APPARENT RECOVERY OF SURFACE APPLIED NITROGEN FERTILIZER BY A COASTCROSS PASTURE

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Abstract

Nitrogen recoveries from five levels of urea and ammonium nitrate surface-applied on coastcross pasture, grown on a dark red latosol (Hapludox), in São Carlos, SP, Brazil, under tropical altitude climate, were estimated. Significant differences occurred within periods ($P<0.05$), depending on climatic conditions. Under adequate plant growth conditions, mean N recovery from urea was about 67%, sometimes reaching 80%, of that from ammonium nitrate. Recovery of ammonium nitrate varied from 45 to 68% of applied N.

Keywords: Ammonium nitrate, *Cynodon dactylon* cv. Coastcross, pasture, recovery, urea.

Introduction

Nitrogen is the most important mineral nutrient to optimize dry mater production of tropical forage grasses. Several authors (Vicente-Chandler et al., 1959; Werner et al., 1967; Corsi, 1986) showed responses of tropical forage grasses to high N levels.

Apparent grassland recovery of N fertilizer is usually within limits of 50 and 80%, and often about 65 to 70% (Dilz, 1988 and Morisson et al., 1989, cited by Whitehead, 1995). With increasing N rates, less N is recovered. According to Corsi (1975), a very low N recovery by tropical forage grasses should be expected, due to deep soils and heavy rains in some periods. Corsi (1994) found that up to 80% of N can be recovered when adequately applied.

Soil surface application of urea, the most common nitrogen fertilizer in Brazilian market, can reduce N recovery by plants, due to losses of NH_3 by volatilization (Terman, 1979).

Urea has a high N concentration, it is easy to manipulate and it causes little soil acidification; so, it is potentially superior to other N sources, from the economic view point. This encourages further studies with urea, mainly due to its efficacy on intensively managed pastures, under high evapotranspiratory 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 rate of 100 kg of P_2O_5 ha^{-1} as single superphosphate, and 30 kg ha^{-1} of micronutrients FTE BR-12. Potassium was applied as KCL, along with the N treatments, in order to replace K removed by cuttings and to maintain K levels in the forage 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 at 24 to 37-day intervals, 10 cm above soil surface. Dry matter weight as well as N concentration (Malavolta et al., 1989) were determined in forage samples. Nitrogen extraction (ext) was calculated by the formula: N(ext) (kg ha^{-1}) = 0.001*[dry matter (kg ha^{-1})*N concentration (g kg^{-1})]. Apparent N recovery [N(rec)] was estimated by the formula: N(rec) (%) = 100*[(N(ext) by fertilized plot - test plot)/applied N dose]. The amount of N in herbage of the unfertilized plots provided an estimate of the N supply originated from soil and atmosphere.

The data were submited to Variance Analysis and the means were compared using Tukey test (SAS Institute, 1993).

Results and Discussion

Apparent N fertilizer recovery varied ($P<0.01$) with N sources, N rates and periods. With increasing N rates occurred a decrease in the apparent N recovery (Table 1), due to a reduction of the dry matter production efficiency. Except for the first period, in which climatic conditions were not adequate (beginning of rainy season, still with dry soil), N recovery was relatively high for both sources, mainly for ammonium nitrate. Therefore, under adequate conditions for plant development (second and fifth period), mean N recovery from urea was 72%, sometimes up to 80%, of that obtained from ammonium nitrate, which ranged from 45 to 75% of the applied N. Data show the high N extraction potential by plants, considering that part of the nitrogen, not determined, is immobilized in roots and stolons, and soil microbial biomass, mainly in intensive rotational systems. Impithuksa and Blue (1985), cited by Monteiro (1998), recorded a 20% N immobilization by roots and stolons, and 30% N by soil microbial biomass, for each of 45% N recovered by forage. This high N extraction by tropical forage grasses may contribute in the reduction of environmental risks, such as nitrate losses, mainly in deep tropical soils.

It could be concluded that apparent N recovery by coastcross herbage was high, and affected by N sources, N doses and period.

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Table 1- Nitrogen extraction (E) and N recovery (R) by coastcross, in five consecutive periods.

	Periods											
N rates (kg ha^{-1})	-----1st-----		-----2nd-----		-----3rd-----		-----4th-----		-----5th-----		mean	
	E kg/ha	R %	E kg/ha	R %	E kg/ha	R %	E kg/ha	R %	E kg/ha	R %	E kg/ha	R %
						Urea						
0	1	0	9	0	10	0	37	0	12	0	14e	0
25	2	3	22	50	24	55	54	57	26	60	26d	45ab
50	4	6	54	88	29	36	76	74	40	56	41c	52a
100	13	11	86	74	48	36	105	59	67	52	64b	46ab
200	31	15	146	65	65	25	141	41	93	37	95a	37b
						Ammonium nitrate						
0	1	0	10	0	8	0	39	0	12	0	14e	0
25	3	7	32	87	25	65	64	92	33	87	32d	67a
50	13	24	63	100	48	79	85	77	60	96	54c	75a
100	26	34	108	94	82	70	136	77	84	66	89b	68a
200	118	58	142	61	78	32	147	39	89	35	115a	45b
Tukey critical range:												
N sources											4.8**	5.2**
rates and periods											9.0**	9.7**

Ext. = dry matter N extraction, in kg ha^{-1}; Rec. = N fertilizer recovery, in %.