EFFECT OF NITROGEN FERTILIZATION UPON SPRING GROWTH IN THINOPYRUM PONTICUM IN ALKALINE SOILS. ARGENTINA

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ABSTRACT

Wheatgrass is a perennial forage grass adapted to low fertility alkaline soils in the Flooding pampa. It has an annual forage growth cycle characterised by a high spring-summer concentration and low values in winter. The objective of this study was to assess that it is possible to anticipate and increase forage growth and DM production of wheatgrass pastures applying nitrogen fertilization. The experiment was carried out at the Balcarce Experimental Station from 28/08/95 to 04/12/95. Using a completely randomized block design the effects of 6 levels of N: 0, 50, 100, 150, 200 and 250 kg Nha^{-1}, added as NO_3 NH_4 were evaluated. The highest forage accumulation was reached with N250 with no differences (p>0,05) with N200 and N150, showing a threefold increase in forage accumulation when compared with N0. A decreasing increment in forage accumulation was obtained with increasing N doses and the highest was with N50 and the lowest with N250 (43 kg DM and 17 kg DM/kg N applied respectively). The results show that nitrogen fertilization can increase and anticipate forage growth and DM production of wheatgrass pastures in late winter and early spring.

KEYWORDS

Wheatgrass, nitrogen fertilization, growth, forage acumulation

INTRODUCTION

The Pampa Deprimida (lowland area of the Pampas) is considered as the principal cattle zone in the province of Buenos Aires, since 26% of its area contains 38% of all the cattle (Fundación COREPRO, 1996). The main forage component are natural pastures, which due to their edaphic and floral heterogeneity present different vegetal communities and therefore, differential productivity. In this sense, the community located on low and alkaline soils has a productivity of 2000 - 2500 kg DM ha^{-1} $year^{-1}$ (Brizuela *et al.*, 1990). The low vegetal coverage dominated by salt grass (*Distichlis spicata*) causes the recommendation of its replacement by wheatgrass (*Thinopyrum ponticum*). Wheatgrass is a perennial gramineous forage adapted to alkaline soils of low fertility that presents an annual cycle of forage growth with high concentration in spring-summer and the lowest values in winter. The purpose of this work was to verify that lacking hydric limitations and other nutrients, nitrogen fertilization would produce a high impact on the primary productivity of a pasture of wheatgrass.

MATERIALS AND METHODS

The experiment was carried out in the Research Station of Balcarce on a pasture of wheatgrass sowed in September, 1982 on a Natracualf. Soil analyses showed that at the beginning of the experiment (August, 1995) the pH was 9.1 and the contents of OM and assimilable P were 79 g kg^{-1} and 15 mg kg^{-1}, respectively. Nitrate concentration in the first 40 cm was 8 mg kg^{-1}. In a randomized block design with three repetitions 6 doses of nitrogen were evaluated: N0, N50, N100, N150, N200, and N250, added as calcareous NH_4N0_3. After an initial cut (T0) made on 28/08/1995 treatments were applied and to prevent P deficiencies, 20 kg ha^{-1} of P were added as super $Ca_3(PO)_2$. Forage accumulation was determined by cuts made throughout the experiment in the central 5 m^2 of a 7.5-m^2 plot at an average height of 2.5 cm. Harvests were made on 19/10 (T1), 1/11 (T2), 10/11 (T3), 21/11 (T4), and 4/12 (T5). The accumulated rainfall during the experimental period was of 250 mm. Statistical comparisons were made by analysis of variance and regression methods (GLM and REG, SAS, 1989).

RESULTS AND DISCUSSION

Nitrogen fertilization increased (p 0.05) forage accumulation in all harvest intervals (partially shown data) and maximum differences were found at the end of the evaluation period. The maximum value in T0 - T5 was obtained with N250, without differences (p 0.05) for N200 and N150 and almost tripling the accumulation of forage of N0. Daily growth rates were estimated starting from the accumulation of forage by means of linear regression. Growth rates for nitrogen doses that differed (p 0.05) were 50.54 ± 17.54, 96.98 ± 6.22, 108,51 ± 4.16, and 147.14 ± 13.52 for N0, N50, N100, and N150, respectively (Table 1).

The mathematical description of the response of forage accumulation to nitrogen fertilization was possible through the resolution of a negative exponential model. The proposed model was the following:

FA: K + (1 - exp (- N doses)

FA: forage accumulation

K: FA for NO

and : coefficients calculated for the model

FA: 3208.5 + 10250 (1- exp (-0.0047 Ni)

With the values adjusted by the model, the marginal increase of dry matter for each treatment was quantified, obtaining a decreasing increment of N0 (43 kg of DM per Kg of nitrogen) up to N250 (17 kg of DM per kg of nitrogen). These results would be showing the efficiency with which each kilogram of additional nitrogen produces a determined quantity of dry matter. These values agree with those found in literature for similar environmental conditions (Fernández Grecco *et al.*, 1995; Marino *et al.*, 1995).

The different growth rates recorded show that by means of nitrogen fertilization it is possible to increase and anticipate the forage accumulation of a wheatgrass pasture.

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Table 1
Effect of nitrogen fertilization on the accumulation of forage and growth rate for the period 28/08 - 4/12

N Doses	Dry matter accumulation (kg ha^{-1})	Growth rate (kg ha^{-1} day^{-1})
N0	3208.5 ^{d}	50.54 ± 17.54
N50	5677.8 ^{c}	96.98 ± 6.22
N100	6747.4 ^{cb}	108.51 ± 4.16
N150	8554.2 ^{ba}	147.14 ± 13.52
N200	9512.7 ^{a}	165.23 ± 37.36
N250	10355.2 ^{a}	172.22 ± 36.09

Figures followed vertically by the same letter superscripts are not significantly different. Duncan's test (p 0.05)