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Initial growth of melon submitted to different sources of organic fertilizers in the semi-arid Bahia

Crescimento inicial de melão submetido a diferentes fontes de adubo orgânico no semi-árido Bahia

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Abstract:

The production of vegetable crops using organic matter has gained prominence and expansion in recent years, due to the superior quality of the products produced and the food safety offered to the final consumer. From this, the present work aimed to evaluate the initial growth of melon submitted to different sources of organic fertilizers in semi-arid conditions in Bahia. The study was developed at the Universidade do Estado da Bahia – UNEB, using the cultivar Goldex®. The performance of the melon crop was evaluated in a randomized block design, consisting of 4 blocks of 5m^2, in a split plot with 4 treatments and 32 replications, involving the following treatments: T1: control; T2: cattle manure; T3: goat manure; T4: poultry litter. The evaluations of plant characteristics were measured by determining the number of leaves, stem diameter, branch length and chlorophyll content. Data were submitted to analysis of variance and Tukey test at 5% significance level. Based on the main results, it was observed that the poultry litter provided a greater number of leaves (7.6), branch length (62.5 cm), stem diameter (8.7 mm) and chlorophyll content (39, 3 µg.cm^{-2}) in relation to the other treatments. Poultry manure is indicated as a viable alternative for application in the melon crop due to the good results for the agronomic characteristics of the crop.

Keywords: *cucumis melo* L., sustainability, agronomic characteristics, organic matter.

Resumo:

A produção de olerícolas com a utilização de matéria orgânica tem ganhado destaque e expansão nos últimos anos, em virtude da qualidade superior dos produtos produzidos e da segurança alimentar ofertada ao consumidor final. A partir disso, o presente trabalho teve como objetivo avaliar o crescimento inicial de meloeiro submetido a diferentes fontes de adubos orgânicos em condições de semiárido baiano. O estudo foi desenvolvido na Universidade do Estado da Bahia – UNEB, utilizando a cultivar Goldex®. Foi avaliado o desempenho da cultura do melão em delineamento estatístico de

blocos casualizados, constituídos de 4 blocos de 5m^2, em parcela subdividida com 4 tratamentos e 32 repetições, envolvendo os seguintes tratamentos: T1: testemunha; T2: esterco bovino; T3: esterco caprino; T4: cama de aves. As avaliações das características das plantas foram mensuradas mediante determinação do número de folhas, diâmetro do caule, comprimento de ramos e teor de clorofila. Os dados foram submetidos a análise de variância e teste Tukey ao nível de 5% de significância. Com base nos principais resultados observou-se que a cama de aves possibilitou maior número de folhas (7,6), comprimento de ramos (62,5 cm), diâmetro do caule (8,7 mm) e teor de clorofila (39,3 µg.cm^{-2}) em relação aos demais tratamentos. O esterco de aves é indicado como alternativa viável para aplicação na cultura do melão em virtude dos bons resultados para as características agronômicas da cultura.

Palavras-chave: *cucumis melo* L., sustentabilidade, características agronômicas, matéria orgânica.

1. Introduction

Belonging to the botanical family Cucurbitaceae, the melon tree (*Cucumis melo* L.), is one of the most popular vegetables worldwide. Being an ancient culture, it has its center of origin in the tropical and subtropical regions of Africa, later spreading to India and Asia (ZHANG et al., 2022).

The cultivation of this vegetable crop occurs in most states of the country, but the semi-arid region of the Northeast stands out, where its cultivation is carried out mostly by family farming. In this region, Rio Grande do Norte leads production with a harvest of 338,615 tons, followed by Ceará with 85,201 tons and Bahia with 58,119 tons in 2018, other states such as Pernambuco, Piauí and Rio Grande do Sul had important contributions to production. (ANUÁRIO, 2018). This year, Brazil produced 581,478 tons with a planted area of 23,426 hectares, and in 2017 it exported 233,000 tons, generating revenue of US$ 162.9 million (ANUÁRIO, 2018).

In the sub-medium Vale do São Francisco between Bahia and Pernambuco, which is an important agricultural hub, the melon harvest comprised a planted area of 2,000 hectares in 2018, with emphasis on cultivation carried out in smaller areas with family labor (ANUÁRIO, 2018).

Most of the melon produced in Brazil is of the yellow type, in which several cultivars and hybrids are inserted. The rest belong to the Pele de Sapo, Gália, Charentais, Cantaloupe and Honeydew types (CAVALCANTE NETO, 2020). Some aspects regarding cultivars must be taken into consideration before cultivation, such as ease of commercialization, agronomic quality, post-harvest conservation, seed origin, susceptibility to diseases, and consumer preference in the domestic and foreign markets. From this, technologies have been used in order to ensure agricultural viability and reduce production costs (GOIS, 2016).

Organic vegetable production has been expanding in recent years, due to the quality of the food produced and food safety. In this agricultural system, there is a concern regarding the non-use of chemical pesticides, in order to avoid contamination of the parties involved in the production context, as well as to seek a balance between the ecological environment and agricultural production (SARTÓRIO et al., 2017).

Since the nutrients supplied come from animal waste in organic agriculture (GUSBERTI et al., 2021), the melon tree has a good response in relation to organic fertilization, and may be a strategy adopted for its cultivation, as its use has numerous advantages, and is aimed at improving the physical, chemical and biological properties of the soil, in addition to being an excellent source for the contribution of microelements, which are not included in conventional chemical formulations that are limited only to macroelements (MORAES & OLIVEIRA, 2017).

Among the sources of manure available for use, poultry is the richest in nutrients, mainly phosphorus and nitrogen. Mazzuchelli et al. (2014), evaluated the production of melon seedlings as a function of chicken manure dosages and found that the addition of a 4% dose of chicken manure in the commercial substrate had greater efficiency, with more developed seedlings. Santos et al. (2019), evaluating the production and quality of melon in an organic production system in the semiarid region

of Bahia, found that the use of biofertilizer in the organic production system promotes improvements in melon productivity and quality.

The study hypothesizes that fertilization with organic sources, such as manure, provides the melon crop with a full initial development, with agronomic characteristics that increase the potential for growth and development of the crop. The use of organic matter sources in the semi-arid region allows the rational exploitation of biomaterials, applying them in the production of vegetables and increasing the productive potential of agricultural crops. The melon plant responds positively to the increase in organic matter sources in the semi-arid region.

Given the above, and considering the potential of the semiarid region of Bahia in the production of melon, the present study aimed to evaluate the initial growth of melon plants subjected to the application of different sources of manure.

2. Material and Methods

The experiment was carried out in the vegetable sector located at the University of the State of Bahia – UNEB, Department of Human Sciences and Technologies – DCHT, in Euclides da Cunha in the State of Bahia, at latitude 10° 32' 17.7" S, longitude 38° 59' 52.8" W. The municipality has an average altitude of 472 m. The climate of the region, according to the Köppen classification, is Aw (KÖPPEN, 1948). The descriptions referring to the characteristics of the cultivar were obtained from the seed company's catalog.

A ridge measuring 70 cm wide, 20 m² in length and 50 cm in height was made for the experiment. Organic fertilizers were weighed in the UNEB soil laboratory, arranged and incorporated into the soil for decomposition. The pits were dug manually, 5 cm deep. The compounds were collected from rural properties in the municipality of Euclides da Cunha, in the State of Bahia.

The data referring to temperature and precipitation during the period of the experiment and the chemical characterization of the soil referring to the experimental area of the installation of the experiment are in Tables 1 and 2. It can be observed that in the months of April and May the rainfall indexes were reduced, indicating a drier period, however, in June the rains occurred more frequently, indicating a rainy period.

Table 1. Monthly mean values of maximum, average and minimum temperature (°C) and rainfall (mm) during the experiment with melon.

Tabela 1. Valores médios mensais de temperatura máxima, média e mínima (°C) e precipitação pluviométrica (mm) durante o experimento com meloeiro.

	Temperature (°C)			
Months	Maximum	Average	Minimim	Precipitation (mm)
April	32.8	26.3	21.8	15
May	33.1	25.5	21.7	45.2
June	27.0	22.2	19.5	146.8

Table 2. Soil chemical characterization, depth 0 - 0.20 m before experiment installation.

Tabela 2. Caracterização química do solo, profundidade 0 - 0,20 m antes da instalação do experimento.

Analysis	Results found											
	pH	P	K	Al^{3+}	Ca^{2+}	Mg^{2+}	H+Al	SB	Na	CTC (T)	V	MO
Reference	H_2O	$mg.dm^{-3}$					$cmol_c.dm^{-3}$				(%)	$g.kg^{-1}$
Values	6.64	14	56	0.040	4.2	2.2	1.36	6.66	0.12	8.02	83.04	11.6

Based on soil analysis, the organic matter content is low with 1.16%, and the ideal would be between 1.5 and 3.0%. However, the evolution of the experiment is not limited, since the management

will be with the incorporation of organic matter. The organic foundation fertilization was carried out with 20 kg of cattle manure, 10 kg of goat manure and 2 kg of poultry litter. Values established by the Brazilian Agricultural Research Corporation (STUCHI, 2015) were used as a basis for organic matter contents.

Sowing took place longitudinally, spacing 30 cm between rows and 30 cm between plants. The watering of the plants was carried out with the aid of drip tapes at a frequency of once a day. In each wetting, sufficient volume was applied to keep the humidity close to field capacity. Weed control was performed manually. The thinning was not carried out due to the loss of biological material in the field due to the occurrence of the disease root rot (*Fusarium solani* f. sp. *Cucurbitae*).

The experimental design adopted was randomized blocks, under field conditions, consisting of 4 blocks of 5 m², organized in a subdivided plot with 4 treatments and 32 repetitions each. The treatments were: treatment 1, containing the plants referring to the control; treatment 2, containing bovine manure; treatment 3, containing goat manure and treatment 4, containing poultry manure.

At 50 days after planting, melon evaluations were carried out, considering 6 useful plants per plot. From this, the following characteristics were measured: number of leaves, performed by counting the true leaves; branch length, measured with the aid of a graduated tape measure and results expressed in cm; stem diameter, measured with a manual caliper and the results expressed in mm; Chlorophyll content was measured with the aid of a portable chlorophyll meter model CFL1030, being used after previous calibration according to the manufacturer's recommendations, and the results expressed in $\mu g.cm^{-2}$.

With the aid of the SISVAR® statistical analysis software, the ANOVA was performed. All data were subjected to analysis of variance and when a significant difference was found, Tukey's test was applied at a 5% probability level ($p < 0.05$), according to the established methodology (FERREIRA, 2011).

3. Results and Discussion

Based on the results of the analysis of variance, there was a significant effect of the treatments, that is, of the sources of organic fertilizer on the number of leaves, length of branches, stem diameter and chlorophyll content of melon plants at the level of 5 % probability ($p<0.05$) (Table 3). This behavior of the results reinforces the strong influence of organic fertilization on the variables evaluated. It is worth mentioning that the reduced values of coefficients of variation in the different variables analyzed admit that the results are reliable for the treatments applied.

Table 3. Summary of analysis of variance for number of leaves (NF - unit), length of branches (CR - cm), stem diameter (DC - mm) and chlorophyll content (SPAD - $\mu g.cm^{-2}$) of melon as a function of sources of organic matter, Euclides da Cunha, 2019.

Tabela 3. Resumo da análise de variância para número de folhas (NF – unit), comprimento de ramos (CR - cm), diâmetro do caule (DC – mm) e teor de clorofila (SPAD - $\mu g.cm^{-2}$) de meloeiro em função de fontes de matéria orgânica, Euclides da Cunha, 2019.

FV	GL	QM			
		NF	CR (cm)	DC (mm)	SPAD ($\mu g.cm^{-2}$)
Block	3	0.941667^{ns}	100.066667^{ns}	3.244529^{ns}	1.538675^{ns}
Treatments	3	4.930556*	1747.555556*	16.249306*	4763.970604*
Mistake	15	15	15	15	15
CV (%)		10.63	7.24	9.51	8.82

*Significant at 5% probability by F test.

When analyzing the number of leaves, it was found that the plants grown in the T4 treatment, that is, with the addition of poultry litter, had the highest values for this variable, statistically differing from the other treatments, with an average of 7.6 (Figure 1A).

This can be explained by the fact that the addition of organic fertilizers to the soil provides improvements in its physical, chemical and biological conditions, and thus acts in the supply of macro and micronutrients, in the retention of cations, in the complexation of toxic elements, such as exchangeable aluminum, in the regulation of soil pH, keeping it in a range favorable to the development of crops, as well as in structuring, infiltration and water retention, aeration and reduction of soil compaction (BOSCH-SERRA, 2020).

The isolated effect of poultry litter may be due to the fact that the incorporation of organic matter into the soil has the potential to provoke intense activity of microorganisms, causing the substances produced to function as agglutinating elements of the particles, improving the structuring of the soil and thus provide the roots with a better development in diameter and depth (ZHANG et al., 2021).

Regarding the variable length of branches, there was a significant difference in treatment T4, (poultry litter) statistically differing from the other treatments, with an average of 62.5 cm (Figure 1B). The results found are similar to those obtained in other works carried out with vegetable crops, where vegetables with the addition of chicken manure and other organic fertilizers had a higher average height when compared to other treatments (ABREU et al., 2010).

In addition, the beneficial effects of using manure from agricultural activities, regardless of the source, are vast, such as improving the physical properties of the soil and the supply of nitrogen and phosphorus as well as other mineral nutrients. In addition, the increase in organic matter content significantly improves water infiltration as well as increasing the cation exchange capacity and accumulation of phosphorus, potassium, calcium and magnesium in the soil (MA et al., 2021).

Regarding the stem diameter, it was found that the plants that were cultivated in treatments T2 (bovine manure), T3 (goat manure) and T4 (poultry litter) had higher values, differing statistically from the control, with averages of 8.5 mm, 8.3 mm and 8.7 mm respectively (Figure 2A). These results are similar to those observed by other authors who, when working with poultry litter in vegetable crops, found increases, and the treatment without manure differed from the others, obtaining lower performance (OLIVEIRA et al., 2006).

In this way, cattle manure has a higher C/N ratio compared to the others, for this reason, its decomposition is slower and can thus cause the immobilization of nutrients such as nitrogen, phosphorus and sulfur in the soil, especially in the superficial layer of 0 -20 cm, through a greater supply of organic-C which consequently stimulates the activity of microorganisms by immobilizing nitrogen in the soil-plant system (ROCKENBACH et al., 2018).

In the literature, there are numerous recommendations of bovine manure as a source of organic fertilization for vegetable crops in general, but with a high numerical difference between them, which can be attributed, in large part, to the production potential of the cultivars used, which is quite variable among them, as well as the root reactions that distinguish when cultures are carried out in different soil and climate conditions (LOPES et al., 2019).

Relating to goat manure the results found, it can be seen that it is more solid and with reduced water content, when compared with manure from cattle and swine, thus having a better structure, favoring aeration, and therefore fermenting quickly being reused in crops with a shorter period of decomposition than the others (SANTOS et al., 2020).

Although there is little literature on goat manure, some authors have found that goat manure is an alternative that has the potential to be adopted for the supply of nitrogen and phosphorus in soils present in the semi-arid region, however a disadvantage is the low availability of raw material, in some regions where this source is not abundant (SANTOS et al., 2020).

As for the chlorophyll content, it was found that the plants grown in the T4 treatment (poultry litter) had higher values, statistically differing from the other treatments, with an average of 39.3 $\mu g.cm^{-2}$ (Figure 2B). The reading of the chlorophyll content is positively correlated with the nitrogen levels in the leaves, constituting indicators of this element in the plant (MELO et al., 2021).

It is noteworthy that through absorption, nitrogen is instantly assimilated into various constituents of the plant cell, with emphasis on the levels of total free amino acids, proteins, photosynthetic pigments (chlorophyll). These constituents will act in diverse physiological and biochemical processes that are essential for plant growth and development (KANT, 2017).

Chlorophyll represents the most abundant natural pigments in plants, being a fundamental variable to estimate the entire photosynthetic potential of plants (MESQUITA, 2015), through its direct link to light absorption, photochemical energy transfer to reaction centers in photosynthesis, growth and adaptation to different environments (TAIZ et al., 2017).

Figure 1. Number of leaves (A) and Length of branches (B) of melon cv. Goldex®. Euclides da Cunha-Ba, 2019.

Figura 1. Número de folhas (A) e Comprimento de ramos (B) do meloeiro cv. Goldex®. Euclides da Cunha-Ba, 2019.

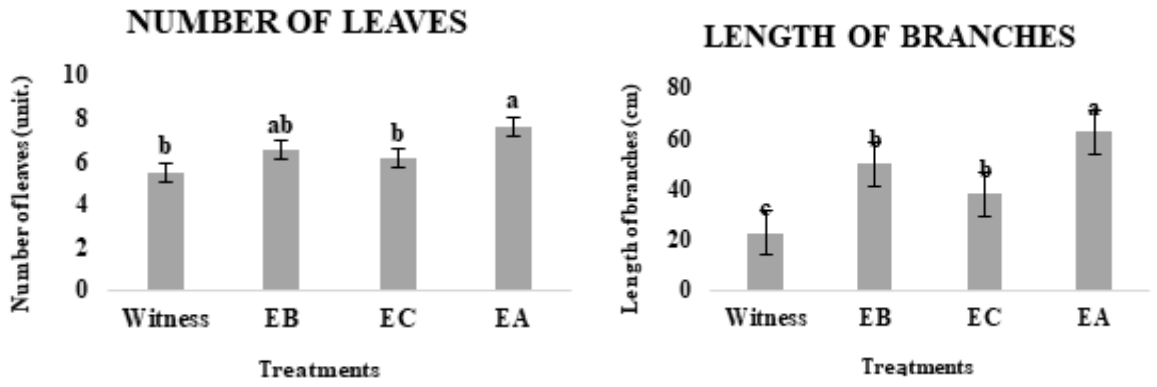
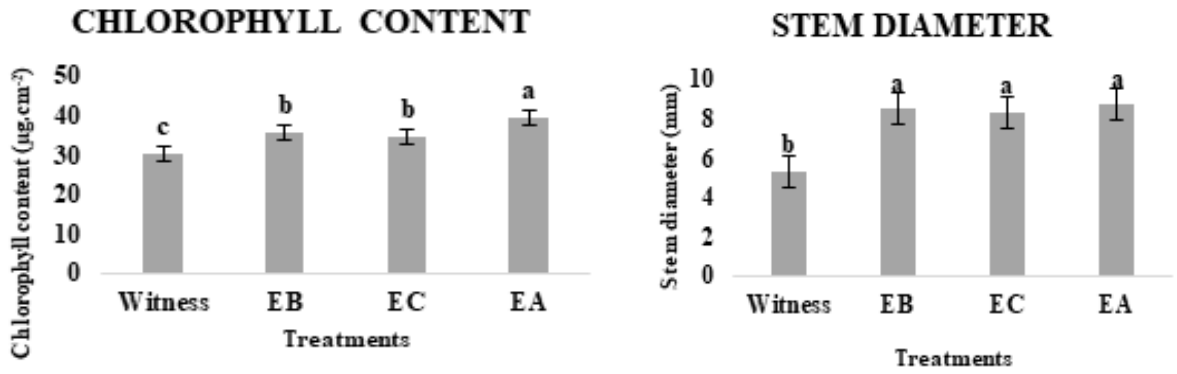


Figure 2. Stem diameter (A) and Chlorophyll content (B) of melon cv. Goldex®. Euclides da Cunha-Ba, 2019.

Figura 2. Diâmetro do caule (A) e Teor de Clorofila (B) do meloeiro cv. Goldex®. Euclides da Cunha-Ba, 2019.



4. Conclusion

The T4 treatment, with the addition of poultry litter, allowed for a greater number of leaves (7.6), branch length (62.5 cm), chlorophyll content (39.3 µg.cm^{-2}) and stem diameter (8 .7 mm) in relation to the other treatments.

The treatment with the addition of poultry litter is recommended as a viable alternative for melon cultivation in semi-arid conditions.

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