

**SOURCES AND RATES OF PHOSPHORUS IN IMPROVING DEGRADED
PASTURE IN BRAZILIAN WEST AMAZON**

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Abstract

The effects of phosphorus sources (triple superphosphate – TSP, single superphosphate – SSP and partially acidulated rock phosphate – PARP) and rates (0, 50 and 100 kg/ha of P₂O₅ on dry matter (DM) yields and chemical composition of a degraded *Brachiaria brizantha* cv. *Marandu* pasture were evaluated in a cutting trial. Phosphorus fertilization, irrespective of sources and rates, showed an effective agronomic technique for pasture recuperation. The grass DM yields and potassium contents were significantly improved by phosphorus application, while weed DM yields were depressed. Irrespective of sources and rates, crude protein, phosphorus, and calcium contents were not affected by phosphorus fertilization. The application of 100 kg of P₂O₅ /ha, as TSP, provided the highest grass yields, while for PARP it was observed the least effect of phosphorus fertilization.

Keywords: calcium, crude protein, dry matter, magnesium, potassium

Introduction

In Rondônia, about four million hectares, originally under forests covering, are now occupied by cultivated pastures. In the first years of exploitation, they present an excellent productivity, as a consequence of the incorporation to the soil of great amounts of nutrients contained in the ashes of the incinerated biomass. However, as time elapses a gradative reduction is observed in their productivity, with reflexes highly significant and negative in the zootechnic indexes of the flocks. Now, about 40% of the pastures in the state are in different degradation stages, what leads to continuous deforestation in order to feed the flocks appropriately, resulting in an itinerant cattle exploitation.

The degradation process resulted from the continuous decline of the productivity of the forage plants, is due to several factors, such as the low native fertility of the soils, inadequate handling of the pastures (high stocking rates and continuous grazing), absence of fertilizations, indiscriminated use of fire, compactation of the soil and the high biotics pressures (pests and diseases), which culminates in the total domination of the area by weeds (Veiga and Serrão, 1987). In this way, the traditional methods of maintenance, with burning and cleaning the pastures, become more and more innocuous. Also, the low phosphorus availability has been identified as the main cause for the instability of the pastures cultivated in Amazônia (Costa, 1996). The high phosphorus demand by the cultivated grass, associated to the losses by erosion, remotion by the grazing animals and the competition that the plants weeds exert, result in the productivity decay and the consequent degradation of the pastures.

In this work it was evaluated the effect of sources and rates of phosphorus upon the dry matter yield and forage chemical composition of *Brachiaria brizantha* cv. *Marandu* degraded pastures.

Material and Methods

A field experiment was conducted, from February 1995 to October 1997. The climate of the area is a tropical of the Am type, with annual mean temperature of 24,5°C, annual rainfall between 2.000 and 2.500 mm, with a defined dry season from June to September.

The soil of the experimental area is a Yellow Latossolo, loamy texture, with the following chemical characteristics: pH in water (1:2,5) = 5,1; Al = 0,7 cmol/dm³; Ca + Mg = 1,09 cmol/dm³; P = 2,5 mg/kg; K = 0,07 cmol/dm³ and Organic Matter = 2,59%. The experimental area consisted of a pasture of *Brachiaria brizantha* cv. Marandu, established eight years ago and characterized as being degraded for the low vigor of the grass, low forage availability and predominance of weeds (30 to 50%).

The experimental design was completely randomized blocks in split-plot with three repetitions. The phosphorus sources (triple superphosphate – TSP, simple superphosphate - SSP and partially acidulated rock phosphate - PARP) represented the main plots and the phosphorus rates (0, 50 and 100 kg of P₂O₅ /ha) the subplots. The fertilizers were broadcasted to after lowering the vegetation through two crossed ground. The main plots measured 8 x 4 m and the subplots 4 x 4 m, being the sampled area of 2,0 m². The variables measured were dry matter yields (DM) of the grass and of the weeds, and crude protein (CP), phosphorus, calcium, magnesium and potassium forage contents. The evaluations were accomplished at 12 weeks intervals, through mechanical cuts made to a height of 20 cm above the soil.

Results and Discussion

For forage dry matter yield, the variance analysis revealed a significant (P <0,05) interaction sources x phosphorus rates (Table 1). For the grass, with the use of TSP or SSP, the largest dry matter yield was obtained with the application of 100 kg of P₂O₅/ha, while for PARP significant effect was not detected (P > 0,05) between the 50 and the 100 phosphorus

rate. Independently of the applied rate, TSP was the to more efficient source (Table 1). In relation to the component weeds, significant effect was not observed ($P > 0,05$) between phosphorus rates, being the largest dry matter yield registered in the control treatment. However, its participation in the botanical composition of the pasture was reduced between 59 and 70% with the application of the different phosphorus sources and rates. Similar results were obtained by Ordoñez and Toledo (1985) and Costa et al. (1997) for degraded pastures of *B. decumbens* and *B. humidicola*, respectively, fertilized with different sources and phosphorus rates. In Pará, Couto et al. (1997), in pastures of *B. brizantha* cv. *Marandu*, verified that the application of 50 kg of P_2O_5 /ha, under the form of TSP or Phosphate of North Carolina, provided the largest forage yields, comparatively to the other used rates (100 to 250 kg of P_2O_5 /ha). In degraded pastures of *P. maximum*, the phosphate fertilization (50 kg of P_2O_5 /ha), increased more than 200% the revenues of grass forage and reduced to less than 5% the weed percentage in contrast with about 75 to 80% in the no fertilized pastures (Veiga and Serrão, 1987).

CP, phosphorus and calcium contents, significant effects were not observed ($P > 0,05$) from phosphorus sources and rates (Table 1). Similar responses were observed in *B. brizantha* cv. *Marandu*, fertilized with different phosphorus rates (0 to 300 kg of P_2O_5 /ha), which presented contents from 0,09 to 0,16% of phosphorus and 10,6 to 12,4% of CP (Paulino et al. 1994). Considering that CP contents lower than 7% are limiting to the animal production, because they imply in low volunteer intake, smaller digestibility of the forage and nitrogenous negative balance, it is verified that the grass, independently of the phosphorus sources and rates, would atend, satisfactorily the minimum needs nutritional of the animals (Minson, 1971). In the other hand, the phosphorus contents, except for the application of 50 kg P_2O_5 /ha, as TSP, were below the minimum level recommended for bovine growth, which according to the NATIONAL RESEARCH COUNCIL (1978) is 0,18%. The potassium contents were

significantly ($P < 0,05$) affected by the phosphorus sources and rates, however they didn't present a defined tendency, which could be explained by the dilution effect or concentration. In relation to magnesium, the smallest concentration was obtained with the application of 100 kg P_2O_5 /ha, as TSP, being not detected significant variations ($P > 0,05$) for the other phosphorus sources and rates (Table 1). Usually, this fact happens as a consequence of an effect of dilution of the concentration of the nutrient, in function of the largest dry matter yield with the application of increasing rates of the fertilizer, independently of the used source. Similar responses were obtained by Costa et al. (1997) for *B. humidicola*. By the results obtained we can conclude that: 1. the phosphatic fertilization, independently of the sources and rates as agronomic practice was shown to be technically viable for the recovering of pastures of *B. brizantha* cv. *Marandu*; 2. the dry matter yield of the grass was increased with the application of increasing rates of phosphorus. The inverse happened in relation to the weeds; 3. CP, calcium and phosphorus contents, independently of sources and rates, were not affected by phosphatic fertilization; 4. the application of 100 kg of P_2O_5 /ha as TSP resulted in the largest forage yields, while PARP presented the smallest effect.

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Table 1 - Dry matter yield of *Brachiaria brizantha* cv. *Marandu* and of weeds, contents of crude protein (CP), calcium (Ca), phosphorus (P), potassium (K) and magnesium (Mg), in function of of sources phosphorus sources and rates.

| Sources of Phosphorus | P ₂ O ₅ (kg/ha) | Dry matter (kg/ha) ¹ | | CP % | Ca | P | K | Mg |
|-----------------------|---------------------------------------|---------------------------------|-------|--------|--------|--------|--------|--------|
| | | Grass | Weeds | | | | | |
| Control | 0 | 1303 d | 847 a | 8,64 a | 3,75 a | 1,47 a | 13,3b | 3,04 a |
| TSP | 50 | 2374 b | 356 b | 9,39 a | 3,93 a | 1,81 a | 16,5a | 2,92 a |
| | 100 | 2650 a | 333 b | 8,53 a | 3,90 a | 1,49 a | 14,5ab | 2,27 b |
| SSP | 50 | 2044 c | 389 b | 8,40 a | 3,77 a | 1,58 a | 15,7ab | 2,95 a |
| | 100 | 2318 b | 321 b | 8,47 a | 3,97 a | 1,46 a | 15,4ab | 2,92 a |
| PARP | 50 | 1863 c | 285 b | 8,46 a | 3,95 a | 1,54 a | 15,8 a | 2,86 a |
| | 100 | 1854 c | 277 b | 9,47 a | 3,60 a | 1,76 a | 17,1 a | 2,84 a |

- Averages followed by same letterS don't differ to each other (P> 0,05) by Tukey test.

¹ - averages of six cuts