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each plot four PVC rings were partially buried into the soil in order to receive the ammonia trap, and were treated with amounts of N fertilizer corresponding to those of the rest of the plot. After each change of the polyurethane discs or after a rainfall of 10 mm or more, traps were moved to another ring. Grass was cut in 24-day intervals, 10 cm above soil surface. Dry matter weight as well as N content was determined in forage samples.

The $N\text{-}NH_3$ losses of the coastcross pasture was estimated within N source and cutting period, considering N doses, by a polynomial regression using REG procedure (SAS, 1993).

RESULTS AND DISCUSSION

Nitrogen levels and sources affected ($P<0.01$) N losses. Losses of ammonia by volatilization from plots treated with ammonium nitrate reached a maximum of 1.6% of N added, whereas losses varied from 1.1 to 52.9% in those receiving urea. Losses of N did depend on applied N level and on climate, especially the amount of rainfall in the period (Table 1). Nitrogen losses occurred mainly in the first three days after urea application, suggesting that a rapid hydrolysis of the fertilizer took place under the experimental conditions (Figure 1). After this time, rate of losses decreased, probably due to a drop of soil pH associated with OH^- consumption during volatilization and with nitrification of ammonium (Whitehead, 1995). Nitrogen losses were related to rates of N applied, with mean losses of 14.6 and 40.2% for 25 and 200 kg N ha^{-1} per cutting, respectively. Intensity of N losses was reduced by rain, mainly in the first three days after N fertilizer application, when hydrolysis of urea was higher. For a rainfall above 10 mm, N losses from urea were only 12.5% in an area treated with 200 kg N ha^{-1} per cutting, whereas it reached almost 53% when no rain occurred after the application of the same rate of urea (Figure 1: P2 and P5, respectively).

It could be concluded that in the studied conditions: 1. Nitrogen losses from urea were higher in the first three days after surface application; 2. Intensity of ammonia volatilization increased with increase in rates of N fertilizer application and it was reduced by rain occurring in the first three days after urea application.

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ID # 04-26

Effect of sources and rates of nitrogen on nutrients extraction in coastcross pastures[1]

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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.

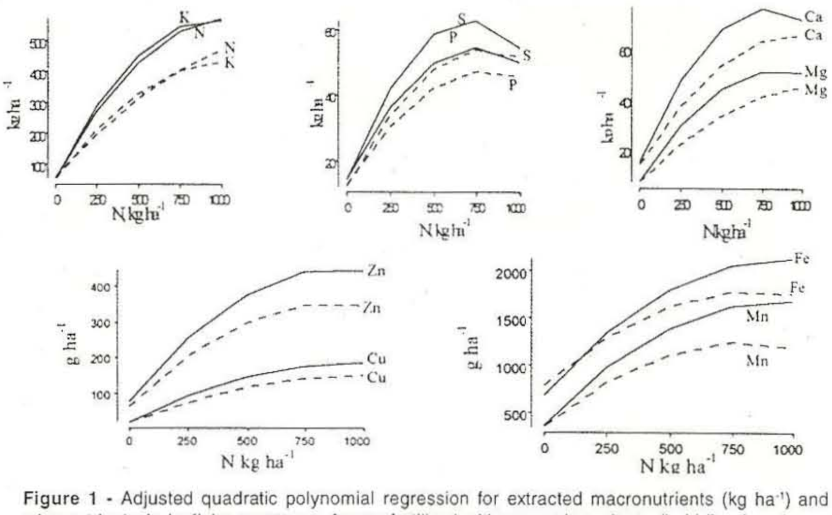

Figure 1 - Adjusted quadratic polynomial regression for extracted macronutrients (kg ha^{-1}) and micronutrients (g ha^{-1}) by coastcross forage fertilized with ammonium nitrate (bold lines) and urea (dashed lines).

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Dry matter production response of coastcross (*Cynodon dactylon* (L.) pears) to sources and rates of nitrogen[1]

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ABSTRACT

Dry matter production of a coastcross pasture grown on a dark red latosol (Hapludox), in São Carlos, São Paulo State, Brazil, under tropical altitude climate, was evaluated. The goal was to verify the efficiency of N rates as urea and ammonium nitrate: 0, 25, 50, 100 and 200 kg ha^{-1} per cutting, in five periods. Both sources were equally efficient. The mean N rates, which produced 80% of maximum forage yield, were 78 and 58 kg N ha^{-1}, respectively, for urea and ammonium nitrate, and were related to dry matter yields of 2,769 and 3,347 kg ha^{-1} per cutting.

KEYWORDS: Ammonium nitrate, forage production, nitrogen fertilizer, pasture, urea.

INTRODUCTION

Although tropical forage grasses do not achieve the quality of the temperate climate grasses, animal productivity on tropical grasses can be high, due to their high dry matter production potential. To express this potential, nitrogen fertilization is one of the most important factors. Response of tropical forages to high N levels has been reported by several authors (Vicente-Chandler et al., 1959; Werner et al., 1967; Corsi, 1986). Vicente-Chandler et al. (1959) found responses up to 1,800 kg of N ha^{-1} per year, but the greatest yield increases range from 300 to 400 kg of N ha^{-1} per year (Werner et al., 1967; Olsen, 1972; Gomes et al., 1987). In relation to coastcross, it can be concluded that responses to applied N depend on management (Monteiro, 1996), with responses occurring up to 500 kg of N ha^{-1} per year (Alvim et al.,

Additional studies are needed in order to establish the most useful N source and the most adequate N rate for intensively managed pastures, mainly when urea is used on soil surface, due to NH_3 losses by volatilization, depending on the climatic conditions.

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 (latitude 22°01´S, longitude 47°54´W and altitude of 836 m), under a tropical altitude climate. Lime was applied to raise soil base saturation to 70% of the cation exchange capacity, and fertilizer was added at a level of 100 kg of P_2O_5 ha^{-1} as single superphosphate, and 30 kg ha^{-1} of micronutrients as FTE BR-12. Potassium was applied as KCL, along with N treatments, in order to replace K removed by cuttings and to maintain K levels in the dry matter at a minimum of 20 g kg^{-1}.

Experimental design was a randomized block one, 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), with four replications. Treatments were applied after each of five consecutive periods (cuttings), in the rainy season. Plot size was 4 x 5 m^2, in which an area of 6 m^2 was used to evaluate forage yield. Forage was cut in 24 to 37-day intervals, 10 cm above soil surface. Dry matter weight was determined in forage samples.

Coastcross dry matter production was estimated within N source and cutting periods by a polynomial regression using REG procedure (SAS, 1993). Eighty percent of the maximum yield was estimated using the fitted model.