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EVALUATION OF THE MORPHOMETRIC CHARACTERISTICS OF MELON UNDER DIFFERENT IRRIGATION MANAGEMENT

AVALIAÇÃO DAS CARACTERÍSTICAS MORFOMÉTRICAS DO MELÃO SOB DIFERENTES MANEJOS DE IRRIGAÇÃO

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ABSTRACT: The work aims to evaluate different irrigation management on the morphometric characteristics of melon. Planting was carried out in a lot located in DIBAU, in the municipality of Marco-CE. The hybrid Goldex F1 was cultivated, spacing 0.3 m between plants and 2.0 m between rows. The experimental design was the DBC with five irrigation managements, M1, M2, M3, M4 and M5 in four blocks. The following variables were evaluated: plant dry mass (DM), marketable fruit mass (MF), fruit length (CF), fruit diameter (DF), leaf area (AF) and °Brix. The results show that even with twice the water depth applied between some managements, no significant difference was observed between the analyzed variables, possibly due to the high permeability of the soils under study, which did not allow waterlogging in the management with higher depths. The managements with smaller depths to plants did not suffer water deficit due to the irrigation frequency, three times a day. It is concluded that with the application of management M1 and M2, it is possible to obtain the same productivity and quality of fruits using less than half of the water used in the other managements.

Keywords: *cucumis melo L.,depths irrigation, semiarid.*

RESUMO: O trabalho tem por objetivo avaliar as características morfométricas do melão sob diferentes manejos de irrigação. O experimento foi conduzido em lote do produtor localizado no Distrito de Irrigação do Baixo Acaraú (DIBAU), no município de Marco-CE entre os meses de setembro e dezembro de 2022. Cultivou-se o híbrido Goldex F1, com espaçamento de 0,3 m entre plantas e de 2,0 m entre linhas. O delineamento experimental foi blocos casualizados com cincos manejos de irrigação, sendo quatro utilizando o sistema Ômega de microirrigação (M1, M2, M3, M4) e o M5o sistema praticado pelos produtores do DIBAU, em quatro blocos. Foram avaliadas as variáveis: massa seca da planta (MS), massa do fruto comercial (MF), comprimento do fruto (CF), diâmetro do fruto (DF), área foliar (AF) e °Brix. Os resultados mostram que mesmo com o dobro da lâmina aplicada entre alguns manejos (M1 e M5) não se observou diferença significativas entre as variáveis analisadas, possivelmente devido à alta permeabilidade dos solos em estudo que não permitiu o encharcamento deste, quando dos manejos com maiores lâminas. Já os manejos com menores lâminas a plantas não sofreram défice hídrico devido a frequência de irrigação, três vezes ao dia. Conclui-se que os M1 e M2, que utilizam a evaporação do tanque Classe A como entrada, é possível manter a qualidade de frutos utilizando menos da metade da água nos demais manejos.

Palavras-chave: *Cucumis melo L.; Lâmina de irrigação; Semiárid.*

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INTRODUCTION

Melon (Cucumis melo L.), belonging to the Cucurbitaceae family, is a fruit vegetable widely consumed and appreciated throughout the world, being a profitable and profitable crop, generally grown outdoors and equipped with irrigation systems(LOZANO et al., 2018).

Brazil exports around 40% of the melon it produces, generating revenue of US$ 165.1 million, with the Northeast region being responsible for the majority of the country's production, highlighting the states of Rio Grande do Norte, Ceará, Pernambuco, and Bahia, which contribute 95% of national production (KIST et al., 2022). The highlight of the Northeast region is due to its soil and climate conditions, which favor the cultivation of this crop, contributing to the good development and growth of plants, in addition to being possible to cultivate throughout the year (LANDAU et al., 2020). However, the occurrence of recurrent periods of drought in the region compromises the irrigated production system, as in the case of melon (XIMENES; SAMPAIO, 2018).

The supply of water through irrigation must meet the needs of the crop, making it necessary, in addition to the irrigation system, to adopt irrigation management, which can be via soil, plant, atmosphere, or combined to determine when and how much water should be used. to apply. However, what is observed is that in most irrigated areas, irrigation management is not carried out (VALNIR JÚNIOR et al. 2022).

Irregular water supply, in addition to negatively affecting production, also has an impact on fruit quality (LOZANO et al., 2018). Furthermore, the importance of efficient use of water is also justified by the fact that irrigation is the sector with the greatest water demand, among human activities, which, associated with a region with low water availability, makes irrigation management a fundamental part of the sustainability of this system. Therefore, the present work aimed to evaluate the effects of different irrigation management on the morphometric characteristics of melon.

MATERIAL AND METHODS

The experiment was carried out on a plot in the BaixoAcaraú Irrigation District (DIBAU), in the municipality of Marco - CE located between coordinates3°05’38.2” and 3°05’38.2” South latitude and along the meridians 40°05’35.4” and 40°05’33.2” West of Greenwich. The region has a climate of the Aw’ type, tropical rainy, according to Köppenwith average annual precipitation of 1190 mm, concentrated between January to May. The average temperature is 26.7°C, with a relative humidity of 84% in the wet period and 70% in the dry period, with an average wind speed of 3.2m s-1 (VALNIR JÚNIOR et al., 2022).

The soil in the experimental area has the following chemical characteristics: pH (H2O) = 7,5; Organic matter = 13,6 g kg-1; P Mehlich = 120,9 mg kg-1; K= 0,82mmolc kg-1; Na= 0,48mmolc kg-1; Ca= 4,9mmolc kg-1; Mg= 2,8mmolc kg-1; Al trocável = 0,0mmolc kg-1; H+Al= 1,32 mmolc kg-1and V= 87% for the 0 to 20 cm layer and pH(H2O) = 6,0; Organic matter = 3,8 g kg-1; P Mehlich = 11,5 mg kg-1; K= 0,26mmolc kg-1; Na= 0,39mmolc kg-1; Ca= 0,90mmolc kg-1; Mg= 0,45mmolc kg-1; Al trocável = 0,0mmolc kg-1; H+Al= 1,65 mmolc kg-1andV= 55% for the 20 to 40 cm deep layer. Both layers had a sandy texture, with excellent permeability and low retention capacity (LOPES et al., 2011). Cultivation was carried out with a Goldex F1 hybrid conducted at a spacing of 0.3 m between plants and 2.0 m between rows, with one plant per hole. Cultural treatments, weeding, application of pesticides, fertilization, and others were applied equally to all treatments. Planting was carried out directly in the area on the

25th and emergence occurred on September 28, 2022.Differentiation of treatments began ten days after emergence (DAE). The irrigation system consists of a 16 mm dripper pipe, with a spacing of 0.30 m and a flow rate of 1.6 L h-1 per emitter, working at a service pressure of 130 kPa, being fed by a three-phase motor pump set of 1. 5 hp, associated with a control head, registers, pressure gauges, fertilizer injection system, and 150 mesh disc filter.

The experimental plots had five rows measuring 6.0 m in length, with 20 plants per row and a total area of 60.0 m².The third row, the central row, was considered as the useful portion, with two plants being discarded, from the beginning and end of the row, resulting in a useful area of 9.6 m² with 16 plants.

The experimental design was randomized blocks with five treatments (management) and four blocks (replications).The treatments consisted of five irrigation managements, as specified below. Management systems M1, M2, M3 and M4 used the Omega irrigation management system (VALNIR JÚNIOR et al., 2017), which used the following input parameters: M1 - daily evaporation of the class A pan evaporation and tank coefficient, kt adopted equal to 1; M2 - daily evaporation of the class A pan evaporation, where kt is equal to 0.75; M3 -daily evaporation of the class A pan evaporation, kt being adjusted by relative humidity, average wind speed and tank boundary; M4 – potential evaporation (ETo) estimated by Hargreaves and Samani. M5 management is carried out by the producer, who uses six fixed irrigation times for each phase of crop development, lasting 10 to 15 days. The reduction coefficient (kr) value was adjusted weekly using the Freeman and Garzoli equation (ROLBIECKI et al., 2021).

The average values of 0.50, 0.80, 1.0 and 0.70 were adopted for the crop coefficient (kc), recommended by Doorenbos and Kassam (1994) and Doorenbos and Pruitt (1997), referring to the periods of vegetative development, flowering, fruiting and maturation, respectively. The irrigation frequency was three times a day for all managements. In the study, a single harvest was carried out 65 days after emergence (DAE). The effects of different irrigation managements were evaluated on the following morphometric variables: plant dry mass (DM), mean longitudinal diameter (MLD), and transverse diameter (MTD) of the fruit, leaf area (AF) and °Brix.

The DM was determined by drying the branches and leaves in a forced air circulation oven at 65°C until constant mass. Commercial fruits were classified as those with MLD greater than 9.2 cm, as fruits below this value are not attractive to the customer due to the thinner mesocarp (fruit pulp) and thinner epicarp (fruit skin), which may cause cracks and losses (GOMES et al., 2017).

The mean longitudinal diameter (MLD) and transverse diameter (MTD) of the fruit were obtained using a ruler and a set square. The leaf area (LA) was estimated by sampling according to Benicasa (2003), in which leaf discs with known area were collected and their respective dry mass obtained, which was then correlated with the total dry mass of the leaves. The °Brix was obtained using a portable analog refractometer in the laboratory the day after harvest.

The data were subjected to the normality test, and when normality was not observed, they were transformed and then analysis of variance (ANOVA) was applied. When a significant effect ($p<0.05$) was observed by the F test, they were subjected to the Scott-Knott mean comparison test at 5% significance. The analyses were performed using Sisvar 5.8 software (FERREIRA, 2011).

RESULTS AND DISCUSSION

During the experiment, climatic conditions were monitored, recording maximum, average, and minimum temperatures of 35.8°C, 29.7°C and 23.5°C, respectively. The average maximum, mean and minimum relative humidity was 83.8%, 60% and 36.2%, respectively. The average evaporation of the class A pan (Ev) was 9.0 mm day-1.

The irrigation managements presented different irrigation depths, with the smallest depth applied in the M2 management at 351 mm, followed by M1 at 454 mm. The M3, M4 and M5 managements presented similar depthsof 986, 991 and 996 mm, respectively. Although a difference greater than 50% was observed in the water applied in the M1 and M2 management systems compared to the other management systems (M3, M4 and M5), the morphometric variables did not show significant differences ($p > 0.05$) as can be seen in Table 1.

The depthsapplied during the melon crop cycle vary depending on the region and period of the year, with values of 238.4 mm observed in the Mossoró region - RN in the period from May to July (CÂMARA et al., 2007), 307.7 mm in Lavras - MG (LIMA et al., 2009), 372.4 mm in Marco - CE in the period from September to November (VALNIR JÚNIOR, et al. 2022) and depthsof 481.1 mm in Pentecoste - CE (BEZERRA; MOURÃO, 2000).

Table 1. ANOVA chart for the variables plant dry mass (DM), fruit mass (MF), mean longitudinal diameter (MLD) and transverse diameter (MTD), plant leaf area (LA) and °Brix of the hybrid yellow melon Goldex F1, subjected to different irrigation managements in a lot in the BaixoAcaraú Irrigation District from September to November 2022.

Source of Variance	Degrees of freedom	Mean Square (MS)					
		DM² (g)	MF (kg)	MLD (cm)	MTD (cm)	LA³ (cm²)	°Brix⁴
Treatment	4	1.839^{ns}	0.034^{ns}	0.457^{ns}	0.337^{ns}	84.9^{ns}	261.2^{ns}
Block	3	0.743^{ns}	0.059^{ns}	1.227^{ns}	0.239^{ns}	210.8^{ns}	281.9^{ns}
Error	12	2.817	0.033	0.566	0.349	387.5	372.8
CV¹ (%)		16.5	10.5	4.6	4.3	22.8	15.4

[1]CV – coefficient of variation; 2 - square root transformed values; 3 - logarithm-transformed values; 4 - values transformed to the second power.Values followed: nsdid not present significant differences (p>0.05) by the F test; and * presented a significant difference at 5% (p<0.05) by the F test.

Water scarcity, as well as excess water, affects fruit quality, especially on °Brix (LOZANO et al., 2018), however, the greater amount of water applied in the M3, M4 and M5 managements did not significantly influence fruit quality, possibly because the soil has high permeability (LOPES et al., 2011), avoiding a situation of waterlogging. In management with smaller depths (M2 and M1), the quality of the fruits was also not significantly influenced, such as MF, DML, DMT and °Brix. Splitting the irrigation four times a day contributed to maintaining good soil water status in the root zone of the crop, which has low retention capacity, thus meeting the needs of the plant. Table 2 presents the average of the morphometric characteristics evaluated in the five managements studied, in which no statistical difference ($p>0.05$) was observed between the managements, even with twice the number of blades applied between the treatments.

Table 2. Average values of plant dry mass (DS), fruit mass (MF), mean longitudinal diameter (MLD) and transverse diameter (MTD), plant leaf area (LA) and °Brix of melon subjected to different managements.

Variables	M1	M2	M3	M4	M5	Average
DS (g)	89.8ª	93.9ª	108.1ª	118.5ª	116.0ª	105.3
MF (kg fruto^{-1})	1.76ª	1.77ª	1.73ª	1.80ª	1.57ª	1.73
MLD (cm)	16.4ª	16.6ª	16.3ª	16.6ª	15.8ª	16.4
MTD (cm)	14.0ª	14.2ª	13.7ª	14.0ª	13.5ª	13.9
LA (cm²)	7.786ª	7.843ª	6.437ª	8.418ª	8.221ª	7.741
°Brix	11.2ª	11.2ª	10.9ª	11.7ª	10.8ª	11.2

* means followed by the same letter do not differ significantly from the Scott-Knott mean comparison test at a 5% significance level.

Dry Matter showed an average twice as high as those observed by Vendruscolo et al. (2018) who recorded values of 44.6 and 42.0 g pl^{-1} for protected cultivation and open field in Goiânia - GO, respectively. This difference may be due to the variety cultivated (Trinity), the location of the cultivation, with greater latitude (16° S) and altitude (750MSL), and the period (July to November), with an average temperature of 23°C during the period.

The fruit mass obtained in this work was higher than those of Vendruscolo et al. (2018) and Queiroga et al. (2007) who obtained averages of 1.3 and 1.0 kg fruit^{-1}, respectively. However, the observed MF was approximately 15% lower than that observed in the work of Araújo et al. (2003). Some factors can influence fruit mass such as the cultivar (CARMO et al., 2017), the number of fruits per plant (DALASTRA et al. 2016), and temperature (QUEIROGA et al., 2007).

The MLD and MTD of the fruit (Table 2) were approximately 15% higher than those observed by Vendruscolo et al. (2018) and Queiroga et al. (2007). The format index (ratio between MLD/MTD) obtained was on average 1.18 higher than that observed by Vendruscoloet al. (2018) which ranged from 1.05 to 1.07 and similar to the upper limit found by Queiroga et al. (2007) which ranged from 1.06 to 1.17.

The leaf area with an average of 7,741 cm² (Table 2) is similar to those observed by Queiroga et al. (2007) who obtained values of 6,199 and 7,048 cm² per plant for the Fleuron and Torreon cultivars of the *Cantalupensis* group.

All managements presented °Brix values above 9.0, the minimum value required for the international market (DALASTRA et al., 2016).The values observed in the study were lower than those observed by Dalastra et al. (2016), with an average of 13.4°Brix for yellow melon when harvesting the fruits between 52 and 72 days after transplanting (DAT). However, Vendruscolo et al. (2018) observed values lower than 8 °Brix when harvesting the fruits at 63 DAT. The authors op cit. justified the low °Brix value by the occurrence of rainfall, more than 90 mm, during the period of fruit maturation, which may have leached nitrogen and potassium, which influences production characteristics such as pulp thickness, soluble solids and total titratable acidity.

The high depth value applied in M3 management is possibly due to the adjustment made with information estimated through averages of the wind speed and relative humidity variables, as we do not have equipment for recording in the area. The larger depth applied in M4 management is possibly due to the overestimation of ETo that has already been observed in other studies.Lima et al. (2019) observed that the Hargreaves–Samani (HS) method had the worst performance among those evaluated for estimating ETo in several locations in Brazil, resulting in an overestimation of around 40% of the ETo obtained by Penman-Monteith. This result corroborates Leitão et al. (2020) and Lima Júnior et al. (2016) who concluded that the HS model overestimates the Penman-Monteith equation in the state of Ceará in the first months of the year, regardless of whether it is calibrated or not.

The ETo estimation methods applied in this work showed variable performance in the literature when compared to Penman-Monteith. Araújo, Costa and Dos Santos (2007) when comparing the methods for estimating potential evapotranspiration (ETo) for Boa Vista – RR observed a “poor” performance for HS and “very good” for the Class A pan (TCA) for the Performance Index (*c*). Cavalcante Júnior et al. (2011) also evaluated the ETo estimation methods for Mossoró – RN in the wet and dry periods and observed that *c* presented poor to very poor performance for both the HS and TCA methods.

CONCLUSIONS

The different irrigation managements did not significantly influence the morphometric characteristics, fruit mass, longitudinal and transversal diameter and °Brix of the Goldex F1 melon hybrid, possibly due to good soil permeability and high irrigation frequency.

Management methods M1 and M2, which use the Class A pan, are recommended because they reduce the application by less than half of the other methods while maintaining the quality of the melon fruits.

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