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Self-Feeding Salt and Cottonseed Meal to Beef Cattle

A Summary of Experiments On Self-Feeding Winter Supplements

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The Story in Brief . . . .

Self-feeding a mixture of salt and cottonseed meal as a supplement to native grass for beef cattle during the winter months has become popular with some farmers and ranchers. Does the consumption of excessive amounts of salt, used to regulate consumption of cottonseed meal under this feeding method, adversely affect the health of cattle?

To find the answer to this question, two, three-year studies were conducted which compared self-feeding salt and cottonseed meal mixtures and hand feeding cottonseed meal to beef cattle.
In these trials:

Beef steers were self-fed a salt-cottonseed meal mixture during the winter months with no apparent effect on their winter weight change. When no costs other than feed were considered, the return per steer was in favor of hand-feeding supplements.

Beef cows were self-fed a mixture of salt and cottonseed meal during the winter months while grazing native grass pastures with no apparent detrimental effect on the health or yearly weight changes of the cows or the number and weaning weight of their calves. Thus, for three successive years, no harmful effects were noted from this feeding practice when ample grass and water were available.

CONTENTS

Self-Feeding Salt and Cottonseed Meal to Beef Cattle

By A. B. Nelson, L. S. Pope, Robert MacVicar, A. E. Darlow, and D. F. Stephens*

Self-feeding a mixture of cottonseed meal and salt as a supplement to native grass for beef cattle during the winter months has become popular with some farmers and ranchers. The salt is added to control consumption of cottonseed meal (or other supplemental feed). Self-feeding such mixtures results in salt being consumed in amounts as great as one pound per head daily. Whether such large quantities of salt adversely affect the health of cattle when fed for several successive winters is not known.

Apparently self-feeding salt and protein supplement mixtures was first practiced by range sheepmen in West Texas during the drouth years of 1934 and 1935. The results were disastrous when ample vegetation was not available. In recent years, cattlemen have shown increased interest in this method of supplemental feeding. Advantages of the system include saving of labor and more uniform consumption of supplement (timid animals get their share and greedy cattle eat less). Also, more uniform distribution of grazing has been demonstrated where feeders have been properly located throughout the pasture. Less feeder space is required for self-feeding, although feeder cost may be increased because of the desirability of a covered feeder. Another advantage is the convenience of feeding in the "rougher" areas where cattle cannot be easily gathered together.

As in many other management practices, some limitations exist. Forced consumption of large amounts of salt may result in a toxicity, especially when ample water and roughage are not available. Other considerations are cost of salt, increased shrink to market, and scouring of cattle. Also, in cow herds in which close observation at calving time is desirable, hand-feeding at a particular place and time may be a preferred management practice.

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The percentage of salt necessary to regulate consumption of cottonseed meal apparently depends on such factors as age, weight, and condition of the cattle, quantity and quality of forage available, and availability and chemical composition of the water supply.

Since 1950, the Oklahoma Agricultural Experiment Station has conducted a series of tests with both pregnant cows and stocker cattle to determine the merit of self-feeding a mixture of salt and cottonseed meal to beef cattle.

THE FEEDING TRIALS

Experiment I—Wintering Steers on Native Grass Pasture

Three wintering trials with yearling and two-year-old steers were conducted at the Ft. Reno Experiment Station, from 1950-51 through 1952-53, to compare hand-feeding cottonseed meal vs. self-feeding the protein supplement as a salt-meal mixture.

Procedure

The wintering test covered an average of 131 days. The steers grazed dry, native grass pastures in which buffalo, side oats grama, and blue grama were the predominant species. Approximately 8 acres of native grass were allowed per steer and this area provided ample winter grazing. The steers were rotated frequently among pastures to reduce the effect of possible differences in forage available.

In each trial, choice Hereford steers were allotted into two groups of 18 or 20 head each on the basis of body weight and grade. Initial and final weights were taken following an overnight shrink in drylot. The age of the steers varied, with long yearlings used in the second trial, and two-year-olds in the first and third trials.

Lot 1 steers were hand-fed an average of 2.2 pounds of cottonseed meal per head daily. Steers of Lot 2 received approximately the same amount of protein supplement self-fed in a salt-meal mixture. A large, movable self-feeder with a tight roof and a wide overhang to the open side to protect the mixture from the weather was used for the salt-meal mixture. Salt was available to the steers hand-fed cottonseed meal.

The steers of Lot 1 were hand-fed the protein supplement on alternate days, twice the daily allowance, as is commonly practiced on the range. The amount of salt in the mixture self-fed to Lot 2 was approximately 10 percent at the beginning of the test period, and was increased

to about 30 percent during the first 20 days. It was necessary to make frequent adjustments in the ratio of salt to meal during the winter to control consumption, depending on pasture conditions. Once the amount of salt necessary to control consumption at the desired level was attained, sufficient salt-meal mixture to last about a week was placed in the self-feeder.

The tests were completed about March 20 each year, since some green feed was beginning to appear in the pastures at that time. The steers were appraised by a committee of representatives from the Oklahoma City stock yards upon completion of each test.

Results

Weight data, feed costs, and financial returns are shown in Table 1. Composition of feeds and grass samples are summarized in Table 2.

Table 1.—Hand-feeding Cottonseed Meal vs. Self-Feeding a Salt-meal Mixture to Yearling and Two-year-old Steers Wintering on Native Grass (3-year average).

	Lot 1 Cottonseed meal; hand-fed	Lot 2 Cottonseed meal-salt mixture; self-fed
Total number of steers per lot[1]	58	57
Average weights, lbs.		
Initial, November 9	889	889
Final, March 20	882	880
Total gain	- - 7	- - 9
Average daily winter supplement, lbs.		
Cottonseed meal[2]	2.17	2.28
Salt[3]	.04	.72
Cost of winter feed per steer, dollars[4]		
Cottonseed meal	12.33	12.89
Salt	.04	.66
Native grass pasture	5.08	5.08
Total	17.45	18.63
Financial results per steer, dollars		
Initial cost @ 27.46 per cwt.	244.11	244.11
Total cost (steer + feed)	261.56	262.74
Appraised value per cwt. at end of trial	28.08	27.92
Total value per steer	247.67	245.70
Net return per steer for winter phase	— 13.89	— 17.04
Overnight shrink in drylot at completion of test, percent	5.6	6.1

[1] Two-year-old steers were used in the 1950-51 and 1952-53 trials; yearlings in the 1951-52 trial. Twenty steers per lot in each year, except only 18 steers in Lot 1 and 17 steers in Lot 2 during the 1951-52 trial.
[2] Hand-fed every other day in Lot 1, and self-fed as salt-meal in Lot 2.
[3] Available free-choice in Lot 1, and self-fed as salt-meal in Lot 2.
[4] Average feed costs per ton were: Cottonseed meal, $87.83; and salt, $14.53.

Table 2.—Average Chemical Composition of Feeds and Grasses in Wintering Study with Steers (Ft. Reno, 1950-53).

	Percent dry matter	Percentage composition of dry matter					
		Ash	Crude protein	Ether extract	Crude fiber	N-free extract	Ca	P
Cottonseed Meal	92.6	7.0	44.0	6.3	11.0	31.7	.22	1.10
Pasture Grass*								
November		10.0	5.4	1.9	31.4	51.3	.34	.08
December		8.9	5.0	1.6	32.4	52.1	.32	.08
January**		10.1	4.2	1.1	32.1	52.5	.32	.07
February		9.8	3.9	1.6	31.4	53.3	.31	.07

* Average by species, of the three predominant grasses: buffalo, side oats grama, and blue grama.
** 1950-51 season only.

The method of feeding cottonseed meal had no apparent effect on the winter weight loss of steers in these trials. The steers of Lot 2, self-fed the salt-meal mixture, lost 9 pounds and those hand-fed cottonseed meal lost 7 pounds per head. The Lot 2 steers were appraised at $.50 per hundredweight less than those hand-fed the cottonseed meal in one test; in other trials, the appraised value at the completion of the test was the same for both lots.

The additional cost of salt consumed by Lot 2 steers increased the winter feed cost by $.62 per head over Lot 1. Considering the slight difference in weight loss, extra cost of salt, and the slightly lower average appraised value of the salt-fed steers over the three-year period, there was a greater financial loss of $3.15 per head for the salt-meal steers as compared to the hand-fed cattle.

In this three-year study, it was necessary to maintain an average of 24 percent salt in the salt-meal mixture to maintain the desired intake of about 2.2 lbs. of cottonseed meal per head daily. Lot 2 steers consumed an average of 0.72 lbs. salt per head daily during the winter period. This is slightly less salt than has been found necessary to control consumption with cows; however, the trials with steers were conducted in an area having more palatable grasses, and water higher in total solids, particularly sulfates. Such factors may influence the amount of salt necessary to achieve a desired protein consumption.

Experiment II—Wintering Pregnant Beef Cows

Three successive trials were conducted from 1950 through 1953 at the experimental range unit near Lake Carl Blackwell, west of Stillwater, to compare hand-feeding pelleted cottonseed meal with self-feeding a

mixture of salt and cottonseed meal to pregnant beef cows during the winter months.

The predominant grasses in the experimental range pastures are big and little bluestem, switch, and Indian grass. Some areas in each of the pastures have considerable buffalo and grama grass.

Procedure

In October, 1950, 37 grade Hereford cows, averaging six years of age, were divided into two lots (18 in Lot 1 and 19 in Lot 2) on the basis of weight, age, and the average weaning weight of the calves produced in previous years. In 1951, the number of cows per lot was increased to 25 by the addition of cows of similar size, age, and breeding. In 1952, some of the older cows were removed and young replacements added.

Many of the cows were fed the same ration for three successive winters, in order to study the effect of repeated winter intake of large amounts of salt. Purebred Hereford bulls were placed in the pastures with the cows on May 1 and removed on about August 15 of each year. With such a program, nearly all of the calves were born in February, March, and April. The bulls were rotated among the pastures to minimize sire effects.

The cattle were allowed to graze the native grass pastures year-long at a rate of approximately 10 acres per cow. During the winter season, the cows consumed an average of about 2.5 pounds of either 41 percent protein cottonseed meal or pelleted cottonseed meal per day. The cows in Lot 1 were hand-fed pelleted cottonseed meal every other day and those in Lot 2 had access to a self-feeder containing a mixture of salt and cottonseed meal.

During the first trial, both groups of cattle had access to a mineral mixture containing one part salt, one part steamed bone meal, and one part ground limestone. During the two remaining trials, a mineral mixture containing two parts salt and one part steamed bone meal was available to both groups of cows during the summer and to the cows of Lot 1 during the winter. During the winters of these two trials, steamed bone meal was included in the mixture self-fed to the cows of Lot 2 in quantities sufficient to equal the phosphorus intake of the cows in Lot 1.

The cows were weighed at approximately monthly intervals, and blood samples were collected at intervals throughout the winter feeding period. Blood samples were also collected from the calves twice dur-

ing early life. These samples were analyzed for plasma chloride, sodium, and potassium. During the first two trials, milk samples were analyzed for chloride, sodium, and potassium content during early lactation while the cows were consuming large amounts of salt.

The level of salt in the mixture was increased gradually during the first weeks of supplemental feeding. At the end of this time the mixture was one-third salt. The average salt content of the mixture for the entire feeding period during the three years was 30 percent. During mild weather, especially in February and March, 1952, the salt content of the mixture was reduced to approximately 25 percent in order to obtain the desired consumption of cottonseed meal (approximately 2.5 pounds).

The chemical composition of samples of forages collected at intervals throughout the year and of the cottonseed meal and cottonseed meal pellets fed are given in Table 3.

Table 3.—Average Chemical Composition of Supplements and Grasses in Study with Cows (Lake Blackwell, 1950-53).

	Percent dry matter	Average composition of dry matter						
		Ash	Crude protein	Ether extract	Crude fiber	N-free extract	Ca	P
Cottonseed meal pellets	94.5	6.7	43.2	5.6	10.5	34.0	.19	.90
Cottonseed meal	94.0	6.7	42.7	6.6	10.4	33.6	.18	.94
Native grass*								
October		6.8	3.9	2.2	35.4	51.7	.35	.05
January		5.9	2.6	1.6	40.9	49.0	.31	.04
June		7.3	12.0	2.6	27.2	50.9	.30	.16
August		6.6	6.7	2.6	32.6	51.5	.23	.06

* Average, by species, of the four predominant grasses: big bluestem, little bluestem, switch, and Indian.

Results

Table 4 shows average weight changes, feed consumption, feed costs, and calving data. The average loss in weight from the beginning of the winter feeding period (October 28) until the last weighing before any calves were born (January 31) was practically the same in both groups. The cows hand-fed pellets (Lot 1) lost an average of 2 pounds per head, and those self-fed salt-meal (Lot 2) lost 5 pounds each. The average weight change for the entire year was a gain of 10 pounds for the cows in Lot 1 and a loss of 4 pounds for those in Lot 2. These

Table 4.—Hand-feeding Cottonseed Meal Pellets vs. Self-feeding Salt-cottonseed Meal to Pregnant Beef Cows (3-year average).

	Lot 1 Cottonsed meal pellets; hand-fed	Lot 2 Cottonseed meal-salt mixture; self-fed
Average number of cows per lot[1]	22	22
Average weight per cow, lbs.		
Beginning winter, Oct. 28	1035	1040
Before calving, Jan. 31	1033	1035
Change to calving	— 2	— 5
End of summer, Nov. 1	1045	1036
Yearly change	10	— 4
Average daily winter supplement, lbs.		
Cottonseed meal[2]	2.53	2.63
Salt[3]	.06	1.14
Steamed bone meal[3]	.02	.02
Feed cost, dollars		
Supplemental winter feed[4]	19.73	21.74
Native grass pasture, yearlong	21.67	21.67
Total	41.40	43.41
Calving data		
Number born[5]	66	66
Number weaned[5]	66	64
Average birth date, March	8	10
Average birth weight, lbs.[6]	76	70
Average weaning weight, lbs.[7]	472	470

[1] In 1950-51, 18 cows in Lot 1 and 19 cows in Lot 2. In 1951-52 there were 25 cows per lot but one cow died in Lot 1. In 1952-53 there were also 25 cows per lot; however, one cow in Lot 1 was killed by lightning and in Lot 2 data for two cows were not included because one calf was born prematurely, and another was born dead.

[2] Hand-fed every other day as a pellet in Lot 1, and self-fed as salt-meal in Lot 2.

[3] Consumed as mineral mixture in Lot 1 and self-fed as cottonseed meal, salt, and steamed bone meal in Lot 2. Mineral mixture for Lot 1 in trial 1 was one part salt, one part steamed bone meal, and one part ground limestone. In trials 2 and 3 the mixture was two parts salt and one part steamed bone meal.

[4] Average feed costs per ton were: Cottonseed meal pellets, $88.92; cottonseed meal, $87.83; salt, $14.53; and steamed bone meal, $97.00.

[5] Total number in three years of experiment.

[6] Corrected for sex.

[7] Corrected for sex and age.

results indicate that both methods of feeding were satisfactory from the standpoint of weight changes of the cows.

The cows of Lot 1 consumed an average of 2.53 pounds of pelleted cottonseed meal per head daily. Those self-fed the salt-meal mixture consumed an average of 2.63 pounds cottonseed meal and 1.14 pounds of salt.

In these tests, the supplemental winter feed cost was $19.73 for the hand-fed cows and $21.74 for the self-fed salt-meal cows. Labor and equipment costs were not included.

The average birth weight of the calves produced by the cows hand-fed cottonseed meal was 76 pounds. This was six pounds more than the

average birth weight of calves produced by cows self-fed the salt-meal mixture. This difference in birth weight is apparently not important, since there was only a slight difference in average weaning weight of the calves (472 and 470 pounds in Lots 1 and 2, respectively.)

The plasma chloride, sodium, and potassium levels were essentially the same in both groups. A slight elevation was noted in the plasma chloride of the cows fed the salt-cottonseed meal supplement. No differences were noted in the sodium, potassium, or chloride content of the plasma of calves suckling these cows. Analyses of milk samples collected during early lactation indicated no differences in content of chloride, sodium, or potassium.

Although no measurements of water intake and urinary volume were made, it was noted that cows self-fed the salt-cottonseed meal mixture drank large quantities of water and excreted more urine than the other group of cows.

DISCUSSION

During the trials reported here, the winter seasons were exceptionally mild and favorable, and ample grass and water were available at all times. Whether results as favorable as these could be expected under more severe climatic conditions, or where grass and water are limited, is not known. An adequate water supply is essential for all cattle; but when large quantities of salt are consumed, the need for sufficient water is increased.

Despite the increased feed cost and the slightly greater financial loss per steer, which resulted from self-feeding cottonseed meal and salt, many commerical cattlemen would consider the saving in labor and other feeding costs as more than enough to offset this. Additional factors, such as cost of the self-feeder and labor involved in mixing and handling the salt and cottonseed meal, were not considered in these trials.

Digestibility and metabolism studies with steers and wethers have shown only slight differences in digestibility and utilization of the various ration constituents when rations containing normal and high amounts of salt were fed. Such differences as were noted appeared to favor the ration lower in salt content.

Research workers at Woodward, Oklahoma, have reported that mixing about ½ pound of crushed rock salt with every 2 pounds of cottonseed meal is required to limit daily consumption of cottonseed

meal to 2 pounds for calves weighing about 400 pounds. Daily consumption of meal was held at 2 pounds per head by mixing 5/8 pound of salt with every 2 pounds of meal for 500-pound steers and 7/8 pound for 700-pound steers.

The test with pregnant beef cows near Lake Carl Blackwell is still in progress and many of the cows have been self-fed the salt-meal mixture for the fourth consecutive winter. The cows will be fed the same experimental ration each winter until they are removed from the experiment at approximately ten years of age. These cows will be slaughtered and various body organs and tissues examined for evidence of a deleterious effect of repeated winter intakes of large amounts of salt.

SUMMARY

Beef steers self-fed salt-cottonseed meal mixtures (average of 24 percent salt) during the winter months while grazing native grass pasture gained practically the same as those hand-fed cottonseed meal. When no costs other than feed were considered, the return per steer was in favor of hand-feeding the supplement.

Beef cows were self-fed a mixture of salt and cottonseed meal (average of 30 percent salt) during the winter months while grazing native grass pastures with no apparent detrimental effect on the health or yearly weight changes of the cows or the number and weaning weight of their calves. It appears that this feeding practice is not harmful for a period of at least three successive years, when ample grass and water are available.

Selected Bibliography

Ares, F. N. 1953. Better cattle distribution through the use of meal-salt mix. *The Cattleman.* Vol. 40, No. 7 (December).

Cardon, B. P. 1953. Influence of a high salt intake on cellulose digestion. *Jour. Animal Sci.* 12:536.

Cardon, B. P., E. B. Stanley, W. J. Pistor, and J. C. Nesbitt. 1951. The use of salt as a regulator of supplemental feed intake and its effect on the health of range livestock. *Ariz. Agri. Exp. Sta. Bul. 239.*

Meyer, J. H. and W. C. Weir. 1954. The tolerance of sheep to high intakes of sodium chloride. *Jour. Animal Sci.* 13:443.

Nelson, A. B., R. W. MacVicar, Wm. Archer, Jr., and J. C. Meiske. Unpublished data on the effect of high salt intake on the digestibility of ration constituents and nitrogen, sodium, and chloride retention by steers and wethers.

Riggs, J. K., R. W. Colby, and L. V. Sells. 1953. The effect of self-feeding salt-cottonseed meal mixtures to beef cows. *Jour. Animal Sci.* 12:379.

Savage, D. A. and E. H. McIlvain. 1954. Salt as a regulator of meal consumption for beef cattle. *U.S.D.A. Southern Great Plains Field Sta. Mimeo. Rpt.*

Weir, W. C. and R. F. Miller, Jr. 1953. The use of salt as a regulator of protein supplement intake by breeding ewes. *Jour. Animal Sci.* 12:219.

Weir, W. C. and D. T. Torrell. 1953. Salt-cottonseed meal mixture as a supplement for breeding ewes on the range. *Jour. Animal Sci.* 12:353.

Summaries of data collected in individual years of the tests reported in this bulletin may be found in Feeders' Day Reports of the Oklahoma Agricultural Experiment Station as follows:

Steers—

Pope, L. S., D. F. Stephens, A. E. Darlow, and R. W. MacVicar. 1951. Protein and mineral supplements for wintering two-year-old steers on native grass. *Okla. Agri. Exp. Sta. MP-22.* p. 67.

Pope, L. S., D. F. Stephens, A. E. Darlow, and V. G. Heller. 1952. Protein and mineral supplements for wintering yearling steers on native grass. *Okla. Agri. Exp. Sta. MP-27.* p. 90.

Pope, L. S., D. F. Stephens, P. E. Loggins, and V. G. Heller. 1953. Protein and mineral supplements for wintering two-year-old steers on native grass. *Okla. Agri. Exp. Sta. MP-31.* p. 121.

Cows—

Nelson, A. B., W. J. VanArsdell, R. W. MacVicar, W. D. Campbell, A. E. Darlow, and O. B. Ross. 1951. The use of salt as a means of regulating cottonseed meal consumption by pregnant cows. *Okla. Agri. Exp. Sta. MP-22.* p. 14.

Nelson, A. B., W. Archer, Jr., R. W. MacVicar, A. E. Darlow, and W. D. Campbell. 1952. Salt as a means of regulating consumption of cottonseed meal by pregnant beef cows. *Okla. Agri. Exp. Sta. MP-27.* p. 70.

Nelson, A. B., R. W. MacVicar, J. C. Meiske, A. E. Darlow, and W. D. Campbell. 1953. Salt as a means of regulating consumption of cottonseed meal by pregnant beef cows. *Okla. Agri. Exp. Sat. MP-31.* p. 43.

Nelson, A. B., R. MacVicar, and W. D. Campbell. 1954. Salt as a means of regulating consumption of cottonseed meal by pregnant beef cows. *Okla. Agri. Exp. Sta. MP-34.* p. 15.