Nitrogen fertilization and cane-plant forage production in sandy soil

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Introduction

Sugarcane has been widely used by small, medium and large farmers to feed ruminants. It is a crop that removes large amounts of nutrients from the soil. For the most currently varieties planted, studies conducted by Oliveira et al (2007) indicated that the N extraction oscillates around 1.2 kg t^{-1} of natural matter of the aerial part. Considering that roots and rhizomes correspond, on average, to 30% of mass of the whole plant, it can be estimated that for each ton of natural matter accumulated by the aerial part occurs by the plant an absorption of 1.5 kg of N. Therefore, for systems with productivity higher than 150 t ha^{-1} of natural matter, the amount of N absorbed by the crop exceeds 200 kg ha^{-1}. The study aimed to evaluate the effect of the nitrogen fertilization on the nutritional status and to evaluate the forage production of the sugarcane variety RB835486, planted in sandy soil.

Material and methods

The study was conducted in a sandy texture soil, at Mercês city in Minas Gerais, latitude 21 ° 11 '39 "south, latitude 43 ° 20' 30" W, altitude of 525 m, from September 2014 to July 2015. The region's climate is, according to Köppen's classification, the Cwb type – a tropical high-altitude climate with rainy summer and mild temperatures. The average rainfall during the study period was 926mm, with 90% of the precipitation occurring from November to March. Before the research's implantation, soil samples were collected in the layers of 0 to 20 and of 20 to 40cm. The content of organic matter in the layer of 0 to 20 and 20 to 40 cm of depth were, respectively, 6.9 and 4.6 g dm^{-3}, which was considered low. On mid-September 2014, 5.0 t of dolomitic limestone and 1.5 t of gypsum were applied, following a recommendation by Oliveira et al. (2007). After limestone and gypsum were applied, the soil was plowed and meshed. On mid-October 2014, a new harrowing was performed in the land. The study was conducted in experimental design in blocks with four replicates. The treatments were five doses of N: zero (witness), 40, 80, 120 and 160 kg ha^{-1}, using urea as source of N. The nitrogen fertilizer, together with potassium, in a single dose of 200 kg of K per hectare, were buried in the interline, when the cane was about 30 cm high. The plots were constituted by five furrows of five meters length. At the bottom of the groove from all plots the phosphate fertilizer was applied at a dose of 100 kg of phosphorus (229 kg of P_2O_5 equivalent) per hectare. After the phosphate fertilization, the sugarcane, variety RB835486, was planted. By the end of January 2015, on the maximum growth phase of the cane, leaves + 3 were collected to evaluate the nutritional status of the plants. The evaluations were performed in the central three meters of each plot, following methods described by Oliveira et al. (2007). On July of 2015, the cane-plant was cut for the evaluation of forage and sugars production, being sampled in the three central lines of the plot. The average values of nutrient contents in leaf +3 and forage and sugar production were submitted to variance analysis, on 5% of probability.

Results and discussion

There was no influence of nitrogen fertilization on the nutritional status of plants, forage and sugar production. The coefficients of variation for all analyzed variables were lower than 10%, thus, the lack of response to nitrogen application was not due to experimental variability. It was found a suitable foliar content for all nutrients, since the concentrations of

these elements were higher to those mentioned as minimal by Oliveira et al. (2007). The average values of forage and sugar production were 150 t of natural matter and 21.4 t per hectare, respectively.

The lack of response to nitrogen fertilization, both for the nutritional status of the plants and for the forage and sugar production, is due to the mineralization of the soil's organic matter and the higher nutritional efficiency of the cane-plant root system, when the crop is well nourished with phosphorus. This is probably because limestone and gypsym was applied in sufficient quantity to neutralize the exchangeable aluminum and the dose of simple superphosphate (100 kg per hectare) applied at the bottom of the planting groove. Regarding the mineralization of the soil's organic matter, one of the factors previously mentioned as responsible for the absence of response to nitrogen fertilization, one can resort to the studies conducted in the coastal plains of Pernambuco by Salcedo et al. (1985) to reinforce this statement. These authors measured carbon and nitrogen mineralization in a red, yellowish, sandy latosolic Podzolic throughout the cane-plant cycle, sampling the soil before planting and at 3, 6, 11 and 16 months after, at the depths of 0 to 20; 20 to 40 and 40 to 60 cm. The total carbon contents were 6.7; 4.1 and 3.4 g kg^{-1}, while, for total N, the values obtained were 0,7; 0.4 and 0.3 g kg^{-1}. Salcedo et al. (1985) found that the estimated amounts of potentially mineralizable N were 139 and 132 kg per hectare, at depths of 0 to 20 and 20 to 60 cm respectively, with a mineralization constant of 0.074 per week. Although the studied soil is considered of low fertility, it can be stated, from the obtained results, that the amounts of mineralized organic N are sufficient to satisfy the needs of the cane-plant. Another factor that may have contributed to the lack of response of cane to nitrogen fertilization is the higher efficiency of the root system of plants well supplied in phosphorus in the nitrate absorption of the solution. Absorption and metabolism of nitrogen are strongly influenced by the availability of phosphorus. In plants with adequate P supply there is an increase in the nitrate absorption of the soil solution and in the translocation of nitrate from the roots to the aerial part increasing the synthesis of amino acids in the leaves. Oliveira et al. (2007) cite studies in which the influence of the availability of P, both from nutrient and endogenous solution, on the absorption and metabolism of N by corn was observed. Well-supplied phosphorus plants before and during the kinetic study showed practically constant nitrate absorption during the experiment. However, plants that were deprived before and during the experimental phase failed to absorb the nitrate from the solution. It is believed that the cane-plant, for having a higher P supply, behaves similarly to the verified in corn plants that are well supplied with phosphorus.

References

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