Nitrogen Fertilization in *Paspalum dilatatum*, Poir: Herbage Production, Nutritive Value and Structural Characteristics

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NITROGEN FERTILIZATION IN *Paspalum dilatatum*, POIR: HERBAGE PRODUCTION, NUTRITIVE VALUE AND STRUCTURAL CHARACTERISTICS

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Abstract

It was studied the effect of nitrogen application on structural changes and quantity and quality characteristics of a *Paspalum dilatatum* Poir sward, under field conditions during two growing seasons. The nitrogen (N) rates were 0 and 440 kg ha^{-1} applied during the first year in split applications. The nitrogen fertilization increased leaf, stem and cumulative total dry matter yield, plant height, tiller density, cover ground and leaf crude protein yield.

Keywords: *Paspalum dilatatum*, nitrogen fertilization, sward structure, production, nutritive value.

Introduction

Paspalum dilatatum Poir (dallisgrass) is a summer grass that thrives in temperate humid natural pastures of the Pampean region of Argentina and of subtropical humid areas of northern Argentina, Uruguay and South Brazil, and makes a high contribution to herbage production in these areas. The enhancement of digestible dry matter and herbage mass in summer as a consequence of the inclusion of *Paspalum dilatatum* in temperate cultivated pasture systems, has already been reported (Acosta et. al. 1994). Basic knowledge on tiller

density, leaf and stem proportion, variations in vertical herbage distribution contribute to the understanding of the plant response to grazing management and N fertilization. It was demonstrated that grazing practices increased the number of true stem segments, the basal area, and the branching angle of plants of dallisgrass, and decreased the internode length of them, concluding that these responses could play an important role in persistence (Vignolio et. al. 1998). However, these plants may also show a more prostrate growth habit. This growth habit variation may negatively affect herbage intake (Lemaire and Chapman 1996). As nitrogen fertilization has an important effect on the expression of plant morphogenesis because of its effects upon variables related to the sward structure (Cruz and Boval, 1999), it may be used as a tool for the enhancement of forage intake due to a better forage access. This work was carried out in order to study the effect of nitrogen (N) fertilization on structural changes and quality and quantity characteristics of a *Paspalum dilatatum* sward.

Material and Methods

Data were collected for two consecutive growing seasons (1995-1996 and 1996-1997) in the experimental field of the Faculty of Agronomy, University of Buenos Aires, in Buenos Aires, Argentina (34º 35 S – 58º 29 W). The soil of the experimental area had the following composition: C% = 1.32; N% = 0.12; P (ppm) = 9.19 and pH = 6.2. *Paspalum* plants were planted in the spring of 1995 in rows 0.15 m apart, and with 0.20 m between plants in the same row. They received 65 mm by week irrigation. Six plots of 4 m^2 were used, being the sampling area of 2.3 m^2 per plot. A randomized block design with three replications was used. Two fertilization levels were imposed, N_0 = no fertilization and N_1 = 440 kg N ha^{-1}. Nitrogen was applied one week after each cut as urea during the first experimental year in split applications of 88 kg ha^{-1} on October 19 1995 (planting date), January 4 1996 and February 13 1996, and 176 kg ha^{-1} on March 18 1996. Cuts for yield evaluation were done every time

the sward reached 60% of the tillers at inflorescence emergence. Cuts were made to 3 cm stubble heights. The harvested material was separated by hand in leaf blades and stems. Forage was oven dried at 65º C until constant weight. Tiller density (tillers m^2) was counted at the end of each growing season in fixed quadrats of 0.25 m^2 randomly put in each plot. Sward structure was estimated immediately before cut, herbage was harvested in 10 cm stratified layers as described by Stobbs (1973). The mean height of sward, excluding inflorescences was determined using a meter rule at 30 random measurements taken in each plot. Ground cover by *Paspalum* plants was estimated by point interception in late winter on 6 September 1996, along two transects per plot at 5 cm intervals. Each point was recorded as green leaf, dead leaf, and bare ground. The nutritive value was evaluated through acid detergent fiber (ADF) analysis (Goering and Van Soest 1970) and crude protein (CP) content was determined by the standard Kjjeldahl procedure (N x 6.25) (A.O.A.C., 1984). Data were analyzed by analysis of variance using the linear model procedure of the STATIXTIS 3.5 program, and significant treatment means were compared by Tukey test ($P<0.05$).

Results and Discussion

The *Paspalum* sward showed an increase of dry matter yield with nitrogen application. As noted in Table 1, the cumulative total dry matter yield for first (1995-96) and second (1996-97) growing seasons was 1.6 and 2.2 times the yield obtained with 0 kg N ha^{-1}. Similar increase showed the cumulative leaf and stem dry matter yield. The N efficiency of dry matter yield was of 12.4 kg per kg N. This result was lower than that found by Faría (1997) for other C_4 grasses. However, it was registered a residual effect during the second growing season, as it was shown by yield response maintenance without fertilization application. The plant height was affected by N fertilization (Table 2). The plant height for N_1 in spring and summer was 18 cm and 10 cm taller than that for N_0. The study shows the positive relationship between

dry matter yield and plant height as the N rate increases. *Paspalum* showed an increased cumulative dry matter, partitioned into leaf and stem with increasing rate of N (Table 1). This behavior was coincident with the increment in tiller density (Table 2). The biomass on offer in the upper layer of the canopy (> 10 cm) was 61% and 44% in spring and 31% and 24% in summer for N_1 and N_0 (Table 2). This fertilization response shows a better spatial distribution of herbage, which would affect positively ingestive behavior of grazing animals. In relation to the effects of N fertilization on cover ground (Table 2), increased green leaves at late winter, indicate lower losses by senescence and longer leaf life span. No differences between, N rates for ADF and CP contents. Leaf and stem CP contents were only higher in summer for N_1 than N_0. Nevertheless, leaf CP yields (kg ha^{-1}) during the two growing seasons increased with N fertilization 2,13 times (852 and 400 kg ha^{-1} for N_1 and N_0). These results indicated that N fertilization is an effective tool to modify positively structural, quantity and quality characteristics of *Paspalum* sward and to obtain increments in herbage production and efficiency of herbage use.

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Table 1 - Effect of nitrogen on cumulative dry matter yield and fractions of *Paspalum dilatatum* in growing seasons.

Growing Season	1995-96 (from three cuttings)			1996-97 (from four cuttings)		
Treatments	N_1	N_0	p	N_1	N_0	p
Cumulative DM yield (kg ha^{-1})	7239	4529	0.03	5110	2370	0.006
Cumulative DM leaf (kg ha^{-1})	2800	1768	0.03	3875	1895	0.008
Cumulative DM stem (kg ha^{-1})	4439	2761	0.04	1235	475	0.009

p= probability

Table 2 - Effect of nitrogen on tiller density, cover of plants, sward structure and nutritive value in different growing seasons.

Date	Late winter 1996			Late winter 1997		
Treatments	N_1	N_0	p	N_1	N_0	p
Tiller density (tiller m^{-2})	777	549	0.019	921	737	0.049
Cover (%)						
Green leaf	59	24	0.013			
Dead leaf	27	45	0.048			
Bare ground	14	31	0.028			
	Spring (means two years)			Summer (means two years)		
Layers (% DM yields)						
< 10 cm	39	56	0.02	69	76	0.01
10-20 cm	30	25	0.01	15	10	0.01
20-30 cm	18	10	0.007	8	7	0.25
> 30 cm	13	9	0.11	8	7	0.41
Height (cm) (Excluding inflorescences)	34.6	16.8	0.0001	29.2	19.3	0.002
ADF (g kg^{-1} DM)						
Leaf	386	392	0.677	385	388	0.46
Stem	436	428	0.547	431	441	0.311
CP (g kg^{-1} DM)						
Leaf	117	111	0.154	159	139	0.0007
Stem	603	696	0.073	101	81	0.002

p= probability