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EFEITOS DA FERTILIZAÇÃO COM NITROGÊNIO SOBRE A PRODUÇÃO E EFICIÊNCIA DO USO DA ÁGUA EM CAPIM BUFFEL

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Resumo - Foi avaliado o efeito de cinco níveis de adubação nitrogenada (0; 60; 120; 240 e 480 kg de N/ha) sob o desempenho do Capim Buffel (*Cenchrus ciliaris*, L.). O delineamento experimental utilizado foi inteiramente casualizado, com três repetições. Foram avaliados a produção de matéria seca da parte aérea (PMSPA), produção de matéria seca das raízes (PMSR), relação folha/colmo (RFC), número de perfilhos (NP) e eficiência de uso d'água (EUA). Foi constatado um efeito linear ($P < 0,002$) para PMSPA e PMSR e um efeito linear e quadrático ($P < 0,02$) para NP e EUA. A RFC não foi influenciada pela adubação nitrogenada. De maneira geral, pode-se concluir que o Capim Buffel respondeu positivamente à adubação nitrogenada.

Palavras-chave: Plantas forrageiras, cobertura vegetal, pastos, semi-árido.

EFFECTS OF NITROGEN FERTILIZATION ON BUFFEL GRASS PRODUCTIVITY AND WATER EFFICIENCE USE

Abstract - The effects of five levels of nitrogen (N) fertilization (0; 60; 120; 240 and 480 kg of N/ha) upon Buffel grass (*Cenchrus ciliaris*, L.) performance were evaluated. A completely random design with three replicates was used. Dry matter yield of aerial portion (DMYAP), dry matter yield of roots (DMYR), leaf/stem ratio (LSR), number of tillers (NT) and water use efficiency (WUE) were measured. The results showed a linear effect ($P < 0.002$) on DMYAP and DMYR and linear and quadratic effects ($P < 0.02$) on NT and WUE. LSR was not influenced by the nitrogen fertilization. Overall, it could be concluded that Buffel grass responded positively to nitrogen fertilization.

Key words: forage plants, plant canopy, pastures, semi-arid.

INTRODUCTION

The Buffel grass (*Cenchrus ciliaris*, L.) is perennial forage that tolerates semi-arid conditions, grazing and is not very exigent in soil fertility (Araujo Filho, 1988). These qualities permit point the Buffel grass as a good alternative to improve the animal production in semi-arid zone of Brazil (Oliveira, 1996). The mean productivity of Buffel grass in this region is 5.500 kg, on dry matter basis of forage per hectare per year without correction of soil fertility (Oliveira, 1996). However, this production could be improved with use nitrogen fertilizer (Wiedenfeld, 1987).

On the other hand, experiments that evaluate forage production with use nitrogen or other fertilizer is not common in semi-arid zone of Brazil. In this region, the soil is poor in fertility, principally in organic matter, and rain events are less and had an irregular distribution during the year (Aouad, 1984). In this way, water is not the unique limiting factor that affects the growth forage. It is also associate with poor soil fertility conditions and a competition for nutrients with native species.

For these reasons the research was carried out to study the effects of five levels (0, 60, 120, 240 and 480 kg of nitrogen per hectare) of fertilization on production of aerial parts (leaf and stem) and roots, leaf/stem ratio, tillering number and water use efficiency in Buffel grass (*Cenchrus ciliaris*, L.).

MATERIAL AND METHODS

This research was carried out at green house in Animal Science Department of Federal Rural University of Pernambuco (UFRPE). It evaluated the effects of five levels of nitrogen (N) fertilization: 0; 60; 120; 240 e 480 kilograms (kg) of N per hectare (ha) divided in five applications each level.

It was utilized plastic vases with carrying capacity to 10 liters of water. The vases was filled with a Podzolic soil with low fertility (pH = 5,4; P = 3,4 ppm; K = 31 ppm; Ca + Mg = 2,3 e.mg./100g of soil; Al = 0,10 e.mg./100g of soil; Na = 15 ppm) according chemical analysis. During the planting, it was done correction of soil fertility, in all treatments, with 100 kg/ha and 200 kg/ha, respectively, with P_2O_5 and K_2O.

The planting of seed was done and after emerged, the plant population per vase was controlled, being used 6 plants/vase. The standard cut was done at 10 centimeters

of high and 35 days after seedling. After that, each 28 days of growth all of treatments were harvested. The nitrogen fertilizer was applied after each harvest.

It was evaluated the dry matter production of aerial parts (leaf and stem) (PAP) and roots (RP), leaf/stem ratio (LSR), number of tillers per vase (NT) and water use efficiency (WUE). The PAP was the forage produced bellow 10 cm of high and it was obtained from the sum of five harvests per experimental unit. The RP was evaluated at the end of experiment, where the roots were washed and put in an air forced stuff regulated to maintain temperature between 60 to 65 ºC for the necessary period to constant weight. The LSR was determined by separation of all leaf and stem parts, weight separately and considering the values expressed in dry matter basis. The NT was determined by counting the total number of tillers per vase. The WUE was calculated by the quotient between the total of water used in each experimental unit between its productions.

The experimental design utilized in this research was a complete randomized block with three repetitions for each treatment. After the average comparation, by Tukey test, it was done an analysis of regression between the level of production and PAP, RP, NT, LSR and WUE.

RESULTS AND DISCUSSION

I was observed a positive response of Buffel grass to nitrogen fertilization, with an increase of production of aerial parts and root in this specie (Table 1).

The highest level of N fertilization produced 276% more when compared without fertilizer. Besides, the fertilizer increase the water use efficient of Buffel grass and plants without N needed 233% more water to produce the same quantity when compared to treatment with 480 kg of N/ha. In the semi-arid regions, the production of the Buffel grass could be increased in two times or more with use N fertilization, resulting in a better water use efficiency for the plants and saving this important and scarce to these regions (Wiedenfeld et al., 1982). These results agree with TABOSA et al. (1990) that obtained an increase of water use efficiency of sorghum spp. in semi-arid zone of Brazil when organic fertilization was utilized in this crop. They observed that not only water is the limiting factor of growth plants, but is associated with others factors like soil fertility and structure.

According to the coefficient of determination (R^2) analysis expressed in Table 1, is positively and have statistical significance ($P<0.05$), except LSR, according to the table proposed by Little and Hills (1972). The LSR was not affected by fertilization ($P>0.05$), but these values were bigger when compared with others from Brazil data (Araújo Filho, 1988). Probably it is a consequence of the high (10 cm) used to harvest the plants. It results on an underestimation of participation of stem on the crop growth. It could represent 50% of total growth of plant, in a tropical species (Pinto, 2000). The linear effects of N fertilization on the RP and NT evidence the importance of this practice in semi-arid regions. The root growth is very important to the production of plant increasing its capacity of absorption (SQUIRE, 1990). This characteristic is especially important to the survival of plants in long dry periods, because it permits then absorbed more water. On the other hand, the NT permits to the plant regrowth and accumulate more soluble carbohydrates to synthesize it.

Table 1 - Effects of five nitrogen fertilizer levels (0, 60, 120, 240 and 480 kg/ha) on aerial parts (leaf and stem) production (APP); root production (RP); leaf stem ratio (LSR); number of tillers (NT) and water use efficiency (WUE) of Buffel grass (Cenchrus ciliaris, L.). The values used are in dry matter basis.

Fertilizer (kg of N/ha)	APP (g/vase)	RP (g/vase)	LSR	NT (Tillers/vase)	WUE[1]
0	6.3	41.0	9.7	53	333
60	8.0	50.0	17.7	76	306
120	11.3	48.7	12.7	97	204
240	15.3	54.0	15.0	144	154
480	27.3	97.3	12.3	135	100
Linear effect	0.00002	0.00183	0.97977	0.00038	0.00005
R^2	0.99	0.90	0.00	0.71	0.86
Quadratic effect	0.07369	0.24682	0.19238	0.00987	0.1385
R^2	0.99	0.97	0.27	0.98	0.96
CV**	12.3	29.33	28.82	21.02	17.01

1 – It was considered the water use efficiency (kg of water/kg of production on dry matter basis) at higher fertilization level (480 kg/ha) equal to 100% . * R2 = coefficient of determination of equation. ** CV = Coefficient of variation

These results, logically, could not be extrapolated to grasslands because were obtained in stuff with controlled conditions. But, it demonstrates that Buffel grass could increase the production and quality if soil corrections fertilizer practices was done.

Probably, in regions where raining between 500 a 600 mm per year and an irregular distribution, like in semi-arid zone of Brazil, the optimum level of fertilizer would be lower than 100 kg of N/ha/year

CONCLUSIONS

The Buffel grass responds positively to nitrogen fertilization, increasing the production of aerial parts, roots, and tillering and water use efficiency. However, it had no effect on the leaf/stem ratio of plant. This indicates that more studies about the impact of nitrogen fertilizer on production of Buffel grass in grasslands conditions must be done.

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