Effect of nitrogen fertilization sources on pearl millet (*Pennisetum glaucum*) yield in the subtropical region of Brazil

Rafaela C. César*[1], Gustavo Z. Battistello[2], Vicente José L. P. Simões[2], Marcelo A. da Silva[3], Lóren P. Duarte[3], Paulo César de F. Carvalho[1]
[1]Universidade Federal do Rio Grande do Sul, Porto Alegre/RS, Brasil.
*Undergraduate – rafaela.cesar@ufrgs.br

The livestock industry in Brazil is a vital segment of the economy, heavily reliant on cultivated pastures where nitrogen (N) use is essential for optimizing production. This study aimed to analyze forage production under different sources of nitrogen fertilization applied to pearl millet (*Pennisetum glaucum*). The experiment was conducted at the Agronomic Experimental Station of the Federal University of Rio Grande do Sul, located in Eldorado do Sul, RS, Brazil, in 2021 and 2022. The experimental design was a randomized block with four treatments and three replications. The experimental units consisted of twelve paddocks, each approximately 1.5 ha in size. The treatments consisted of three sources of N: Urea (46% N); NH_4NO_3 - ammonium nitrate (32% N); NH_4NO_3 (+) - calcium and sulfur-supplemented ammonium nitrate (27% N + 5% Ca + 3.7% S); and a control without N application. Fertilization occurred once per cycle at full dose (100 kg N ha^1), 45 days after pasture establishment. The evaluated variables were the forage accumulation rate (FAR, kg of dry matter (DM) ha^{-1} day^-1) and the total forage production (TFP, kg ha^1). The FAR was monitored using grazing exclusion cages and forage cuts, conducted approximately every 26 days during the grazing period. The TFP was calculated by summing the initial forage mass with the FAR for each period across both harvests. Steers (*Bos taurus*) under continuous stocking and put-and-take technique were utilized to maintain pearl millet at an average height of 40 cm, according to the "Rotatinuous" grazing concept (i.e., management targets to minimize grazing time per unit of dry matter intake). The data were subjected to ANOVA and means were compared using Tukey's test, both at a significance level of 5%. The NH_4NO_3 (+) treatment showed higher FAR (119 kg DM ha^{-1} day^{-1}) and TFP (12.278 kg DM ha^{-1}compared to the control (FAR = 60 kg DM ha^{-1} day^{-1}), (TFP=6.839 kg DM ha^{-1}). The other sources of N showed intermediate results. The combination of N with different nutrients, as seen in the NH_4NO_3(+) treatment, proved to be the most effective source for promoting higher FAR and consequently increasing total forage production. The addition of Ca and S enhances primary production in pastures due to the synergy of essential nutrients, which are crucial for plant health and growth. This increase, often underestimated in agricultural fertilization practices, resulted in a TFP exceeding 10.000 kg DM ha^{-1}. We conclude that both the application of nitrogen and the choice of nitrogen source significantly influence primary productivity in summer pastures in southern Brazil. The NH4NO3(+) treatment,in particular, demonstrates the benefits of supplementing nitrogen with additional nutrients to maximize forage production.

Keywords: Nitrogen fertilization; urea; primary production, nutrient synergy.