A mixture of 1 part salt to 3 parts meal (by weight), calculated to last for 2 or 3 days, was placed in bunks each year on November 1. After initial rate of consumption was determined, the mixture was adjusted until meal intake averaged about 1 lb/cow-day. Thereafter the supply was replenished every 5 days, or when change in proportion of salt was necessary

Table 1. Salt-meal ratios required to maintain meal intake at prescribed levels.

| Month | Dates | Meal | Salt (lb/cow-day) 1963–64 | 1964–65 | 1965–66 | 1966–67 |
|---|---|---|---|---|---|---|
| November | 1–2 | 1.0 | 0.33 | 0.33 | 0.33 | 0.33 |
| | 3–7 | 1.0 | 0.25 | 0.33 | 0.50 | 0.50 |
| | 8–10 | 1.0 | 0.25 | 0.33 | 0.75 | 0.50 |
| | 11–14 | 1.0 | 0.25 | 0.50 | 0.75 | 0.50 |
| | 15 | 1.0 | 0.33 | 0.50 | 0.75 | 0.50 |
| | 16–30 | 1.0 | 0.33 | 0.75 | 1.00 | 0.50 |
| December | 1–5 | 2.5 | 0.33 | 0.75 | 1.00 | 0.75 |
| | 6–9 | 2.5 | 0.50 | 0.75 | 1.00 | 0.75 |
| | 10–15 | 2.5 | 0.50 | 0.90 | 1.00 | 0.75 |
| | 16–22 | 2.5 | 0.50 | 1.00 | 1.12 | 0.75 |
| | 23–27 | 2.5 | 0.75 | 1.00 | 1.12 | 0.75 |
| | 28–31 | 2.5 | 1.00 | 1.00 | 1.12 | 0.75 |
| January | 1–4 | 3.0 | 1.00 | 1.25 | 1.12 | 1.00 |
| | 5–26 | 3.0 | 1.00 | 1.25 | 1.25 | 1.00 |
| | 27–31 | 3.0 | 1.00 | 1.25 | 1.12 | 1.00 |
| February | 1–15 | 3.0 | 1.00 | 1.25 | 1.12 | 1.00 |
| | 16–28(29) | 3.0 | 1.00 | 1.25 | 1.25 | 1.00 |
| March | 1–10 | 3.0 | 1.00 | 1.25 | 1.25 | 0.75 |
| | 11–15 | 2.0 | 1.00 | 1.25 | 1.00 | 0.50 |
| | 16–19 | 2.0 | 0.75 | 1.25 | 1.00 | 0.50 |
| | 20–25 | 2.0 | 0.75 | 1.25 | 1.00 | 0.25 |
| | 26–31 | 2.0 | 0.50 | 1.25 | 1.00 | 0.25 |
| April | 1–30 | 1.0 | 0.50 | 0.75 | 0.50 | 0.25 |
| May | 1–4 | 1.0 | 0.50 | 0.75 | 0.50 | 0.25 |
| | 5–31 | 1.0 | 0.50 | 0.75 | 0.25 | 0.25 |

to attain prescribed intake. Cattle fed a high-salt diet drink considerably more than those eating salt voluntarily (Savage and McIlvain, 1954); therefore, bunks were located no more than ⅛ mile from water so the cattle would not have far to travel.

Each year, only cows in the herds from November through August were considered as experimental animals. Replacements were occasionally introduced during these periods; thus, size of treatment groups varied by years, but grazing intensity remained about constant.

Herds were checked daily from late fall until spring to ascertain calving dates. Each year, calves were weighed about 30 days after calving and immediately before marketing. Annual calf drop for each treatment was the percent of experimental cows that weaned calves.

In 1963–64, cows were weighed directly off the range in November, April, and August. Annually thereafter, weighing began in November and was repeated approximately every 3 months. The salt-meal mixture was withheld for 5 days before each weighing during the feeding period, and prescribed quantities of meal were provided daily in open troughs. Self-feeding was interrupted to make water intake normal and thereby avoid exaggeration of body weights.

## Results and Discussion

### Consumption of Supplements

Protein supplements were evidently eaten almost exclusively by adult animals. Competition among cows largely denied calves access to cake. The salt-meal was apparently unpalatable to calves; by late winter many were large enough to reach the supply, but none were observed eating.

Table 2. Average consumption of salt (lb/cow) from salt-meal mixture.

| Month | 1963–64 | 1964–65 | 1965–66 | 1966–67 | Average |
|---|---|---|---|---|---|
| November | 8.9 | 17.0 | 24.2 | 14.7 | 16.2 |
| December | 17.9 | 28.2 | 32.9 | 23.2 | 25.6 |
| January | 31.0 | 38.8 | 37.6 | 31.0 | 34.6 |
| February | 29.0 | 35.0 | 33.0 | 28.0 | 31.2 |
| March | 25.5 | 38.8 | 33.5 | 15.0 | 28.2 |
| April | 15.0 | 22.5 | 15.0 | 7.5 | 15.0 |
| May | 15.5 | 23.2 | 8.8 | 7.8 | 13.8 |
| Total | 142.8 | 203.6 | 185.0 | 127.2 | 164.6 |

Throughout the study, average daily intake of cake per cow was as prescribed. Consumption of meal periodically deviated from schedule until the mixture was adjusted, but quantity consumed per cow-year averaged the same as for cake—418 lb. Salt-meal ratios necessary to maintain intake at approximately the prescribed levels are shown in Table 1.

Salt consumed from the self-fed ration averaged almost 165 lb/cow annually but varied from about 127 lb in 1966–67 to 204 lb in 1964–65 (Table 2). Intake fluctuated most in fall and spring, least in midwinter. Availability of green herbage was apparently the main factor influencing quantity consumed after early March. In 1967, for example, the last frost was on February 23, and shortly afterward grass began growing rapidly. Salt content necessary to regulate intake of meal was consequently less than in previous years, when growth had started considerably later and cattle ate less salt. In 1965, temperature consistently exceeded 40 F only after May 1. With growth of grasses delayed, a high proportion of salt was necessary until feeding ended; hence, intake from March through May totaled more than in other years. Salt consumption for November averaged considerably less the first year than afterward, probably because cows were unaccustomed to a high-salt ration.

Calves were observed eating salt and bonemeal supplied ad lib., mainly from early summer until weaning. Quantity consumed, though indeterminable, was probably small compared to that eaten by cows. Therefore, intake of these supplements was attributed entirely to adult animals.

Consumption of salt supplied ad lib. averaged 15 lb/cow-year for the salt-meal treatment, as compared to 26 lb for hand-feeding. From both this source and the salt-meal mixture, therefore, self-fed cows each ingested about 180 lb/year. The total would have possibly been greater if meal hand-feeding had not replaced salt-meal self-feeding for 10 to 15 days annually.

Bonemeal intake averaged 27 and 29 lb/adult

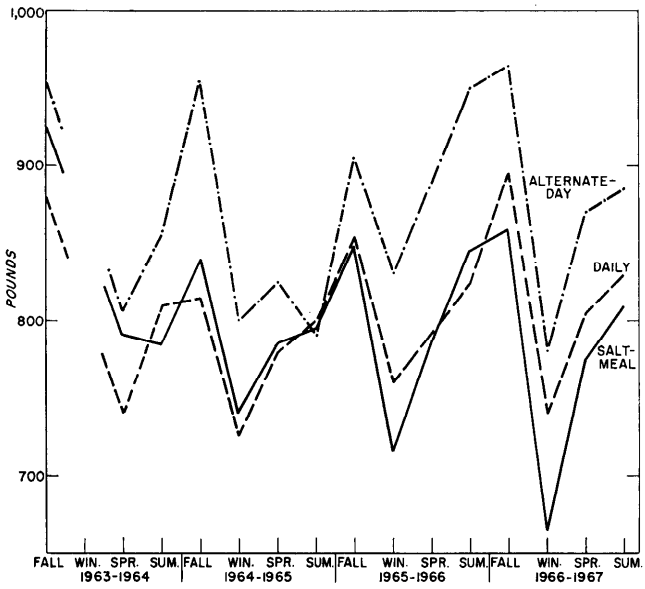


FIG. 1. Average weights of cows, by treatments, years, and seasons.

animal-year for salt-meal and alternate-day treatments. Cattle fed daily ate quantities similar to those for other treatments during the first 2 years but less thereafter; consequently, consumption averaged only 22 lb annually.

### Weight and Condition of Cows

Initially, cows assigned the salt-meal ration were slightly heavier than others. Before feeding began, however, cows designated for alternate-day feeding gained the most; those for daily feeding, the least. In November, weights averaged 953, 924, and 879 lb/cow for the alternate-day, salt-meal, and daily-fed groups, respectively (Fig. 1).

After treatments were applied, cows fed on alternate days averaged heavier than others at all periods except summer 1965. For the entire study, weights were 870, 803, and 798 lb for alternate-day, daily, and salt-meal feeding, respectively. Weight advantage in winter and spring for cows fed on alternate days was possibly attributable to greater intake of forage; they spent far less time than others on feedgrounds and presumably grazed more. Similar findings were reported in Texas (Melton and Riggs, 1964).

Winter weights of cows fed salt-meal declined steadily after 1964–65; whether method of feeding was responsible is problematical, since treatment was discontinued annually from June to November.

No digestive disturbance was noted among cattle fed on alternate days, although cake consumption averaged 6 lb/cow per feeding from January 1 through March 31. In a Texas study (Melton and Riggs, 1964), cows ate 7 lb/feeding without harmful effects.

Scours were common during the feeding season among cows receiving the salt-meal mixture. Most of the animals scoured for 3 or 4 days at least once per season, but no serious cases were observed. Riggs et al. (1953) concluded that self-feeding salt-meal may cause scouring and eventual death when salt intake is 1 to 1.5 lb/cow daily and forage quality is relatively low. However, Nelson et al. (1954) observed no detrimental effect of salt on health or weight of cows that ate 1.14 lb/day while grazing bluestem range in Oklahoma.

As compared to cows in other treatments, those fed salt-meal became noticeably paunchy during the feeding period, particularly from January until mid-March. Also, these cows generally had longer, rougher hair than others during winter. Both conditions were possibly responses to abnormally high intake of water, which was usually quite cold. Loss of hair from one or more areas measuring about 4 to 6 inches in diameter on the upper body was common during winter among cows showing strong evidence of British beef breeding; Brahman crosses, with shorter coats, were not noticeably affected. Riggs et al. (1953) mentioned, but did not describe, differences in condition of hair between cows fed high and low levels of salt.

Two cows died in the self-fed herd as compared to none in the other herds. Both died during winter, but whether salt toxicity was responsible is problematical. No autopsies were performed, because deaths had apparently preceded discovery of carcasses by 12 hours or more.

### Calf Production

Calf crops averaged highest for cows fed on alternate days and lowest for those self-fed the salt-meal (Table 3). Thus, as compared to daily feeding, distributing supplement at 2- to 3-day intervals did not impair reproduction. It possibly improved nutrition sufficiently during winter to increase calving percentage. The alternate-day schedule apparently stimulated grazing and improved opportunity for timid cows to obtain cake. Effects of feeding interval on calving were similar to those reported from western Texas, where calf crops averaged slightly greater for cows fed 3 times weekly than for those fed daily (Melton and Riggs, 1964).

Treatment evidently affected conception rate little. The low percentage of calf crop weaned by cows fed salt-meal was attributable to prenatal and neonatal mortality. In 1963–64, two calves in the salt-meal treatment died either before birth or shortly afterward. No such loss occurred in the other herds. During the final 3 years, when treatment influences on calf production were assessed, 10 pregnancies terminated in calf deaths: one in 1964–65, four in 1965–66, and five in 1966–67. Two cows aborted in late summer. Five calves that had apparently been carried full term were either born dead or died shortly after birth. Three calves,

**Table 3. Calf crops and weights and ages of calves, by treatments and years.**

| Treatment | Year | Calf crop weaned % | Spring weighing | | | Weaning | | | Daily gain, spring to weaning |
|---|---|---|---|---|---|---|---|---|---|
| | | | Weight lb | Age days | Weight per day of age lb | Weight lb | Age days | Weight per day of age lb | |
| Daily | 1964–65 | 73 | 271 | 145 | 1.9 | 409 | 230 | 1.8 | 1.6 |
| | 1965–66 | 63 | 289 | 135 | 2.1 | 437 | 228 | 1.9 | 1.6 |
| | 1966–67 | 75 | 230 | 110 | 2.1 | 411 | 218 | 1.9 | 1.7 |
| | Average | 70 | 263 | 130 | 2.0 | 419 | 225 | 1.9 | 1.6 |
| Alternate day | 1964–65 | 96 | 283 | 139 | 2.0 | 409 | 228 | 1.8 | 1.4 |
| | 1965–66 | 43 | 251 | 108 | 2.3 | 405 | 201 | 2.0 | 1.7 |
| | 1966–67 | 95 | 262 | 116 | 2.3 | 452 | 224 | 2.0 | 1.8 |
| | Average | 78 | 265 | 121 | 2.2 | 422 | 218 | 1.9 | 1.6 |
| Salt-meal | 1964–65 | 70 | 140 | 128 | 1.1 | 384 | 213 | 1.8 | 2.9 |
| | 1965–66 | 45 | 221 | 127 | 1.7 | 363 | 220 | 1.6 | 1.5 |
| | 1966–67 | 63 | 261 | 131 | 2.0 | 427 | 238 | 1.8 | 1.5 |
| | Average | 59 | 207 | 129 | 1.6 | 391 | 224 | 1.7 | 1.9 |

born alive and evidently healthy, disappeared within 2 days and carcasses were not found. If all pregnancies among cows fed salt-meal had resulted in weaned calves, calf crops would have averaged 76%.

All cows diagnosed as pregnant among those fed on alternate days weaned calves. In 1964–65, a calf in the herd fed daily died either before birth or soon afterward.

The reason for the high incidence of calf mortality associated with salt-meal feeding is uncertain. In Arizona trials (Pistor et al., 1950; Cardon et al., 1951), cows that ingested 1 lb of salt daily during the final 2 to 3 months of gestation calved normally and both cows and calves appeared healthy. On an Oklahoma range (Nelson et al., 1954), calf crops were similar for cows self-fed salt-meal and those hand-fed cottonseed meal pellets on alternate days. Riggs et al. (1953) reported that two cows fed high levels of salt during gestation calved normally, but one calf developed severe diarrhea and died when 5 days old. Postmortem examination revealed no symptoms of salt toxicity. In a companion trial, normal parturition and healthy calves were reported for cows on a high-salt ration during 191 days; salt intake ranged from 1.6 to 2.0 lb/head daily for 79 days. In view of these findings, probability appears low that calf mortality in the present experiment was attributable solely to the large quantity of salt ingested by cows. However, high-salt supplement may have interacted with another dietary factor—possibly low nutritive value of range forage—to impair production.

All breeding animals were brucellosis-free when the study ended. Cull cows, tested when removed, also reacted negatively.

Calf crops varied considerably by years, primarily because percentages were low for all treatments in 1965–66. No reason for this difference was apparent.

Weaning weights for daily and alternate-day treatments were similar, averaging 419 and 422 lb/calf (Table 3). Cows self-fed salt-meal weaned calves weighing about 28 lb less than those of hand-fed cows. Average age at weaning varied only 6 days among treatments; therefore, calf weight per day of age at weaning was lowest for self-feeding.

Calf weight per day of age in the spring, when the youngest calves were about 30 days old, was consistently lowest for salt-meal feeding. Thus, calves in this herd either weighed less than others at birth or gained less while their dams were eating the salt-meal. Gain from spring weighing until weaning was greatest for the salt-meal treatments, but only because calves dropped during 1964–65 averaged merely 1.1 lb per day of age in the spring and gained 2.9 lb daily afterward. In subsequent years, gains from spring until weaning were less for calves in the self-fed herd than for those in other treatments.

### Feed Distribution Costs

Days per year on which cottonseed cake or meal was distributed totaled 165 for daily feeding, 92 for alternate-day feeding, and 47 for self-feeding. The latter included 4 days to determine intake rate and adjust the mixture.

Transportation and labor requirements per distribution were only slightly greater for alternate-day than for daily feeding. Thus, cost for alternate-day distribution was estimated at 57 to 60% of that for daily. Although self-feeding required only 51% as many distribution days as alternate-day, the overall cost advantage was materially less than this relationship indicates. Self-fed cattle annually consumed about 154 lb more salt per head

than those hand-fed. This not only increased cost of the ration but added about 27%, by weight, of materials requiring storage and handling. Mixing the salt and meal was also chargeable to self-feeding but cost could vary considerably, depending on facilities available and quantities prepared. Covered bunks for salt-meal cost more than open troughs for cake, but this difference could normally be prorated over several years and would add relatively little to annual expense.

### Conclusions

As compared to daily feeding, the alternate-day program saved 40% or slightly more in distribution costs, without detriment to cows or calves. In fact, this schedule may have favorably affected both calf crop and condition of the cows. Although cost was least for salt-meal feeding, the saving was insufficient to compensate for the low production of cows fed by this method. Thus where range conditions, kind and quantity of supplement fed, and feeding period are similar to those of the experiment, alternate-day distribution provides an effective means of augmenting the range diet during winter. Adulterating cottonseed meal with salt to regulate intake during winter is inadvisable until the cause of low reproductive success that attended this procedure is identified and corrected.

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## Short Duration or Non-Selective Grazing

Stock raiser E. M. Rushmore of Bulawayo, Rhodesia, has been chiding ASRM and the Journal for not publishing new deveolpments on "short duration grazing." A manuscript by Dr. C. A. R. Savory, Ecological Consultant in Bulawayo, credits A. Voisin's book on *Grass Productivity* (1961) with advancing a system of short-term grazing interspersed with long rests on intensively managed pastures. He further credits Howell and Acocks with development of a similar system on short grass ranges in South Africa—known as Non-Selective Grazing.

In Rhodesia, Dr. Savory reports that over 150 ranches and farms are using "short duration grazing," with planned variations, but with a central theme of short graze, long rest, no burning, no initial bush clearing, and increased stocking combined where necessary with wildlife management. The system also involves rotation to avoid overgrazing any one paddock.

Dr. Gene Payne, now at Egerton College in Kenya, writes: ". . . when grazing is intensified within a short period, more species of plants are used and the less palatable species are more heavily used . . . . This means a greater conversion per acre of energy into animal products." Writing in the Kenya *Weekly News*, Payne and Sid Goodloe warn that misuse of the system could lead to range deterioration. Larry White, now at Embu, Kenya states that he thinks the method warrants research under different kinds of environment. In brief, Gene Payne thinks we in America have been lax in studying the many possibilities in grazing systems, mostly because of the cost and long time involved in this kind of research. He adds: "Nor are we as aware of what is developing in range management outside the USA as we should be."

The Journal could use one or more brief, authoritative, factual articles reporting research or experience with Short Duration or Non-Selective Grazing.—*Robert S. Campbell.*