Effect of Sources and Rates of Nitrogen on Nutrients Extraction in Coastcross Pastures

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EFFECT OF SOURCES AND RATES OF NITROGEN ON NUTRIENTS EXTRACTION IN COASTCROSS PASTURES

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Abstract

The contents and the extraction of mineral nutrients were determined in a coastcross pasture established on a dark red latosol (Hapludox), in São Carlos, SP, Brazil, under tropical altitude climate, receiving five rates of urea and ammonium nitrate, applied on surface. There were differences ($P< 0.05$) among sources and rates of N. Nutrients extraction increased with the nitrogen levels. Especially high were total N (319 and 446 kg ha^{-1}) and K (341 and 467 kg ha^{-1}) extractions. When forage yield was high (treatment with 500 kg of N ha^{-1}) and for both fertilizers, macronutrients extraction was greater for K and N, followed by Ca, S, P and Mg. Micronutrients extraction occurred in the following decreasing order: Fe, Mn, Zn and Cu.

Keywords: mineral extraction, *Cynodon dactylon* cv. Coastcross, surface application, urea, ammonium nitrate.

Introduction

Pastures are the main and cheapest component of beef cattle diet in Brazil. Although tropical forage grasses generally do not reach excellent quality, since the live weight gain they are able to produce is 0.6 to 0.8 kg animal^{-1} per day (Gomide et al., 1984), the animal production per area, however, can be very high, with values up to 1,200 kg ha^{-1} per year of live weight (Corsi, 1986), due to their high potential of dry matter (DM) production.

Fertilization of pastures, mainly with nitrogen, is one of the most important factors that determines high DM production. As a result, the extraction of other nutrients of soil also occurs. This can limit efficiency of nitrogenous fertilization if these nutrients are not replaced. This effect needs also to be taken into account in pastures for cattle production, since, although 60 to 99% of ingested nutrients can return to pasture as excreta, losses can be high, because of uneven excreta distribution in pasture (Zarrow, 1987, referred by Corsi and Martha Júnior, 1997).

So, it is necessary to understand mineral extraction by forage grasses, especially in intensive production systems which use heavy fertilizations, in order to guide fertilizer use.

Material and Methods

The experiment was carried out from November 1998 to April 1999, on a coastcross (*Cynodon dactylon* cv. Coastcross) pasture, grown on a dark red latosol (Hapludox) with 30% clay, in São Carlos, São Paulo State, Brazil, at latitude 22°01´ S, longitude 47°54´ W and altitude of 836 m, exposed to a tropical altitude climate.

Experimental design was a randomized block design, with four blocks, in a 2 x 5 factorial arrangement (two N sources: urea and ammonium nitrate, and five rates: 0, 25, 50, 100 and 200 kg ha^{-1} per cutting). Treatments were applied in five consecutives periods (cuttings), during the rainy season. Plot size was 4 x 5 m^2, with an usable surface of 6 m^2 to evaluate forage yield.

Soil base saturation was increased to 70% with lime application, besides the addition of 100 kg ha^{-1} of P_2O_5 as single superphosphate, and 30 kg ha^{-1} of FTE BR-12. Potassium was applied as KCl during the N application, at rates of 320 kg ha^{-1} on treatments 0, 100 and 250 kg N ha^{-1} and at a rate of 700 kg of K_2O ha^{-1} on treatments 500 and 1,000 kg of N ha^{-1}.

Forage cuttings were made in a 24-day interval, at the height of 10 cm. After weighing plot yield, a sample of 500 g of green forage was dried at 60°C in a stove with air circulation until constant weight was obtained, to calculate dry matter. Mineral concentration was analyzed (Malavolta et al., 1989) to calculate the extraction of each element (EExt) by the forage dry matter: EExt (in kg ha^{-1} or g ha^{-1}) = 0.001 x [dry matter (in kg ha^{-1}) x E concentration (in g kg^{-1} or mg kg^{-1})].

Total nutrients extraction by coastcross dry matter was estimated within-sources-rates interaction by a polynomial regression using REG procedure (SAS, 1993).

Results and Discussion

Analysis of variance showed differences ($P<0.05$) among N sources and rates, and rate x source interaction for N, K, Mg, Cu, Zn e Mn. The quadratic polinomial regressions estimated adequately extracted macro and micronutrients within-sources-rates interactions, with determination coeficients (R^2) greater than 90.0%, except for Fe (R^2 = 56.0%).

Comparing the N rates more commonly used, within 250 and 500 kg ha^{-1}, with the control, an increase in extraction of 3.5 to 5.5 times of N and Cu was verified; of 3.0 to 3.5 times of P and Mn; of 3.0 to 4.0 times of S and Ca; of 4.0 to 6.0 times of K; of 3.0 to 4.5 times of Zn; and of 2.0 times of Fe.

Maraschin (1988) reported that nutrient removal of soil by *Cynodon* varieties tend to be high with high forage yields and that the addition of N increases DM yield and also requires more fertilizer. The author, citing Pratt and Darst (1987), mentions data that indicates the need of more nutrients and a continuous application for sustainable levels of production. These data indicates, for Coastal Bermuda grass, a nutrient removal (kg ha^{-1}), due to productions of 6 and 12 t ha^{-1} of DM, respectively, N = 270-540, P = 30-60, K = 250-498, S = 30-60, Mg = 48-96. In the present experiment, results (Figure 1) also indicates that extraction of nutrients increases with N levels and that this nutrient removal is also considerable.

Figure 1 indicates that in treatments with 500 and 1,000 kg of N ha^{-1}, in which applied K rates were greater because forage yield was greater, the higher extraction of this nutrient in these treatments reflects this greater quantity of applied K. Since there was a decrease in the increments of forage yield, mainly at the highest N rate (Corrêa et al., 2001), this greater K extraction in treatments with 500 and 1,000 kg of N ha^{-1}, mainly as ammonium nitrate, is signalizing for a luxury use of this nutrient.

For high forage yields (treatment 500 kg ha^{-1}) and for both fertilizers, macronutrients extraction was greater for K and N, followed by Ca, S, P and Mg. Micronutrients extraction occurred in the following decreasing order: Fe, Mn, Zn and Cu. This fact agrees with the assertion (Silva, 1995) that N is one of the most absent elements in soil and that it has a fundamental role in modulation of response to plant fertilization.

It could be concluded that high coastcross forage yields need high replacements of nutrients, in order to avoid a decline in pasture productivity and to maintain its persistence.

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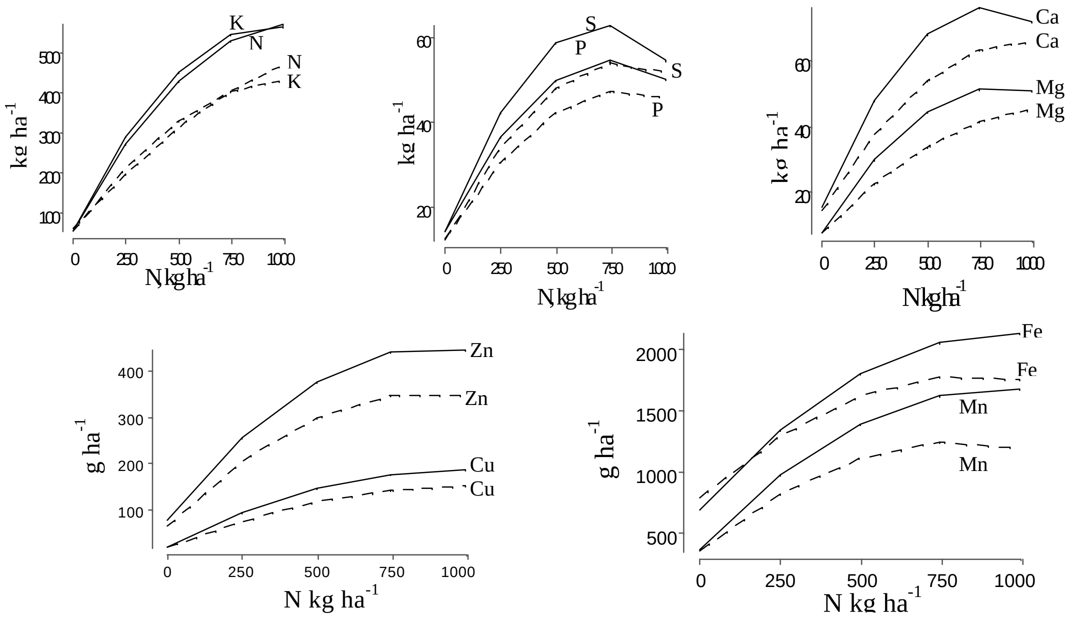

Figure 1 - Adjusted quadratic polynomial regression for extracted macronutrients (kg ha^{-1}) and micronutrients (g ha^{-1}) by coastcross forage fertilized with ammonium nitrate (bold lines) and urea (dashed lines).