THE EFFECTS OF LOW SUPPLEMENTARY PHOSPHORUS INTAKES ON RANGE COWS IN THE SAGEBRUSH-BUNCHGRASS REGION

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The low phosphorus contents of native flood-meadow hays and of bunchgrasses native to the sagebrush-bunchgrass range have prompted the analysis of data from a nutrition study with regard to the effects of low phosphorus intake by beef cattle. It is recognized that a great amount of research on phosphours has been reported, but a paucity of information exists on the phosphorus nutrition of beef cattle in the sagebrush-bunchgrass region. Also, it is recognized that the data reported herein are not the results of a well controlled experiment.

This paper presents phosphorus levels in the forage and the effects of low phosphorus supplementation upon conception date, calving percentage, birth and weaning weights of calves, and inorganic blood phosphorus levels of Hereford cows.

EXPERIMENTAL PROCEDURE

Data were analyzed from two groups of cows on a nutrition study conducted in the sagebrush-bunchgrass region beginning in 1946 and ending in 1950. Forty-two mature Hereford cows were selected from the Station herd in 1946 and assigned randomly to 2 treatment groups. Except for necessary culling or other management requisites, all cows remained in their respective groups for the 4 years.

During the winters both groups of cows received native flood-meadow hay ad libitum. The vegetative composition of the hay was about 90% rushes (*Juncus* spp.) and sedges (*Carex* spp.) and 10% grasses and forbs. Analyses of a number of hay samples showed a range in phosphorus content from 0.10% to 0.13% with an average of about 0.12%. The winter hay-feeding periods were generally initiated in December of each year and terminated in late April.

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Following trailing to range in April both groups of cows grazed sagebrush-bunchgrass range until late September. Chemical analyses of bunchgrasses showed a range of phosphorus content in May from 0.2% to 0.3%. In August the range in forage phosphorus was from 0.05% to 0.13%. Range and cattle management required that the cows in group 1 have access to 160-acre ranges. Cows in group 2 grazed with the remainder of the Station herd in 2,000-acre ranges. There was a greater quantity of forage available to the cows in group 1.

Cows and calves grazed native flood-meadow aftermath from late September until the calves were weaned during late November.

Stock salt was provided ad libitum to both groups of cows and, in addition, cows in group 2 had disodium phosphate and bonemeal available at all times. No salt was mixed with the supplements.

Phosphorus intakes of cows in both groups were estimated from daily hay consumption records during the winters and from forage analyses and an assumed dry matter intake of range forage during the summers. In addition, intake from the phosphorus supplements for the cows in group 2 were estimated from the records of supplement intake. The phosphorus intake during the winter periods was approximately 9 gm. per head per day. Phosphorus intake, for the range periods, was approximately 30 gm. and 5 gm. per head per day during May and late August, respectively.

The following data were collected: Blood inorganic phosphorus of cows, calf birth date, birth weight, and weaning weight, and calving percentage. Conception dates reported were calculated, using a 282-day gestation period, from known birth dates of calves. Phosphorus in blood and forage was determined by the method of Fiske and Subbarow (1925).

RESULTS AND DISCUSSIONS

The average conception dates of range cows on 2 levels of phosphorus intake are presented in table 1.

The 3-year average conception dates were July 23 and July 7 for cows in groups 1 and 2, respectively. These means were significantly different at the 1% level of probability.

The birth weight of calves was not affected by low phosphorus supplementation or year differences, and averaged 70 lb. over the 4 years.

Table 2 presents the average weaning weights of calves and the pounds of beef produced per cow for the 4 years.

Table 1. Average conception dates of range cows on low phosphorus intakes

Year	Group 1 No phosphorus supplement	Group 2 Low phosphorus supplement
1947	July 7	June 24
1948	August 6	July 22
1949	July 23	July 5
Average	July 23	July 7

Table 2. Average weaning weights of calves and pounds of beef produced per cow for the years indicated

	Group 1 No phosphorus supplement		Group 2 Low phosphorus supplement	
Year	Avg. weaning weight	Production per cow	Avg. weaning weight	Production per cow
	lb.	lb.	lb.	lb.
1947	341	264	337	225
1948	315	270	342	293
1949	309	250	256	229
1950	346	224	325	249
Average	328	254[a]	315	250[a]

[a]Total pounds weaned for 4 years ÷ total number of cows involved.

Supplementation of phosphorus at a low rate did not result in increased birth weights or weaning weights of calves, or the pounds of beef produced per cow in the Squaw Butte study.

Though phosphorus supplementation increased calving percentage, a Chi-square analysis showed no significant treatment differences in number of calves born.

Average blood inorganic phosphorus values of cows in both groups, shown in table 3, were usually below 4.0 mg. % except in the fall of the year, and were lowest in April 1948 when the values were 2.4 and 2.6 mg. % for cows in groups 1 and 2, respectively. Low phosphorus supplementation had no consistent effect on blood inorganic phosphorus values.

Table 3. Average blood inorganic phosphorus of range cows on low phosphorus intakes

	Blood inorganic phosphorus (mg. P/100 ml. blood)	
Sampling Date	Group 1 No phosphorus supplement	Group 2 Low phosphorus supplement
11-19-46	3.97	3.75
4-15-47	4.25	3.82
10- 1-47	4.20	4.01
4-18-48	2.35	2.62
5- 2-49	3.50	3.32

Various workers have emphasized the relationship of blood or plasma inorganic phosphorus and dietary phosphorus. Black, Ellis, and Jones (1942) noted that a phosphorus deficiency existed in the ration when the blood inorganic phosphorus content was less than 4.0 mg. per 100 ml. of blood. Black et al (1949) concluded that to prevent phosphorus deficiency the minimum amount of inorganic phosphorus in the blood of cattle should be above 4.0 mg. %. Knox, Benner, Watkins (1941) noted that inorganic phosphorus in blood plasma appeared to be closely related to phosphorus intake with a correlation coefficient of 0.61 between forage phosphorus and blood phosphorus. Nelson et al. (1955) found that plasma inorganic phosphorus of cows was related to phosphorus intake during the winter. However Knox, Benner, and Watkins (1946), in a later publication, stated that plasma inorganic phosphorus levels were below 4.0 mg. % as much as they were above, and on occasions fell to "dangerously" low levels of slightly over 2 mg. %. Wheeler (1945) found that serum phosphorus of cows was not related to variation in intake. Long et al. (1952) found numerous instances of individuals of various breeds of beef cattle constantly having plasma inorganic phosphorus levels below 4.0 mg. % with no ill effects on reproductive capacity. They stated that normal reproductive performance can be obtained in beef cattle having plasma phosphorus values considerably below 4.0 mg. % and that caution should be made in interpretation when attempting to use blood inorganic phosphorus as a measure of phosphorus nutrition.

SUMMARY

Data on the effects of low phosphorus intake and low phosphorus supplementation were analyzed from a nutrition study conducted with

range cows in the sagebrush-bunchgrass region and initiated in 1946.

Making the phosphorus supplements available in the form of bonemeal and disodium phosphate resulted in significantly earlier average conception dates. The average conception date for cows that received no additional phosphorus was July 23, whereas the average conception date for cows that received the phosphorus supplements was July 7. Percentage of calves born was increased by low phosphorus supplementation, but not significantly.

Birth weight and weaning weight of calves was not increased by making bonemeal and disodium phosphate available to the cows.

Blood phosphorus levels were not different between groups and were above 4.0 mg. % only in the fall. The lowest values were below 3.0 mg. % in April 1948.

The failure to increase weaning weight of calves and blood inorganic phosphorus of cows when disodium phosphate and bonemeal were made available emphasizes the necessity for further study of relationships between animal production levels and factors influencing phosphorus intake.

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