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ESTERCO OVINO AUMENTA A CAPACIDADE DE RETENÇÃO E MANUTENÇÃO DE ÁGUA NO SOLO DO CARIRI PARAIBANO

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1 RESUMO

A matéria orgânica do solo contribui para a sustentabilidade dos sistemas agrícolas, pois, influencia os atributos físicos, químicos e biológicos do solo, estabilizando a produtividade dos agroecossistemas. O teor de matéria orgânica no solo beneficia o aumento da capacidade de troca de cátions, assegurando os nutrientes no solo e reduzindo suas perdas por lixiviação. Nesse sentido, objetivou-se avaliar doses de esterco ovino para retenção e manutenção de água no solo na Microrregião do Cariri paraibano. O delineamento utilizado foi o inteiramente casualizado com seis doses de esterco ovino (0, 5, 10, 15, 20 e 25%, m/m) e quatro repetições. Foram realizadas avaliações de pesagem durante seis dias, a cada 24 h, para a determinação da porcentagem de água disponível em relação à massa seca do solo (m/m). Os dados foram submetidos à análise de variância ao nível de 5% de probabilidade de erro e as médias das doses de esterco foram submetidas a regressão polinomial. O esterco ovino aumenta a capacidade de retenção e manutenção da água no solo do Cariri paraibano, sendo uma alternativa para a atenuação dos problemas ocasionados pela perda de água por lixiviação e, por conseguinte, melhorando a capacidade produtiva do solo e vida dos produtores.

Keywords: matéria orgânica, nutrientes no solo, status hídrico.

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SHEEP MANURE INCREASES THE WATER HOLDING AND MAINTENANCE CAPACITY OF SOIL IN THE CARIRI PARAIBANO REGION

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2 ABSTRACT

Soil organic matter contributes to the sustainability of agricultural systems, as it influences the physical, chemical and biological attributes of the soil, stabilizing the productivity of agroecosystems. The organic matter content in the soil benefits the increase of the cation exchange capacity, ensuring the nutrients in the soil and reducing its losses due to leaching. In this sense, the objective was to evaluate different doses of sheep manure for retention and maintenance of water in the soil in the Microregion of Cariri, in Paraíba state. The design used was completely randomized with six doses of sheep manure (0, 5, 10, 15, 20 and 25%, w/w) and four replications. Weighing evaluations were carried out for six days, every 24 h, to determine the percentage of available water in relation to the soil dry mass (w/w). Data were subjected to analysis of variance at a 5% probability of error and means of sheep manure doses were submitted to polynomial regression. Sheep manure increases the capacity of retaining and maintaining water in the soil of Cariri, in Paraíba state, being an alternative to alleviate the problems caused by the loss of water through leaching and, therefore, improving the productive capacity of the soil and the life of producers.

Keywords: organic matter, soil nutrients, water status.

3 INTRODUCTION

Soil is a natural resource essential to life, providing a wide range of ecosystem services, such as biomass production, nutrient cycling, water storage, support for plants and biodiversity, in addition to constituting the basis for food production and ensuring food security for the growing population (VANWALLEGHEM et al., 2017).

In agroecosystems, soil organic matter (SOM) stocks can be influenced by various management practices. Changes in SOM have consequences for soil chemical, physical, and biological properties and are dependent on soil conditions, climate, and adopted cultural practices (CARIDE et al., 2012; BARBOSA et al., 2019; LAL, 2004; RANGEL et al., 2008).

The intensive conventional use of natural resources has led to a loss of soil productive capacity due to a decrease in nutrients, organic matter, and biodiversity and increased compaction caused by intense machinery traffic. These factors reduce soil quality, particularly by limiting water retention capacity and consequently decreasing microbiological activity (TIAN et al., 2016). Optimal soil organic matter levels indicate good agricultural and environmental soil conditions, characterized by reduced erosion, filtration, and a rich habitat for living organisms.

Organic management practices preserve and contribute considerable amounts of organic materials to the soil, so these practices can increase the retention and maintenance of water in the soil and thus offer better physical and water conditions for cultivation, especially for small farmers and family-based farmers, who, in most cases, do not have sufficient financial resources to invest in sophisticated technologies and must therefore opt for alternative technologies such as the use of locally available and economically viable waste (GMACH et al., 2020).

Soil organic matter plays an important role in agricultural sustainability and influences the physical, chemical, and biological attributes of the soil, with an impact on the stability and productivity of agroecosystems. Because organic matter is related to multiple aspects of the environment and soil, it can be altered to a

greater or lesser extent depending on the agricultural system, making it one of the main indicators of soil quality (COSTA et al., 2013).

On the basis of the above, it is important to highlight that the practices for contributing organic matter to the soil are associated with both crop and soil characteristics, as well as the availability of abundant sources in the desired location, such as sheep manure available in the Cariri region of Paraíba (OLIVEIRA et al., 2020). Therefore, the objective of this study was to evaluate the effects of different doses of sheep manure on soil water retention and maintenance in the Cariri microregion of Paraíba.

4 MATERIALS AND METHODS

The research was carried out between August and September 2021 in the municipality of Soledade, PB, at coordinates of 7°03'44.9" South latitude and 36°21'31.4" West longitude. According to the Köppen classification, the climate of the study area is considered Bsh-hot semiarid, with predominantly precipitation less than 600 mm/year (FRANCISCO, 2010).

In the municipality, the vegetation is of the hyperxerophilic caatinga type (BRASIL, 2006), and the reclassification of the profiles was carried out by Campos and Queiroz (2006). There are basically four classes of soils: the typical Chromic Luvisols, the Planossolo Natric typical orthic, the Neosols Quartzarenic typical orthic and Neosols Litholics Eutrophic, with a typical orthic Chromic Luvisol with a clayey texture used in the experiment.

A completely randomized design (CRD) with six sheep manure doses (0, 5, 10, 15, 20, and 25%, w/w) and four replicates was used (Figure 1). Both the sheep manure and the soil used in the experiment were collected at the Santa Luzia site, which is located in the rural area of Soledade, PB, at coordinates of 7°00'28.4" South latitude and 36°22'24.0" West longitude. For the soil, the 0–20 cm layer was collected.

Figure 1. Partial view of the containers with substrates originating from the mixture of sheep manure doses and a typical ortic Chromic Luvisol

Source: Author's own (2021)

The soil was mixed with manure at doses corresponding to each treatment (0, 5, 10, 15, 20, and 25%, w/w). Then, 400 g of the substrates obtained from the mixture were placed in 400 mL cups. The substrates were subsequently irrigated with 150 mL of public water supplied by CAGEPA (Paraíba Water and Sewage Company) and stored indoors for 24 hours until the field capacity (FC) moisture content was reached (Figure 2). It was necessary to use 150 mL drains to quantify the water retained in the substrate and that drained in each plot (Figure 3). For six days, the plots were subsequently

weighed every 24 h on an SF-400 Electronic Kitchen scale. Scale for determining the percentage of available water in relation to the dry mass of the soil (m/m), as described by Silva et al. (2020).

Figure 2. Substrates at field capacity 24 hours after being irrigated with 150 mL of CAGEPA water

Source: Author's own (2021)

Figure 3. Substrates at field capacity and their drainage containers

Source: Author's own (2021)

The data were subjected to analysis of variance (ANOVA) at a 5% probability of error level, and the means of the sheep manure doses were subjected to polynomial regression analysis. For this purpose, Sisvar *software was used* (FERREIRA, 2019).

5 RESULTS AND DISCUSSION

The results of the variance analysis revealed that the sheep manure dose significantly increased the substrate water content during the six days after saturation (DAS) (Table 1).

Table 1. Summary of variance analyses for substrate water content as a function of sheep manure dose

FV	GL	Mean Squares					
		1 OF THE	2 DAS	3 DAS	4 DAS	5 DAS	6 DAS
Doses	5	36.02**	26.38**	25.21**	34.73**	31.46**	30.61**
Residue	18	1.46	1.19	1.09	0.84	0.92	0.86
CV (%)		4.89	6.22	9.25	12.97	18.76	21.54

FV – Sources of variation, GL – degrees of freedom, DAS – days after substrate saturation and ** - significant at 1% probability according to the F test

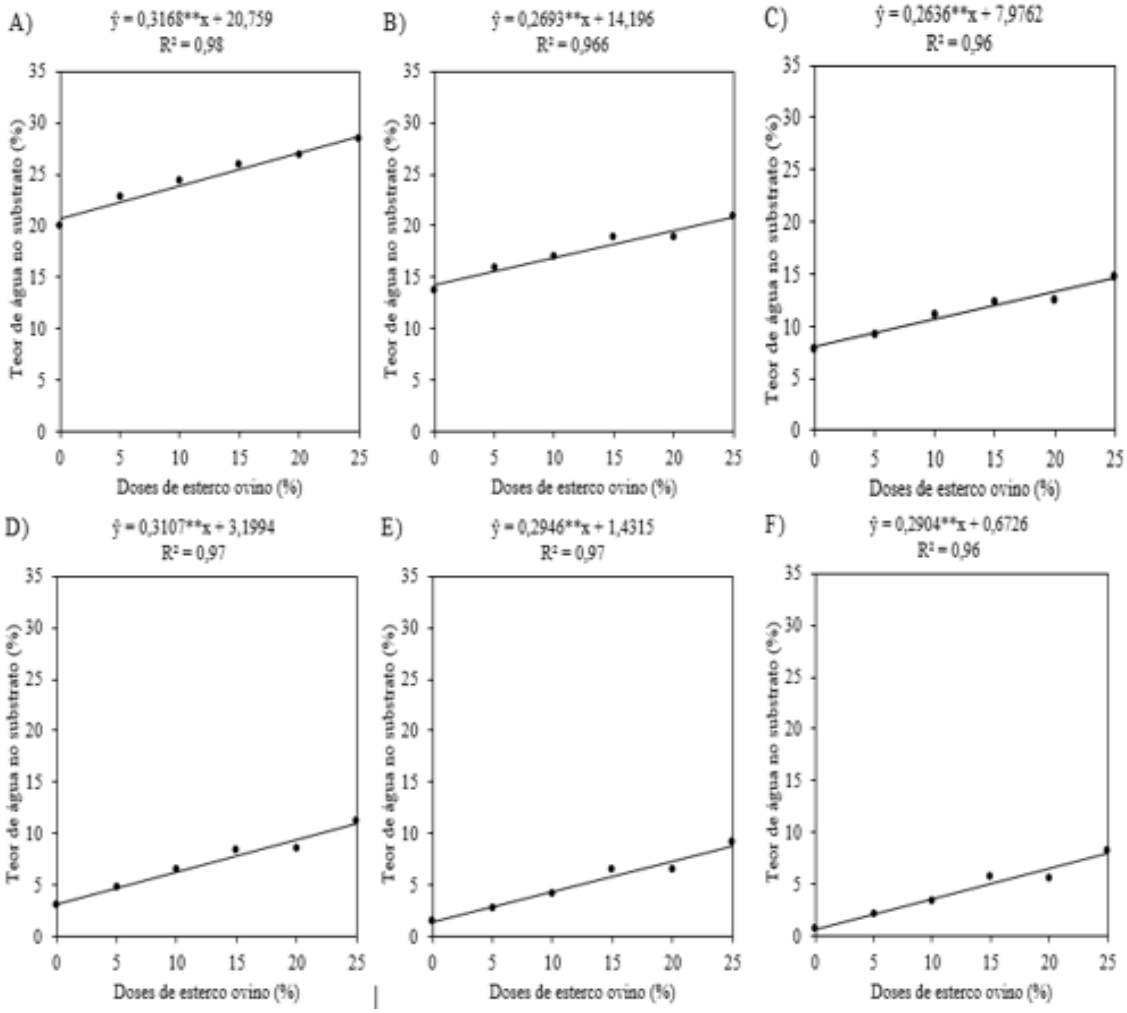
Source: Author's own (2021)

Conceição et al. (2005) and Unger et al. (1991) reported that SOM has the ability to influence infiltration, water retention, soil structure and susceptibility to erosion, as well as other attributes, such as cation exchange capacity, nutrient cycling, complexation of toxic soil elements and stimulation of the soil biota.

In a study involving the application of various manures, Brito et al. (2005) reported that sheep manure was the residue that caused the main changes in soil chemical properties, promoting the greatest increases in calcium, organic matter, and cation exchange capacity. In this context, a significant increase in water content was observed due to the addition of sheep manure. Therefore, this manure can be used for sustainable soil management, given that it is a very abundant residue and can be cost effective (ALENCAR et al., 2008), considering that many producers in semiarid regions raise sheep on their properties while also engaging in agriculture.

The effect of sheep manure dose as a source of organic matter for soil water retention and maintenance was notable, as it was observed that the 25% dose, whether at 1 day or up to 6 days after saturation (DAS), managed to retain and maintain more water in the soil. However, the plots that did not have sheep manure incorporated into the soil (0%) lost more water over time than did the other plots (Figure 4A, B, C, D, E, and F). Given the above, it can be inferred that the increase in soil water retention and maintenance capacity occurs because organic matter allows greater aggregation and cohesion between particles, thus making the soil more porous and with greater water retention, benefiting infiltration (SANTOS and PEREIRA, 2013). The regular addition of large amounts of organic materials is a common strategy to improve soil water availability.

Figure 4. Substrate water content as a function of sheep manure dose at 1 day (A), 2 days (B), 3 days (C), 4 days (D), 5 days (E) and 6 days (F) after saturation



Source: Author's own (2021)

6 CONCLUSION

Sheep manure increases the water retention and maintenance capacity of the typical clayey textured Luvisol of the Cariri region of Paraíba, providing an alternative for mitigating problems caused by water loss through leaching and, consequently, improving the productive capacity of the soil and the lives of producers.

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