NON-CONVENTIONAL P SOURCES FOR ZEBU COWS IN BRAZIL[1]

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ABSTRACT: To evaluate non-conventional phosphorus sources, a group of 400 Nellore cows mantained under pasture received a mineral mixture with different P sources (group I: superphosphate - 500 ppm P; group II: superphosphate - 340 ppm P plus rock phosphate Patos 160 ppm P; group III: superphosphate 340 ppm P plus dicalcium phosphate 160 ppm P; group IV - dicalcium phosphate 500 ppm P). There were no differences in pregnancy rate, calving rate and calving interval. A fluorine deposition in bone was observed for the treatments with superphosphate and rock phosphate (66.92 ± 15.53; 69.97 ± 6.5 and 64.05 ± 3.35% respectively for group I, II and III). Superphosphate was almost as good dicalcium phosphate to provide phosphorus for grazing cows and there was a potentially significant economic advantage over dicalcium phosphate.
Key words: phosphorus, cattle, rock phosphate, fluorine

FONTES NÃO CONVENCIONAIS DE FÓSFORO PARA GADO ZEBU NO BRASIL

RESUMO: Quatrocentas vacas Nelore, mantidas em pastagem, receberam mistura mineral contendo fontes não convencionais de fósforo (grupo I - 500 ppm P-superfosfato triplo; grupo II - 340 ppm P como superfosfato e 160 ppm P como rocha Patos; grupo III - 340 ppm P como superfosfato e 160 ppm P como fosfato bicálcico; grupo IV - 500 ppm P como fosfato bicálcico). Não se verificou diferenças na taxa de prenhez, porcentagem de nascimento e intervalo entre partos. Observou-se que houve maior concentração de flúor nos ossos para o tratamento com fosfato de rocha. O superfosfato triplo apresentou-se como fonte adequada de P e mostrou vantagem econômica em relação ao bicálcico.
Descritores: fósforo, fosfatos, flúor, bovinos

INTRODUCTION

In Brazil, livestock production levels are low and have remained stagnant for several decades. Forages are low in protein, energy and minerals, particularly phosphorus (LOPES & NUNES, 1991).

Many research data (McDOWELL, 1985) have shown that growth and reproductive performance increase significantly when grazing cattle are provided with mineral supplementation. In tropical countries average calving percentage was increased from 52 to 74% by mineral supplementation.

The cost of P supplementation in Brazil is high, and represents about 70% of the total cost of a mineral mixture. Besides, there is shortage of P supplements. Alternative P sources as rock phosphate and fertilizers are cheaper and could be used in order to minimize those problems.

The present research was carried out to investigate the use of non-conventional P sources to replace the dicalcium phosphate in mineral mixtures for zebu cows in an attempt to reduce the costs of mineralization of the herd, and its effects on reproductive parameters.

MATERIAL AND METHODS

A private beef herd located in the Central region of Brazil was used. A total of 400 breeding Nelore cows, divided into four groups were

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maintained under cultivated grass pasture (*Brachiaria* ssp) with free access to ground water.

Each group was offered a mineral mixture prepared from the normal mixture used on the farm, with different P sources, as follows:

Group I: superphosphate - 500 ppm P.

Group II: superphosphate (340 ppm P) and Patos rock phosphate (160 ppm P).

Group III: superphosphate (340 ppm P) + Dicalcium (160 ppm P).

Group IV: dicalcium phosphate (500 ppm) - normally used in farm.

The mineral mixture composition and chemical analysis are shown in TABLES 1 and 2.

The mineral supplementation was given in covered wood buckets and its intake was recorded.

During the breeding season natural mating was used (1 bull per 25 cows) and pregnancy diagnosis was performed through rectal palpations 60 days after the end of the breeding season. Pregnancy rate, calving rate and calving interval were recorded in two consecutive breeding seasons.

At the beginning and the end of the trial, blood sampling and bone biopsy were carried out in 10% of the animals for phosphorus and fluorine analysis (LITTLE, 1972).

Discrete data were tested for association by chi-square analysis. The effects of treatments upon reproductive parameters were estimated by least square analysis of variance. Differences between means were compared using the Tukey test.

RESULTS AND DISCUSSION

The pregnancy rate for the first year was 68.69: 69.00: 77.78 and 74.75% respectively for groups I, II, III and IV. In the second year the results were 58.16: 56.12: 57.58 and 62.24 %, respectively. There were no statistically significant differences between those results. Between years there were statistical differences ($P<0,01$), with mean values of 72.54 and 58.52% for first and second year. It was observed that the pregnancy rate decreased even for the group which received dicalcium phosphate. The reason for this is unknown.

TABLE 1. Composition of mineral mixtures offered to Nelore cows (g/100g).

	GROUP			
	I	II	III	IV
Super-phosphate	17	10.2	12.10	--
Patos rock phosphate	--	12.24	--	--
Dicalcium phosphate	--	--	6.32	21.62
$CaCo_3$	10.88	10.20	7.34	--
Urea	30	30	30	30
$ZnSO_4$	2.35	2.04	2.50	2.74
$CuSO_4$	1.30	1.16	1.40	1.53
$COSO_4$	0.03	0.03	0.03	0.03
KI	0.02	0.02	0.02	0.02
S	2.00	2.00	2.00	2.00
Salt	36.42	32.11	38.29	42.06

For the second year the values are low. For Nelore cows, in Brazil, the observed mean values of pregnancy rate vary between 70-80%.

Calving rate was 58.00%. There were no differences among groups and the values were 58.00, 65.00, 53.00 and 56.00% for groups I, II, III and IV, respectively.

Calving interval mean value was 337.42 ± 7.83 days (n = 194), and for group I, II, III and IV the values were 335.22 ± 14.04; 334,86 ± 16,26; 329.70 ± 16.06 and 349.88 ± 15.10 day, respectively. There were no statistical differences. Calving intervals of 12 - 13 months are considered optimum under temperate condition (FERREIRA & SÁ, 1986). However the calving interval values can be misleading, since the calculation is based on those cows exhibiting successive parturitions, thus giving no indication of the proportion that fails to conceive (MEIRELLES *et al.*, 1990). A more accurate indication of herd reproductive performance might be the number of open days, provided that it is calculated using the actual days from parturition to conception for cows which became pregnant and a value of 365 days is given to all those which did not successfully remate for a year or more after calving.

TABLE 2 - Chemical analysis of mineral mixtures offered to Nelore cows (%).

	Dry Matter	Ash	P	F	Ca
GROUP					
I	98.24	81.96	4.62	0.26	11.9
II	97.84	83.54	4.94	0.34	11.6
III	96.11	84.42	5.58	0.16	10.0
IV	98.28	84.22	5.93	0.04	11.5

Including these aspects in this study, it was possible to detect an effect of group upon the open days ($P < 0,05$). Open day values were 179.28 ± 13.83; 226.34 ± 13.83; 236.88 ± 13.83; 211.94 ± 13.83. Results obtained with dairy cattle in Brazil (MEIRELLES *et al.*, 1990) showed open day values of 151. A period of 100 days can be considered acceptable according some authors (FERREIRA & SÁ, 1986). However with Nelore cattle the open day period is normally longer than for dairy cattle and a period of 150 days is the normal value in tropical conditions.

The mineral mixture intake was 127.78 ± 33.20; 101.38 ± 33.04; 115.17 ± 36.98 and 110.17 ± 43.00 g/head/day, respectively for group I, II, III and IV. Those results gave a phosphorus and fluorine intake of 6.59 and 0.16; 5.50 and 0.48; 7.08 and 0.16; 6.51 and 0.04 g/d, respectively. It is observed that the mineral mixture and P intake were lower for group II, although there were no statistical differences. There is a tendency to decrease intake of mineral mixture when animals are fed with rock phosphate due to palatability problems (DAYRELL, 1991).

The intake of fluorine was compared to some obtained by DAYRELL (1991), which observed levels of 0.18 to 0.32 g/d. In this range, the authors did not find any effect on weight gain and reproductive performance when heifers received rock phosphate as P source. The results obtained in the present work corroborate those findings. The mean values of phosphorus in plasma and phosphorus and fluorine levels in bone are in TABLE 3.

For plasma inorganic P there was no difference among groups and the values are in the normal range (THOMPSON, 1978).

Phosphorus content in bone ash showed statistical differences ($P < 0,01$) and values were lower for group I. Some researchers (AMMERMAN *et al.*, 1974) found that animals with P content in bone ash between 17.6 and 18.1% did not show P deficiency, although according to literature (McDOWELL, 1985) level of 17% is considered critical. The values reported in the present experiment are low compared to those mentioned in literature, even for the animals which received dicalcium phosphate (group IV). For the fluorine content there were differences among groups, and the animals which received dicalcium phosphate presented lower values ($P < 0,01$). The animals which received rock phosphate (group II) had highest fluorine level in bone ash. The percentage of fluorine deposition during the experiment was 66.92 ± 15.33; 69.97 ± 6.50 and 64.05 ± 8.38 respectively for groups I, II and III. The group IV showed an increase of 42.11 ± 11.96% in bone fluorine content ($P < 0.01$).

According to literature (DAYRELL, 1991) the fluorine content in bone ash of bovines which received dicalcium phosphate and rock phosphate was 507 and 1370 ppm, after one year, and the percentage of fluorine deposition in the animals which received rock phosphate was 114.73%. In those animals, fluorine signs started after 4.5 year after the beginning of the treatment. In the present work the data obtained are in accordance with those indicated although the percentage of fluorine deposition was lower, probably because rock phosphate was mixed with other sources. Signs of fluorosis were not observed after two years of experiment.

The cost of each mineral mixture was 1.08; 1.21; 2.02 and 2.92 US$/100 head/day for group I, II, III and IV, respectively. It is observed that cost for DP is approximately three times more than when superphosphate is used.

It may be stressed that there were no differences in the reproductive data when DP or the other sources were used. However, the results for

TABLE 3 - Phosphorus and fluorine levels in plasma and bone ash of zebu cows.

	phosphorus in plasma (mg%)	phosphorus in bone (%)	fluorine in bone (ppm)
Group I	5.08 ± 0.30[a]	12.96 ± 0.16[a]	1069.90 ± 135.77[a]
Group II	4.81 ± 0.30[a]	13.41 ± 0.16[b]	1608.23 ± 135.77[c]
Group III	4.64 ± 0.32[a]	13.72 ± 0.16[b]	776.06 ± 135.77[b]
Group IV	4.38 ± 0.31[a]	13.60 ± 0.16[b]	632.37 ± 135.77[b]

a,b,c Means in a column with different letters are significantly different.

fluorine content in bone must be taken in account, since future problems of fluorosis could occur.

CONCLUSION

From the present findings it could be concluded that superphosphate was almost as good as dicalcium phosphate to provide phosphorus for grazing zebu cattle, and there is a potentially significant economic advantage of this source over dicalcium. Results of high fluorine content in bone suggest, however, the possibility of future fluorosis problems.

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