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EFEITO COMBINADO DE MATÉRIA ORGÂNICA E ADUBAÇÃO POTÁSSICA NO DESENVOLVIMENTO INICIAL DO MILHO

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RESUMO: O objetivo deste trabalho foi avaliar o efeito combinado da matéria orgânica e da adubação potássica no desenvolvimento inicial do milho. O experimento foi conduzido no IFCE/*Campus* Sobral, em vasos. O delineamento experimental utilizado foi em blocos ao acaso, no esquema fatorial 5x2 (cinco doses de potássio x com e sem matéria orgânica), com quatro blocos. O fator adubação potássica foi composto por 100%; 120%; 140%; 160% e 180% da adubação recomendada. O fator matéria orgânica, com presença e ausência de esterco bovino. A irrigação com a adubação potássica foi realizada em intervalos quinzenais, durante o período de condução do experimento. Aos trinta dias após o plantio, avaliou-se a altura da planta, número de folhas, comprimento da raiz, diâmetro do caule, massa fresca da parte aérea, massa seca da parte aérea, massa fresca da raiz e a massa seca da raiz. A aplicação de esterco bovino no substrato apresentou acréscimo nas variáveis altura da planta, comprimento da raiz, o diâmetro do caule, massa fresca e seca da raiz e da parte aérea, em comparação ao tratamento sem adubação orgânica. O uso de esterco bovino em plantas de milho favorece o desenvolvimento inicial da cultura.

Palavras-chave: *Zea mays*, parâmetros de crescimento, Cloreto de potássio.

COMBINED EFFECT OF ORGANIC MATTER AND POTASSIUM FERTILIZATION ON THE INITIAL DEVELOPMENT OF CORN

ABSTRACT: The objective of this work was to evaluate the combined effects of organic matter and potassium fertilization on the initial development of corn. The experiment was conducted at IFCE/Campus Sobral in pots. The experimental design used was randomized blocks in a 5x2 factorial scheme (five doses of potassium with and without organic matter), with four blocks. The potassium fertilizer factor was made up of 100%, 120%, 140%, 160%, and 180% of the recommended fertilization. The organic matter factors associated with the presence and absence of cattle manure. Irrigation with potassium fertilizer was carried out at fortnightly intervals during the experimental period. Thirty days after planting, the plant height, number of leaves, root length, stem diameter, fresh mass of the aerial parts, dry mass of the aerial parts, fresh mass of the roots and dry mass of the roots were evaluated. Compared with the treatments without organic fertilizer, the application of cattle

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manure to the substrate resulted in increases in the variables plant height, root length, stem diameter, and fresh and dry masses of the roots and shoots. The use of cattle manure on corn plants favors the initial development of the crop.

Keywords: *Zea mays*, plant height, potassium chloride.

1 INTRODUCTION

Corn (*Zea mays* L.) is a species that belongs to the Poaceae family and is native to the Americas. It is one of the most efficient energy-storing plants in nature. It is one of the most interesting cultivated plants due to its origin, structure and variation (Magalhaes; Durães, 2006). Despite its importance, adjustments in the management of this crop still require attention, with the goal of maximizing its development and productivity in the most diverse cultivation systems, especially in terms of nutritional management, with the increase in and combination of inputs that favor the plant and provide greater economic return to the producer in a sustainable manner.

OM plays an important role in agricultural sustainability; influences the physical, chemical and biological attributes of the soil; impacts the stability of the productivity of agroecosystems (Costa; Silva; Ribeiro, 2013); and is considered the main indicator of soil quality, serving as a basis for agricultural sustainability (Lal, 2004).

The organic residues present on the soil surface have a direct effect on the dynamics of soil microorganisms (Costa; Silva; Ribeiro, 2013). Furthermore, the decomposition of organic material should be considered a source of nutrients in the soil, since its decomposition results in the mineralization of nutrients in plant tissues (Conceição; Mielniczuk; Spagnollo, 2005; Pavinato; Rosolem, 2008).

In the agronomic field, studies on fertilizer application methods are common, mainly aiming to reduce losses and increase the efficiency of use in crops. In the case of potassium fertilization, potassium chloride (KCl) is the main source of potassium (K) used in grain-producing crops in Brazil (Lopes, 2005). The response of corn to potassium fertilization varies according to the type of soil, calcium (Ca) and magnesium (Mg) saturation in the solution and initial level of these in the soil (Becker; Meurer, 1986).

Therefore, the objective of this study was to evaluate the initial development of corn plants in the presence and absence of organic matter in the soil via the use of increasing doses of potassium chloride.

2 MATERIALS AND METHODS

The experiment began on September 20, 2023, in an area belonging to the IFCE/*Campus* Sobral. The corn seeds were sown in pots with a volume of 1 dm^3, prepared with gravel and a small screen to separate the gravel and the substrate.

The trial was conducted in a randomized block experimental design with a 5 × 2 factorial scheme (five potassium doses with and without organic matter), with four blocks. The potassium fertilization factor was composed of 100%, 120%, 140%, 160%, and 180% of the recommended dose. The organic matter factors associated with the presence and absence of cattle manure. For application of the treatments, 50% of the pots received only soil, and the other 50% received soil and organic matter.

Thirty days after planting, the plant height (H - cm), number of leaves (NF), root length (CR - cm), stem diameter (DC - cm), fresh mass of the aerial part (MFPA - g), dry mass of the aerial part (MSPA - g), fresh mass of the root (MFR - g) and dry mass of the root (MSR - g) were evaluated. For the variable plant height, the length between the plant collar and the insertion of the flag leaf was considered. The dimensions of the plants were obtained with the aid of a graduated ruler and a digital caliper. The weight was obtained via a precision analytical electronic scale. To determine the dry matter content, the plants were placed in paper bags, dried in a forced circulation oven at 70 ± 1 °C, and weighed on a precision analytical scale (0.0001 g).

The data were subjected to analysis of variance via the F test, and when significant, the means were subjected to the Tukey test at a significance level of 5% for the organic matter (OM) factor. When the potassium chloride (KCl) dose factor was significant, regression analysis was applied. All analyses were performed via R: A Language software. and Environment for Statistical Computing, R version 4.3.2 (R Core Team, 2023) with the AgroR: Experimental Statistics packages and Graphics for Agricultural Sciences, version 1.3.5 (Shimizu; Marubayashi; Goncalves, 2023).

3 RESULTS AND DISCUSSION

A significant effect of the organic matter factor on the variables plant height, stem diameter, root length, fresh mass of the aerial part, fresh mass of the root, dry mass of the aerial part and dry mass of the root was detected. However, for the variable number of leaves, there was no difference. No significant effect was observed for the potassium dose (KCl) factor or for the interaction between the organic matter and KCl dose factors in the studied variables (Table 1).

Table 1. Summary of analysis of variance for the variables plant height (H), number of leaves (NF), stem diameter (DC), root length (CR), fresh shoot mass (MFPA), fresh root mass (MFR), dry shoot mass (MSPA) and dry root mass (MSR) of corn.

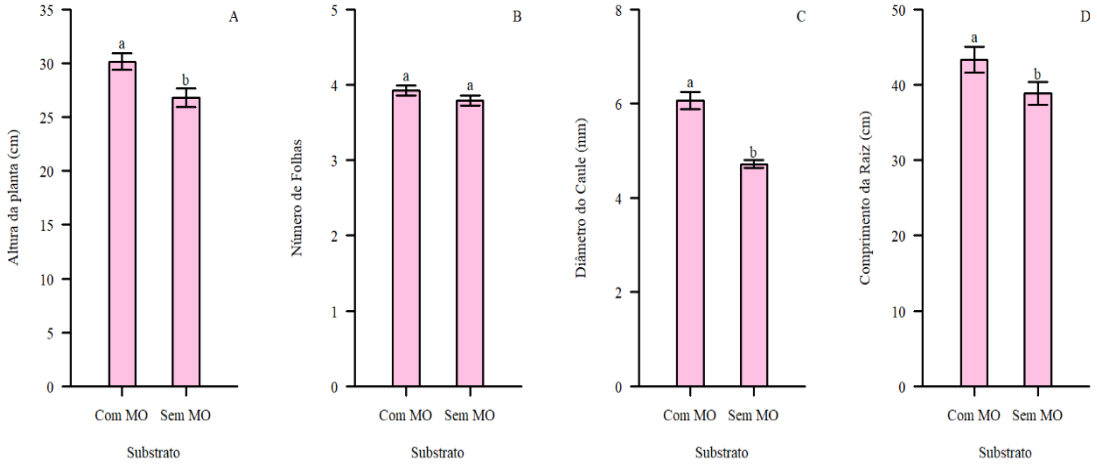
FV	GL	Quadrado Médio							
		H	NF	DC	CR	MFPA	MFR	MSPA	MSR
MO	1	$110,83^{**}$	$0,173^{ns}$	$18,26^{**}$	$203,25^{**}$	$69,62^{**}$	$42,38^{**}$	$2,398^{**}$	$3,139^{**}$
KCl	4	$6,95^{ns}$	$0,079^{ns}$	$0,67^{ns}$	$48,52^{ns}$	$1,31^{ns}$	$1,08^{ns}$	$0,025^{ns}$	$0,115^{ns}$
Bloco	3	$27,17^{ns}$	$0,031^{ns}$	$0,74^{ns}$	$101,60^{ns}$	$1,29^{ns}$	$1,86^{ns}$	$0,052^{ns}$	$0,220^{ns}$
MO x KCl	4	$12,75^{ns}$	$0,068^{ns}$	$0,30^{ns}$	$51,25^{ns}$	$0,94^{ns}$	$1,60^{ns}$	$0,018^{ns}$	$0,122^{ns}$
Erro	27	13,43	0,0972	0,31	47,30	0,60	2,31	0,031	0,118
CV	%	12,88	8,08	10,42	16,62	14,22	24,53	21,56	33,70

Source: prepared by the authors.
Note: FV = sources of variation, GL = degrees of freedom; MO = organic matter; KCl = potassium chloride dose; CV (%) = coefficient of variation (CV); *,* *F value significant at the 5% and 1% levels, respectively; ^{ns} F value not significant (P >0.05).

The use of organic matter in plants had a positive effect on the plant height variable, differing significantly from the treatment without organic matter (Figure 1A). However, for the number of leaves, no difference was detected between the treatments (Figure 1B). Bovine manure was superior to the treatment without organic fertilization for the variables stem diameter (Figure 1C) and root length (Figure 1D).

Studies with castor bean plants carried out by Oliveira *et al.* (2009) reported similar results. These authors reported that there was no increasing linear response with increasing organic matter dose, regardless of the source used. However, the highest values were in castor bean plants that received cattle manure.

Figure 1. Effects of organic matter on the plant height (A), leaf number (B), stem diameter (C) and root length (D) of corn plants.

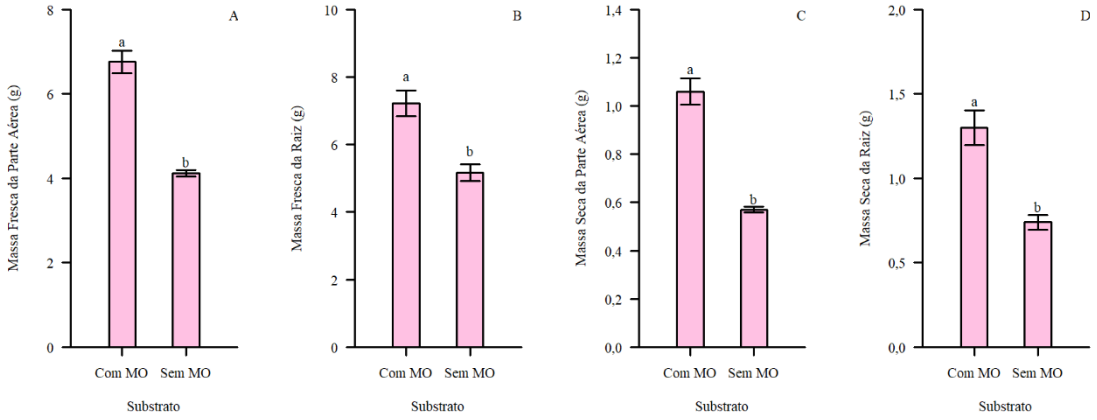


Source: prepared by the authors.
Note: Treatments followed by the same letter do not differ from each other according to the Tukey test at the 5% significance level.

The effects of organic matter were also observed by Gomes *et al*. (1991) and Gomes, Couto and Pereira (1985), who, when testing different substrates for the production of *Eucalyptus grandis seedlings*, in their simple forms and in mixtures, reported that substrates richer in organic compounds provided greater seedling growth.

Compared with the treatment without organic fertilization, the application of cattle manure to the substrate increased the fresh and dry masses of the root and aerial parts (Figure 2).

Figure 2. Effects of organic matter on the fresh mass of aerial parts (A), fresh mass of roots (B), dry mass of aerial parts (C) and dry mass of roots (D) of corn plants.



Source: prepared by the authors.
Note: Treatments followed by the same letter do not differ from each other according to the Tukey test at the 5% significance level.

In an essay carried out by Souza *et al.* (2012), who evaluated different sources of organic fertilizer (control, cattle manure, chicken litter, pig litter and humus) in a Red Argisol with sandy texture, they verified that in the first cultivation, there were significant increases in the fresh mass of the aerial part, in which cattle manure promoted better results for all the variables analyzed.

Trindade, Faria and Almeida (2000) reported increases in the growth, height and dry matter weight of papaya trees as the proportion of manure in the substrate increased to 30%, confirming information obtained in studies carried out with other perennial and semiperennial crops.

According to studies carried out by Sales *et al.* (2017), the incorporation of organic matter into a substrate positively affects plant growth in terms of all the characteristics evaluated. However, substrates composed only of soil and soil with the addition of chemical fertilizer resulted in less plant development than substrates that used organic sources did, and in the substrate with only soil, the amount of nutrients available was possibly not sufficient for plant maintenance and growth.

4 CONCLUSIONS

The use of cattle manure on corn plants favors the initial development of the crop.

No response of corn plants to potassium fertilization was observed in the initial development phase.

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