Salt Consumption by Breeding Cows on Native Range in the Northern Great Plains

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Little information is available on the amounts of salt (sodium chloride) used by breeding cows on native range or the seasonal distribution of use, although such information is important to livestock management. Salt intake is influenced by the form of the salt (loose or block), differences between individuals, water intake, the supply of other minerals, age and possibly breeding status of animals, composition of forage, soils, season, and climate. Since salt is inexpensive, usually more of it is provided than consumed or needed.

Salt is essential to animal nutrition. Chlorine is a normal constituent of saliva and other body secretions, and its absence causes poor health, appetite failure, and loss of weight (Mitchell and McClure, 1937). Sodium, which functions as a carrier of chlorine, is also necessary for animal health. It is found primarily in blood serum and in muscles. Allowing animals to satisfy their normal salt appetite appears to satisfy requirements for these elements. Lack of salt also lowers digestibility of forage by steers (Smith *et al.* 1950).

Sodium chloride and other salts are found in many forage species in the West, and often in water supplies. Many western soils contain variable amounts of alkali salts. The forage and both surface and subsurface waters obtain salts from these soils.

In New Mexico Lantow (1933) found greater amounts of chlorine in green vegetation than in dry. Native grasses contained 0.05 to 0.64 percent salt, with the salt content increasing with forage growth. Goss (1903) in New Mexico found samples of saltgrass *(Distichlis* sp.) contained 0.28 percent salt, seepweed *(Suaeda* sp.) 1.53 percent, fourwing saltbush *(Atriplex canescens)* 0.08 percent, and greasewood *(Sarcobatus* sp.) 1.11 percent salt. In Texas Fraps and Lomanitz (1920) found native grasses to average about 0.25 percent salt. However, Morrison (1956) indicated that salt content of pasture grasses, western plains, averaged 0.19 to 0.06 percent salt (sodium plus chlorine) with increasing growth and maturity. He also stated that most dry hays ranged from 1.19 to 0.23 percent salt.

Hensel (1921) reported salt consumption by two-year-old steers in Kansas to average about 2.8 pounds per head per month during the spring, but only about 1.2 in October. Ares (1941) found salt consumption by cows on rangeland was little affected by placing the salt at water or away from it. Consumption per cow averaged 13.4 and 12.0 pounds annually for the respective locations. Studies of salt consumption by Stanley (1938) in Arizona indicated that salt consumption was greater on dry feed than on green. However, Lantow (1933) found a high correlation between salt consumption and precipitation during a given period.

Kennedy (1935) found abnormally high consumption of salt-bonemeal mixture (3 to 1 proportions) during the drought of 1936 on the same pastures used in this study. On these same pastures Woolfolk (1944) reported no effects of stocking rate on salt-bonemeal consumption, but did find a direct relationship between summer precipitation and salt consumption. Woolfolk also suggested that high amounts of alkali in the soils and water reduced salt-bonemeal consumption.

Use of salt both as an aid in livestock distribution, and as a feed intake regulator for concentrates during winter is increasing (Ares, 1953).

Method of Study

In the course of a range stocking-rate study with Hereford breeding cows at the U. S. Range Livestock Experiment Station, Miles City, Montana, salt consumption was determined at 28-day intervals throughout the year from early November 1951 through October 1957.

The cows were divided into six groups of 10 animals and each group was grazed at a separate stocking rate on native range. The groups were rotated from separate summer to winter pastures and back each year. The animals were on winter range from November 1 to mid-May, and on summer range the remaining 5.5 months of the year. Calves were born on the winter range between late March and early May and weaned at the end of the summer grazing season. Cows normally consumed about ¾ ton of hay during late winter.

Stock water was available to all groups of animals from a central tank at each range unit. There was no other source of permanent water, although some ponds and shallow streams furnished water for short periods after storms.

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[1] *Conducted as part of a cooperative study with the former Northern Rocky Mountain (now International) Forest and Range Experiment Station, U. S. Forest Service, Missoula, Montana, Montana Agriculture Experiment Station, and Animal Husbandry Research Division, Agricultural Research Service.*

Table 1. Precipitation by months at U. S. Range Livestock Experiment Station, Miles City, Montana, 1951-57.

Month	1951	1952	1953	1954	1955	1956	1957	7-year average	80-year average 1878-1957
	(Inches)								
Jan.	0.07	0.31	0.67	0.39	0.16	0.33	0.58	0.36	0.55
Feb.	0.27	0.73	0.43	0.19	0.51	0.10	0.29	0.36	0.44
Mar.	0.17	0.87	0.60	0.35	0.24	0.11	0.73	0.44	0.78
Apr.	0.36	0.18	1.96	0.88	1.43	0.30	1.82	0.99	1.04
May	1.12	1.53	2.93	0.78	5.55	2.37	1.84	2.30	1.99
Jun.	2.43	1.84	2.38	2.40	2.30	1.08	3.10	2.22	2.70
Jul.	1.49	0.78	1.33	0.69	0.60	1.94	1.39	1.17	1.49
Aug.	3.12	0.49	0.85	2.44	0.14	2.26	1.21	1.50	1.12
Sep.	1.38	0.47	0.23	0.85	0.31	0.24	0.72	0.60	0.99
Oct.	0.51	0.00	1.88	0.29	0.71	0.51	0.58	0.64	0.86
Nov.	0.28	0.45	0.03	0.09	0.67	0.81	1.18	0.50	0.50
Dec.	1.03	0.15	0.24	0.07	0.45	0.29	0.01	0.32	0.48
Total	12.23	7.80	13.53	9.42	13.07	10.34	13.45	11.40	12.94

Coarse-ground, non-iodized stock salt was provided free-choice to each group of cows at permanent locations ¼ to ½ mile from the central water source. No additives or other minerals were available during the study. Salt was placed in open boxes through 1954 and afterwards in covered containers.

Vegetation was a mixture of mid- and short-grass species, browse, forbs, and annuals typical of the drier southwestern portion of the Northern Great Plains. The dominant grasses were blue grama *(Bouteloua gracilis)*, western wheatgrass *(Agropyron smithii)*, needle-and-thread *(Stipa comata)*, green needlegrass *(S. viridula)*, and buffalo grass *(Buchloe dactyloides)*. The most abundant shrubs were big and silver sagebrush *(Artemisia tridentata* and *A. cana)*, and black greasewood *(Sarcobatus vermiculatus)*. Forbs and annuals were minor components.

Weather

Average annual precipitation during the study period was about 12 percent below the long-time average (Table 1). However, considerable year-to-year variation was evident. The lowest precipitation was recorded in 1952 and the highest in 1953. A cycle for alternate years of above average and below average precipitation was noted.

Results

Salt consumption was found to differ significantly between animal groups, between years, and between 28-day periods during the year (Table 2). All interactions were also significant.

Group C-S, one on intermediately stocked range, consumed more salt than any of the other groups, and group F-V, on the most lightly stocked range area, consumed less salt than any other group (Table 3). However, salt consumption was not correlated with average range stocking rate over the 6-year period. No consistent increase or decrease in salt consumption with progressive change in stocking rate was evident. However, the consistently low salt consumption by group F-V throughout the years may be related to stocking rate. This tends to parallel McIlvain's (1960) results. He found lower salt consumption under light stocking.

The high salt consumption by animal group C-S was most evident during the summer grazing season. The factor influencing high consumption by this group was possibly the absence of browse in the summer pasture. The amount of browse vegetation in this pasture was considerably less than in any other on the summer range.

Soil differences also may have influenced salt consumption on the summer range. Significant areas of Beckton silty clay loam, a soil containing dispersed sodium and usually classified as site *saline upland* or *dense clay*, were present in the summer pastures of both animal groups A-Q and F-V.

During the winter salt consumption was usually highest for animal group E-T. Here again vegetation composition seems the most likely influence. The winter pasture for this group had considerably less browse cover than any other pasture on the winter range.

Salt consumption was significantly greater in the grazing years (from November 1 of previous year to October 31 of current year) of 1953 and 1955 than in other years (Table 3). It was not different between 1953 and 1955 or between the other years of the period, although a cycle was evident for an alternate increase and decrease by years.

Annual salt consumption was found to be significantly correlated with total May-June pre-

Table 2. Analysis of variance for three factors influencing salt consumption.

Source of Variation	df	Mean Square
Animal group	5	359.70**
28-day period	12	2,510.84**
Animal group x Period	60	75.31**
Year	5	154.41**
Animal group x Year	25	56.81**
Period x Year	60	104.31**
Error b	300	12.95

**Significant at 1 percent level.

Table 3. Average amount of salt consumed per breeding cow per 28-day period, correlations, and comparison of means[1] for years, animal groups, and 28-day periods throughout the year.

Year	Animal Group and Average Stocking Rate (Acres/A.U.M.) A-Q (2.12)	E-T (2.40)	C-S (3.24)	B-R (3.30)	D-U (3.40)	F-V (4.13)	Average
	(Pounds)						
1952	0.98ab[2]	.89ab	1.34b	.87ab	1.21ab	.78a	1.01a
1953	0.96a	1.24a-c	1.47bc	1.17ab	1.59c	.97a	1.23b
1954	0.91a-c	.79ab	1.40d	1.25cd	1.12b-d	.59a	1.01a
1955	1.38cd	1.23bc	1.75d	1.55cd	.72a	.97ab	1.27b
1956	.96bc	1.12c	1.23c	.58ab	1.04c	.56a	0.91a
1957	.87a	1.03a	1.55b	.86a	.93a	.88a	1.02a
($s_{\bar{x}}$ for Duncan's comparisons of years within an animal group = .100)							
Averages	1.01b	1.05b	1.46c	1.05b	1.10b	0.79a	

Correlations with:

Stocking Rate	Annual Precipitation	Growing season Precipitation	May-June Precip.	Previous Year Growing season Precipitation	Previous Year May-June Precipitation
—.20	+.58	+.55	+.85*	—.79	—.73

28-day Period ending:	Year 1952	1953	1954	1955	1956	1957	Average
	(Pounds)						
Nov 29	.80b	.78b	.79b	.60b	.18a	.83b	0.66ab
Dec 27	.47a	.72ab	.55ab	.97bc	.80ab	1.30c	0.80ab
Jan 25	.47a-c	.72bc	.82c	.58a-c	.32ab	.19a	0.52a
Feb 23	.85b	1.32c	.81b	.34a	.32a	.20a	0.64ab
Mar 21	.46a	1.11b	1.01b	.27a	.38a	.45a	0.61ab
Apr 19	.46a	.74a	.59a	.53a	.78a	.40a	0.58ab
May 15	.70b	1.64c	.38ab	.56ab	.77b	.29a	0.72ab
Jun 13	.30a	1.01b	.44a	1.17b	.28a	.59a	0.63ab
Jul 11	1.06c	.69bc	.45ab	.18a	1.05c	.68bc	0.73ab
Aug 8	.76a	1.00ab	1.11ab	.97ab	1.40b	.94a	1.03b
Sep 6	1.37a	1.60a	1.37a	2.10b	1.57a	1.42a	1.57c
Oct 5	2.06b	1.36a	1.38a	3.15c	2.06b	2.36b	2.06d
Nov 1	3.42b	3.33b	3.42b	4.75c	1.98a	3.63b	3.42e
($s_{\bar{x}}$ for Duncan's comparison of 28-day periods within a year = .206)							

28-day Period ending:	Animal Group A-Q	E-T	C-S	B-R	D-U	F-V
	(Pounds)					
Nov 29	.52	.89	.54	.56	.96	.52
Dec 27	.59	1.38	.75	.68	.87	.55
Jan 25	.40	.84	.55	.48	.50	.33
Feb 23	.55	.82	.74	.62	.60	.50
Mar 21	.50	.87	.75	.51	.61	.44
Apr 19	.47	.90	.52	.46	.67	.47
May 15	.54	.87	.65	.53	1.09	.66
Jun 13	.59	.56	.80	.73	.68	.43
Jul 11	.74	.50	.97	.71	1.03	.46
Aug 8	1.05	.67	1.79	1.08	1.21	.39
Sep 6	1.44	1.08	2.59	1.74	1.35	1.22
Oct 5	2.06	1.20	3.66	2.40	1.64	1.40
Nov 1	3.68	3.04	4.62	3.10	3.14	2.95

[1]Duncan, 1955.

[2]Means in the same row followed by the same letter are not significantly different at 5 percent level.

cipitation (Table 3). Salt consumption was inversely but not significantly correlated with both spring and growing season precipitation during the previous year. Correlations of salt consumption with both growing season (April-September) and annual grazing year precipitation of the current year were also high but not significant.

It is possible that dilution of salts in forage by high water content or leaching of salts from forage during the more moist years influenced the higher salt consumption during those years. Leaching of minerals from mature forage by rainfall has been found by both Guilbert *et al.* (1931) and Watkins (1937), and suggested by Woolfolk (1944) from blood analyses of cattle.

The high negative correlations of salt consumption with precipitation during the previous year were possibly due to the cycle of alternate dry and wet years during the study period. It is possible that had the cycle not occurred these correlations would be much lower.

Salt consumption varied little during the winter, spring, and early summer. During this portion of the year salt consumption per breeding cow averaged from about 0.6 to 1.0 pound per 28 days (Table 3). Well water at the winter range was higher in sodium chloride (0.11 percent) and lower in total solids (0.17 percent) than at the summer range (0.06 and 0.31 percent).

After about July 11 salt consumption significantly and progressively increased until mid- and late October when consumption reached an average of about 3.4 pounds per breeding cow per 28-day period (Table 3). When the cows were moved to the winter range after weaning salt consumption fell to the normal winter level of about 0.6 pound.

These seasonal differences in consumption were also found by Woolfolk (1935).

The high salt consumption of breeding cows and calves during late summer and fall was probably due to a combination of several factors. Calves with the cows were normally about 3 months of age by mid-July, and would be expected to consume forage and probably salt also by that time in addition to that consumed by the cows. Observations throughout the period tended to indicate this.

On these ranges forage growth is usually completed by late July, or even earlier in dry years. After cessation of growth precipitation may leach salts and minerals from this dry growth. Animals would then be expected to increase salt consumption if the salt consumed in forage was not adequate to satisfy the salt appetite.

It has been observed that precipitation during July, August, and early September seldom causes regrowth, which conceivably could furnish sufficient salt to satisfy the appetite.

Summary

Salt consumption by breeding cows on native range typical of the drier portion of the Northern Great Plains was studied from 1951 through 1957. Six groups of Hereford cows and calves were grazed each at a different stocking rate on separate summer and winter ranges. Calves were born on the winter range. Average winter feeding was about ¾ ton of hay per cow.

Ground stock salt was available free-choice to each group throughout the year. No other minerals or additives were furnished. Salt consumption was determined by individual animal groups at 28-day intervals.

Salt consumption apparently was not influenced by stocking rate, but may have been by presence of saline soils or lack of browse forage or both during the summer and by lack of access to browse forage during the winter.

Salt consumption was apparently affected by weather. A high correlation was found between May-June precipitation and salt consumption that year. It is possible that some combination of leaching of dry forage or dilution of salt in plants or both by the higher precipitation is the decisive factor of the weather influence.

Salt consumption was much higher during August, September, and October than during any other time of the year, and it increased rapidly during this time. The increased consumption during this period is probably due to some combination of use by growing calves in addition to the use by cows, and possibly by increased consumption by cows grazing forage leached of part of the minerals and salts.

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