

EFFECTS OF TRIPLE SUPERPHOSPHATE SUPPLEMENTATION ON GROWTH PERFORMANCE, CARCASS YIELD, HEAVY METALS AND FLUORINE LEVELS IN BEEF CATTLE ON PASTURE.

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Background

The zebu crossbreed (*Bos taurus indicus*) has a remarkable reproductive and productive capacity due to its perfect adaptability to heat tolerance as well as to its rusticity in tropical countries. Phosphorus deficiency is by far the most widespread and economically important mineral deficiency affecting grazing livestock in Brazil, found in the "cerrados" (savannas), a region which covers more than 200 million hectares in Brasil. The cost of mineral supplementation in Brazil is extremely high and the phosphorus, usually from dicalcium phosphate (DICAL), may represent as much as 70% of the total cost of a good mineral mixture. A number of long-term on-farm mineral supplementation experiments and radioisotope metabolism trials have demonstrated the effectiveness of cheaper phosphorus alternative sources as triple superphosphate (TSP). Brazilian triple superphosphate contains good phosphorus percent (20-21% P), low fluorine levels (0,45%) than the majority of foreign rock phosphates both in dry matter basis. Biological phosphorus availability as high as dicalcium phosphate. Besides it is important to control the presence of heavy metal residues (Arsenic, Lead, Cadmium and Mercury) in meat that attempt guarantee the international legislation levels, trade market and maintenance of the import markets and the consumers security. In Brazil governmental agencies it has made the control of residues in meat to guarantee the safe and the health of the population.

Objective

To investigate the effects of triple superphosphate and dicalcium phosphate on growth performance, carcasses yields and control the presence of heavy metal residues (Arsenic, Lead, Cadmium and Mercury) to guarantee the meat safety of beef cattle on pasture.

Methods

Trial started in December 1996 when two hundred cows were assigned at random to two treatments groups of one hundred animals each. Cows were given free access to a mineral mixture containing triple superphosphate (treatment 1) or dicalcium phosphate (treatment 2) as phosphorus sources, trace minerals (Zn, Cu, Co and I) plus salt. Calves were born from early August to late November 1997 and remained with their dams on two grazing of *Brachiaria humidicola*. The animals started receiving triple superphosphate and dicalcium phosphate as early as at the time of conception until slaughter. All animals were Zebu breed crosses. In April 1998, at weaning, eighty calves were divided in two groups of forty animals each and allocated to two grazing areas of *Brachiaria brizantha* until the slaughter in September 1999. Animals were weighted at every 28 days. A representative group of twenty animals (ten of each treatment) were slaughtered (BRASIL, 1981). At the slaughtering, carcasses were weighted, and 60 different tissue sites (20 muscle, 20 liver, and 20 kidney) were sampled according international quality control procedures to analyze Pb, Cd, As and Hg (BRASIL, 1999). Sample of the 12^a rib of each animal were also collected to determine fluorine level. After refrigeration (24 hs/5° C) forequarter and hindquarter were separated from each left side and deboned to obtain the meat and bone totals.

Results and discussions

Average weaning weights were similar between the two treatment groups. Phosphorus source did not affect reproductive parameters which were very good for both treatments. The Table 1 presents the effects of phosphorus sources on performance, phosphorus and fluorine bone rib levels of the experimental animals.

TABLE 1 - Effects of phosphorus sources on performance, phosphorus and fluorine bone levels.

TRAIT	PHOSPHORUS SOURCES	
	TRIPLE SUPERPHOSPHATE	DICALCIUM PHOSPHATE
Live weight at born (kg)	29.1 ^a	28.7 ^a
Weaning weight (kg)	170.5 ^a	182.8 ^a
Weight at the final of feeding phase (kg)	415.7 ^a	404.0 ^a
Live weight gain (kg)	245.2 ^a	221.2 ^a
Daily live weight gain (g)	473.0 ^a	427.0 ^a
Rib fluorine at slaughter (ppm)	2625 ^a	1945 ^a
Rib phosphorus at slaughter (%)	17.9 ^a	17.4 ^a

Means in the same column for the same trait bearing a common superscript are not different (P > 0,05)

At the end of trial, the levels of fluorine accumulation in the animals rib bone of both treatment groups were within the normal range (NATIONAL RESEARCH COUNCIL, 1989). Higher bone fluorine levels in animals that received triple superphosphate may be attributable to higher fluorine content of TSP. As one could expect, based on the fluorine levels of the mineral triple superphosphate mix (1850 ppm), no fluorosis problems were observed. Animal performance was very good and was not affected by the treatments. These results are generally in agreement with the studies told by AGUIAR et al. (1998), EUCLIDES FILHO et al. (1997) when evaluating crossbred zebu. In addition, there was an estimated profit of US\$ 10 per head, as cost advantage for animals receiving triple superphosphate.

No differences were observed between live weight, dressing percentage or yields. The table 2 presents the carcass yields results for the experimental animals.

TABLE 2 - Effects of phosphorus sources on carcass yields for the experimental animals.

TRAIT	PHOSPHORUS SOURCES	
	TRIPLE SUPERPHOSPHATE	DICALCIUM PHOSPHATE
Live weight at slaughter	465.0 ^a	476.0 ^a
Carcass weight (kg) / Dressing percentage (%)	254.5 ^a / 54.8 ^A	270.0 ^a / 56.6 ^A
Half cold carcass weight (kg)	125.8 ^a	135.1 ^a
Hindquarter 8 th ribs (kg) / %	73.4 ^a / 58.3 ^A	78.6 ^a / 58.2 ^A
Forequarter (kg) 5 th ribs (kg) / %	52.4 ^a / 41.7 ^A	56.5 ^a / 41.8 ^A
Total lean meat	98.98 ^a / 78.65 ^A	106.56 ^a / 79.06 ^A
Total bone	26.88 ^a / 21.34 ^A	28.04 ^a / 20.93 ^A

Means in the same column for the same trait bearing a common superscript are not different (P > 0,05)

Values to close were found in experiment of NOGUEIRA et al. (1989), which had observed that bovine Nelore with average age of 24 months and 489.12 of live weight presented an dressing percentage of 56.84 %. Already OLIVIERA et al. (1995) tells to incomes of 55.83 % for Nelore animals of 401.15 of live weight. These results indicate that the phosphorus sources had not interfered with the performance of the animals. When compared in terms of weight or percentage of meat or bones the differences between the groups had not been observed.

Table 3 - Average of values (mg/kg) of arsenic, lead, cadmium and mercury in the samples of muscle, liver and kidney of bovines submitted a different phosphorus sources TSP (treatment 1) or DICAL (treatment 2).

Heavy metals	Triple Superphosphate			Dicalcium Phosphate		
	Muscle	Liver	Kidney	Muscle	Liver	Kidney
Arsenic (mg/kg)	ND	ND	ND	ND	ND	0,0169
Lead (mg/kg)	ND	ND	ND	ND	ND	ND
Cadmium (mg/kg)	ND	0,481 ^a	1,914 ^a	ND	0,521 ^a	2,005 ^a
Mercury (mg/kg)	ND	ND	ND	ND	ND	ND

Although results for Arsenic residues were detected in kidney samples of the Treatment 2 (dicalcium phosphate), their levels were inferior of those established by the Brazilian Legislation (BRASIL, 1999) to established 2 mg/kg. No significant differences between treatments were observed for cadmium residues. The values found in the kidney, for both treatments, were higher than 1,0 mg/kg, value tat is established by the Brazilian Legislation. These results could be related more to enviromental apsects such as water or pasture than the phophorus sources given. Amongst the analyzed muscle samples, in none was detected traces of heavy metals.

Conclusions

There were no differences between dicalcium phosphate and triple superphosphate as phosphorus source in relation to animal performance and carcass yields, of beef cattle on pasture from conception to slaughter. Arsenic, Cadmium, Mercury and Lead levels in meat, liver and kidney of animals slaughtered were extremely low and far below of the safety limits for human and animal feeding. In the conditions where this work was carried out were possible to conclude that the mineral mixture, contend triple superphosphate, which was proposed by the researches of the EMBRAPA-CPAC, could be used for animal feed. Moreover the use of fertilizing triple Superphosphate, produced from the TAPIRA'S ROCK, as source of supplemental phosphorus, does not offer risks for human and/or animal health.

Pertinent literature

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