EFFECT OF N AND P FERTILIZERS ON NUTRITIVE VALUE OF DWARF ELEPHANTGRASS (*PENNISETUM PURPUREUM)* CV N-75 MOTT

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ABSTRACT

Crude protein (CP), Ca and P concentrations and *in vitro* dry matter digestibility (IVDMD) of irrigated dwarf elephantgrass (*Pennisetum purpureum* cv. N-75 Mott) as affected by the factorial combination of N (0, 150, 300 and 450 kg N/ha/year) and P (0, 50 and 100 kg $P_2 0_5$/ha/year) fertilization was evaluated in a tropical dry forest in Zulia State, western region of Venezuela. A randomized complete block design with three replications was used. Soil was a low-fertility sandy-loam Udic Paleustalf (pH 6.1). Nitrogen fertilization did not influence (P>0.05) any of the variables. Mean CP, IVDMD, Ca and P were: 8.13, 61.3, 0.26 and 0.33 %. Phosphorus fertilization only influenced forage Ca content, which decreased (P<0.05) from 0.30 to 0.23 % as applied P rate was increased. The NxP interaction was not significant (P>0.05).

KEYWORDS

Pennisetum purpureum, nutritive value, fertilization, nitrogen, phosphorus.

INTRODUCTION

Dwarf elephantgrass (*Pennisetum purpureum* Schum. cv. N-75 Mott) was obtained from the Merkeron hybrid. The discovery of dwarf genes in this species led to renewed interest on its use for pastures. This species is adapted to well-drained areas with 1300 to 3500 mm annual rainfall, where high amounts of medium- to high-quality forage can be obtained (González, 1995). Carrying capacity of four to seven animals/ha, average daily gains of 0.9 kg/animal and milk productions over 16000 l/ha/year has been reported for this grass (Mott, 1984; González, 1992).

Fertilization with major elements to maintain adequate soil fertility is required by high-yielding forages due to their capacity for extracting soil nutrients. In tropical regions with lower rainfall and seasonal (wet/dry) climates, pasture irrigation is justified in intensive dairy production systems to take advantage of the productive potential of those species. However, very little information on the nutritive value of dwarf elephantgrass under these conditions was found.

The objective of this research was to evaluate some components of the nutritive value of irrigated dwarf elephantgrass as affected by nitrogen and phosphorus fertilization under tropical dry forest conditions in Venezuela.

MATERIALS AND METHODS

The experiment was conducted on a dwarf elephantgrass pasture in Zulia State, western region of Venezuela (10º 28' N lat., 72º 05' W long.). Climate and vegetation correspond to a tropical dry forest. Average annual rainfall and temperature are 750 mm and 28 ºC, respectively. Soil is a sandy-loam Udic Paleustalf with pH 6.1, 2.6 and ppm P. Exchangeable Ca, Mg, K and Na were 5, 3, 0.20 and 0.17 meq/100 g soil.

Thirty-six plots (3 x 4 m) of dwarf elephantgrass were used to evaluate the factorial combinations of four rates of N fertilization (as urea), 0, 150, 300 and 450 kg/ha/year, applied in equal fractions after each cutting, and three rates of P_2O_5 (as triple superphosphate), 0, 50 and 100 kg/ha/year applied at the beginning of the trial, using a randomized complete block design with 3 replications. The experimental area was irrigated with sprinklers to provide 50 mm water/week. Seven harvests of all plant material from the central area (2x3 m) of each plot were carried out at 45-day intervals. Forage crude protein (CP) content (Kjeldahl procedure), *in vitro* dry matter digestibility (IVDMD) (modified Tilley and Terry procedure) and Ca (atomic absorption spectrophotometry) and P concentrations (colorimetric method) were determined in composite samples collected from each plot at every cutting.

The analysis of variance and mean comparisons were conducted using the general linear model procedure of the Statistical Analysis System (SAS).

RESULTS AND DISCUSSION

Mean CP content, IVDMD, and Ca and P concentrations of dwarf elephantgrass as affected by N fertilization are given in Table 1. No differences (P>0.05) between N rates were detected for any of the variables. Average CP content was 8.2 %. The initial effect of increasing N fertilization rate is usually an increase of dry matter yield, with little or no effect on plant tissue N (Reid and Horvath, 1980). In relation to IVDMD, Valentim et al. (1988) found no effect of up to 300 kg N/ha on dwarf elephantgrass. The influence of N fertilizer on DM digestibility depends on the balance between the beneficial and detrimental effects on sward development and tissue composition (Wilson, 1982). No consistent effect of N fertilizers on forage Ca levels has been found since it depends on soil levels of Ca and other elements, particularly N and K (Minson, 1990). Forage P concentration had a non-significant (P>0.05) trend to decline with increasing applied N, probably due to dilution in the additional dry matter production (Minson, 1990) and to reduced P uptake when soil P reserves are low (Reid and Horvath, 1980).

In relation to the effects of P fertilization (Table 2), forage Ca decreased (P<0.05) with increasing P fertilizer, while the other variables were unaffected. A decline in forage Ca with P fertilizers has been reported in several grasses (Mesa and Hernández, 1989). Forage P tended to increase with applied P. Fertilizer P often has little effect on herbage P content unless the soil is severely deficient (Minson, 1990). In relation to IVDMD, several authors (Wilson, 1982, Minson, 1990) have concluded that there is little or no influence of P fertilization. No significant effect of the N x P interaction was detected on any of the studied variables.

Overall CP and IVDMD values of dwarf elephantgrass obtained in this research were lower than those found by Mott (1984) but in agreement with those reported by González (1990).

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Table 1

In vitro dry matter digestibility (IVDMD) and crude protein (CP), Ca and P contents (%, dry basis) of dwarf elephantgrass (*Pennisetum purpureum)* as affected by N fertilization[z].

N fertilization, kg/ha/year	IVDMD	CP	Ca	P
0	60.1	8.00	0.27	0.35
150	62.0	8.31	0.26	0.36
300	61.6	8.06	0.27	0.30
450	61.3	8.13	0.26	0.31
Overall	61.3	8.13	0.26	0.33
SE[y]	1.2	0.24	0.01	0.02

[z] Least-square means based on 63 observations and did not differ among N levels.
[y] Standard error of the least-square means.

Table 2

In vitro dry matter digestibility(IVDMD) and crude protein (CP), Ca and P contents (%, dry basis) of dwarf elephantgrass (*Pennisetum purpureum)* as affected by P fertilization[z].

P fertilization, kg P_2O_5/ha/year	IVDMD	CP	Ca	P
0	61.1	8.15	0.30 [a]	0.31
50	62.7	8.15	0.26 [ab]	0.33
100	59.9	8.16	0.23 [b]	0.35
SE[y]	1.7	0.21	0.01	0.01

[z] Least-square means based on 84 observations.
[y] Standard error of the least-square means.
a, b Means on the same line with different superscripts are different, P<0.05.