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Production and economic viability of ‘Kent’ mango subjected to regulated deficit irrigation in the semi-arid

Produção e viabilidade econômica da mangueira ‘Kent’ submetida a irrigação com déficit regulado no semiárido

Producción y viabilidad económica del mango ‘Kent’ sometido a un riego deficitario regulado en las zonas semiáridas

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ABSTRACT
Mango (*Mangifera indica* L.) production has great importance for Brazilian agriculture, being concentrated in the states of Bahia and Pernambuco. Although mango is a drought-tolerant crop, inadequate irrigation management reduces its yield. Thus, the objective was to evaluate production parameters and economic viability of ‘Kent’ mango subjected to controlled water deficit in the phenological stages of flowering, fruit growth and maturation. The experiment was conducted in the municipality of Petrolina/PE, semi-arid region of the São Francisco Valley, in a ultisol. The experimental design was randomized blocks, in a triple factorial scheme, with application of four irrigation depths (40, 60, 80 and 100% of crop evapotranspiration - ETc), three phenological stages (F1 - flowering, F2 - fruit growth, F3 - fruit maturation) and two production cycles (2018 and 2019 seasons), with four replicates, each of which consisting of four plants. The irrigation with 40% ETc in the flowering stage and 80% of the ETc in the growing and ripening of fruits phases promoted higher yield, water use efficiency and benefit/cost ratio in the cultivation of ‘Kent’ mango in the Brazilian semi-arid region.

Keywords: *Mangifera indica* L., Water Use Efficiency, Yield.

RESUMO
A produção de manga (*Mangifera indica* L.) tem grande importância para a agricultura brasileira, concentrando-se nos estados da Bahia e Pernambuco. Embora a manga seja uma cultura tolerante à seca, o manejo inadequado da irrigação reduz a sua produtividade. Assim, objetivou-se avaliar parâmetros de produção e viabilidade econômica da manga ‘Kent’ submetida a déficit hídrico controlado nos estádios fenológicos de floração, crescimento e maturação dos frutos. Assim, objetivou-se avaliar parâmetros de produção e viabilidade econômica da manga ‘Kent’ submetida a déficit hídrico controlado nos estádios fenológicos de floração, crescimento e maturação dos frutos. O experimento foi

conduzido no município de Petrolina/PE, semiárido do Vale do São Francisco, em um Argissolo amarelo. O delineamento experimental utilizado foi o de blocos casualizados, em esquema fatorial triplo, com aplicação de quatro lâminas de irrigação (40, 60, 80 e 100% da evapotranspiração da cultura - ETc), três estádios fenológicos (F1 - floração, F2 - crescimento do fruto, F3 - maturação do fruto) e dois ciclos de produção (safras 2018 e 2019), com quatro repetições, cada uma composta por quatro plantas. A irrigação com 40% ETc na floração e 80% da ETc nas fases de crescimento e amadurecimento dos frutos promoveu maior produtividade, eficiência no uso da água e relação custo/benefício no cultivo da manga 'Kent' no semiárido brasileiro.

Palavras-chave: *Mangifera indica* L., Eficiência do Uso de Água, Produtividade.

RESUMEN

La producción de mango (*Mangifera indica* L.) es de gran importancia para la agricultura brasileña, concentrándose en los estados de Bahía y Pernambuco. Aunque el mango es un cultivo tolerante a la sequía, el manejo inadecuado del riego reduce su productividad. Así, el objetivo fue evaluar parámetros de producción y viabilidad económica del mango "Kent" sometido a un déficit hídrico controlado en las etapas fenológicas de floración, crecimiento y maduración de los frutos. Así, el objetivo fue evaluar parámetros de producción y viabilidad económica del mango "Kent" sometido a un déficit hídrico controlado en las etapas fenológicas de floración, crecimiento y maduración del fruto. El experimento se realizó en el municipio de Petrolina/PE, en la región semiárida del Valle de São Francisco, en un argissolo amarillo. El diseño experimental utilizado fue el blo-cos casualizado, en un esquema factorial triple, con aplicación de cuatro láminas de riego (40, 60, 80 y 100% de la evapotranspiración del cultivo - ETc), tres etapas fenológicas (F1 - floración, F2 - crecimiento del fruto, F3 - maduración del fruto) y dos ciclos de producción (cosechas 2018 y 2019), con cuatro repeticiones, cada una compuesta por cuatro plantas. El riego con 40% ETc en floración y 80% ETc en las fases de crecimiento y maduración de los frutos promovió mayor productividad, eficiencia en el uso del agua y relación costo/beneficio en el cultivo de mango 'Kent' en la zona semiárida brasileña.

Palabras clave: *Mangifera indica* L., Eficiencia en el Uso del Agua, Productividad.

1 INTRODUCTION

In 2019, Brazil produced about 1.4 million tons of mango (*Mangifera indica* L.), and the largest production was located in the Northeast Region, with the states of Bahia and Pernambuco standing out as the largest producers (IBGE, 2020). The cultivar 'Kent' is one of the most produced in the region probably due to the absence of fibers and better flavor, which puts it among the most appreciated in some European countries and Japan.

However, the management of its flowering is difficult, which limits production (Araújo et al., 2017).

The growing need for optimization of water resources in the semi-arid region has required research on irrigation management aimed at increasing water use efficiency. For this, it is necessary to analyze the water needs of plants in each stage of greater sensitivity to water stress, besides using cultivars that are adapted to local conditions (Daniel et al., 2021).

Although mango is considered a drought-tolerant plant, studies show that inadequate irrigation management reduces soil water availability, which may affect physiological events, plant growth rate and, consequently, fruit yield and quality (Figueirêdo et al., 2020). However, some investigations report that the reduction of irrigation depth in less sensitive phenological stages may not hamper or may even improve fruit production and quality with greater water savings (Cotrim et al., 2017; Coelho et al., 2021).

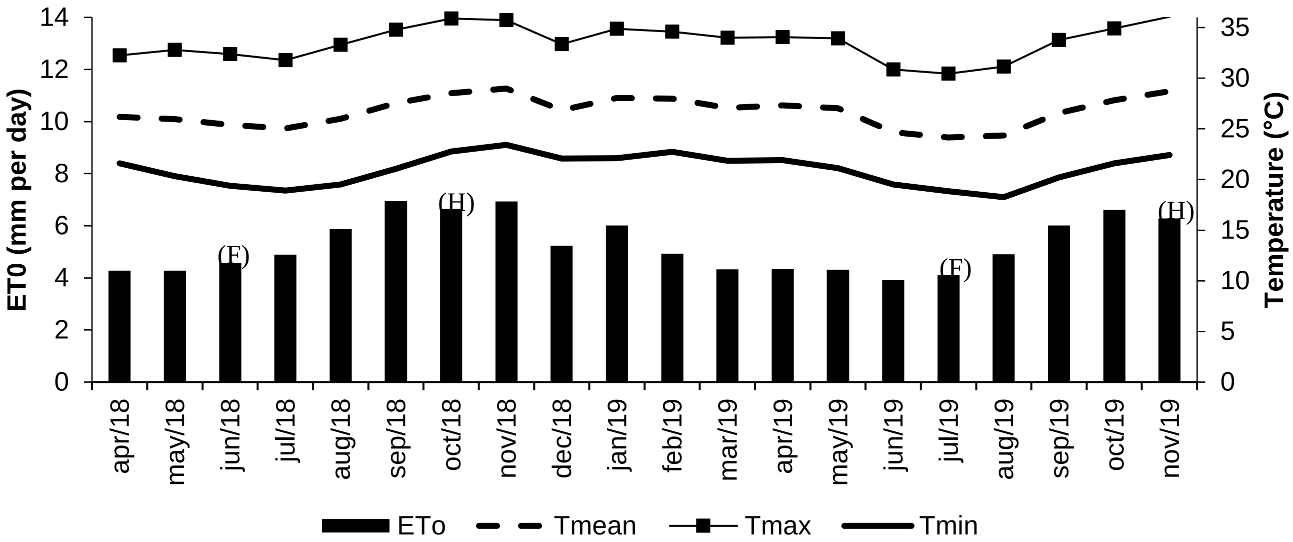
Thus, the objective of this study was to evaluate was to evaluate production parameters and economic viability of 'Kent' mango subjected to regulated deficit irrigation in the phenological stages of flowering, fruit growth and maturation in a semi-arid environment.

2 MATERIAL AND METHODS

The study was conducted in the orchard of the Special Fruit Farm, located in the municipality of Petrolina, PE, Brazil (09º 08' South, 40º 18' West and average altitude of 370 m), in the Sub-middle São Francisco River Valley. The soil of the experimental area, classified as ultisol, was sampled for characterization of the chemical attributes in specialized laboratory (Table 1). According to Köppen's classification, the climate is classified as BSh, i.e. very hot semi-arid, with rainy season in summer extending to early autumn (Alvares et al., 2013).

The experimental design used was randomized blocks, in a triple factorial scheme, with the application of four irrigation depths (40, 60, 80 and 100% of crop evapotranspiration - ETc), three phenological stages (F1 - flowering, F2 - fruit growth, F3 - fruit maturation) and two consecutive production cycles (2018 and 2019 seasons), with four replicates, each of which consisting of four plants. Reference evapotranspiration was obtained by the FAO-Penman-Monteith method (Allen et al., 1998), using daily data collected from a weather station installed near the experimental site and crop coefficients (Kc), which ranged from 0.6 to 1.0, as suggested by Teixeira et al. (2008). Figure 1 shows climatic data from that station for the experimental period.

Figure 1. Average monthly reference evapotranspiration (ET_o) and monthly averages of minimum (Tmin), mean (Tmean) and maximum (Tmax) temperatures from a weather station installed in the experimental area, in Petrolina-PE, during two production cycles of 'Kent' mango



F - Flowering; H - Harvest
Source: Authors.

Table 1. Chemical characterization of the soil in the 'Kent' mango orchard. Special Fruit Farm, Petrolina, PE. 2018

Layer	ECse	pH	P	K^+	Na^+	Ca^{2+}	Mg^{2+}	Al^{3+}	$H^+ + Al^{3+}$	SB	CEC	V
m	mS cm^{-1}		mg dm^{-3}	cmol$_c$ dm^{-3}								%
0.0-0.2	0.46	4.3	41.76	0.43	0.13	3.7	0.9	0.0	0.5	5.2	5.7	91.5
0.2-0.4	0.23	4.5	40.53	0.36	0.11	2.2	1.1	0.0	1.4	3.8	5.2	72.4

ECse - Electrical conductivity of saturation extract; P - Available phosphorus extracted by Mehlich; Ca - Exchangeable calcium; Mg - Exchangeable magnesium; Na - Exchangeable sodium; K - Exchangeable potassium; Al - Exchangeable acidity; SB - Sum of bases; CEC - Cation exchange capacity at pH 7.0; V - Base saturation
Source: Authors.

The experiment was conducted in a ‘Kent’ mango orchard in October 2017 at spacing of 6.00 × 2.00 m, in production stage. Along the experiment, pruning, fertilization, phytosanitary treatments and floral induction were performed as described by Mouco (2015). Harvest was carried out in October 2018 for the first cycle and in November 2019 for the second cycle.

The irrigation was daily performed, in order to replace the ETc of the previous day. The irrigation system used was drip irrigation, with two hoses per row of plants. The emitters were spaced 0.30 m from each other and had a flow of 1.7 L h^{-1}. The monitoring of soil moisture up to 60 cm in depth was carried out every two weeks, using a multisensory capacitance probe FDR PR2 (Delta), which was inserted into access tubes.

The crop evapotranspiration (ETc) was defined by Eq. 1, using the crop coefficients (Kc) recommended by Teixeira et al. (2008) for the 'Tommy Atkins' mango tree, since there is no research to determine the Kc of the 'Kent' mango tree in the region. in Table 2. To estimate the ETc, the reduction coefficient (Kr) was used according to Keller & Karmeli (1974) (Eq. 2).

$$\mathrm{ETc} = \mathrm{ETo} \times \mathrm{Kc} \times \mathrm{Kr} \quad (1)$$

$$\mathrm{Kr} = \frac{\mathrm{Cs}}{0.85} \quad (2)$$

Where:

ETc - Crop evapotranspiration

Cs - shading coefficient, which was calculated by Eq. 3.

$$\mathrm{Cs} = \frac{\mathrm{A}}{\mathrm{Sp\ x\ Sr}} \, (3)$$

Where:

A - being the projected canopy area on the ground (m^2); and, Sp - spacing between plants (m) and Sr the spacing between rows (m).

Table 2. Mango phenological stages, with their respective durations and crop coefficients (Kc) used in the experiment

Phenological stage	*Kc	Beginning (dapp**)	Duration (days)
Rest	0.7		
Vegetative growth	0.8	0	130
Branch maturation	1.0	130	30
Floral induction	0.3	160	20
Flowering (F1)	1.0	180	30
Fruit growth (F2)	0.9	210	60
Fruit ripening (F3)	0.8	270	20
Harvest (F3)	0.6	290	10

*Teixeira et al. (2008); **dapp - Days after production pruning
Source: Authors.

Number of fruits per plant, average fruit weight and yield were evaluated at harvest. The fruits were harvested in the maturity stage E2 (initial phase of maturation), adopted as a standard for export (Brecht et al., 2011). Water use efficiency (WUE) was calculated by the ratio between the weight of fruits produced and the volume applied during each cycle as a function of the treatments tested.

The two cycles were analyzed in order to identify which percentage of water stress at different times of the production cycle led to the best benefit/cost ratio, which is the ratio between net revenue and total expenditure of production. For this, percentages of 40, 60 and 80% were applied in three stages (flowering, fruit growth and fruit maturation), in relation to yield (t ha^{-1}), to collect information about the benefit and volume of water applied (m^3 ha^{-1}). Benefit was calculated considering the prices of ‘Kent’ mango for the producer, which averaged R$ 1.80. For the costs, the water prices were fixed at R$ 94.20 ha^{-1} per month and the cost of electricity was R$ 97.30 for every 1000 m^3. These values are the same as those used by Simões et al. (2021).

The results were submitted to the normality of residuals test by Shapiro-Wilk and homogeneity of variances, by Bartlett. After verifying that the data met the assumptions

of normality and homogeneity, a variance analysis was performed, using the F test at 0.05 probability. When there was a significant difference between treatments, the Tukey test of means at 0.05 probability for qualitative factors and regression analysis at

0.05 probability for quantitative factors were performed, to choose the models that best represent the data, with based on the significance of the model and its determination coefficient. Statistical analyses were carried out using SISVAR software (Ferreira, 2017).

3 RESULTS AND DISCUSSION

The results of the analysis of variance of the data collected are described in Table 3.

Table 3. Summary of Analysis of variance table with the mean squares of the variation factors in relation to the variables analyzed.

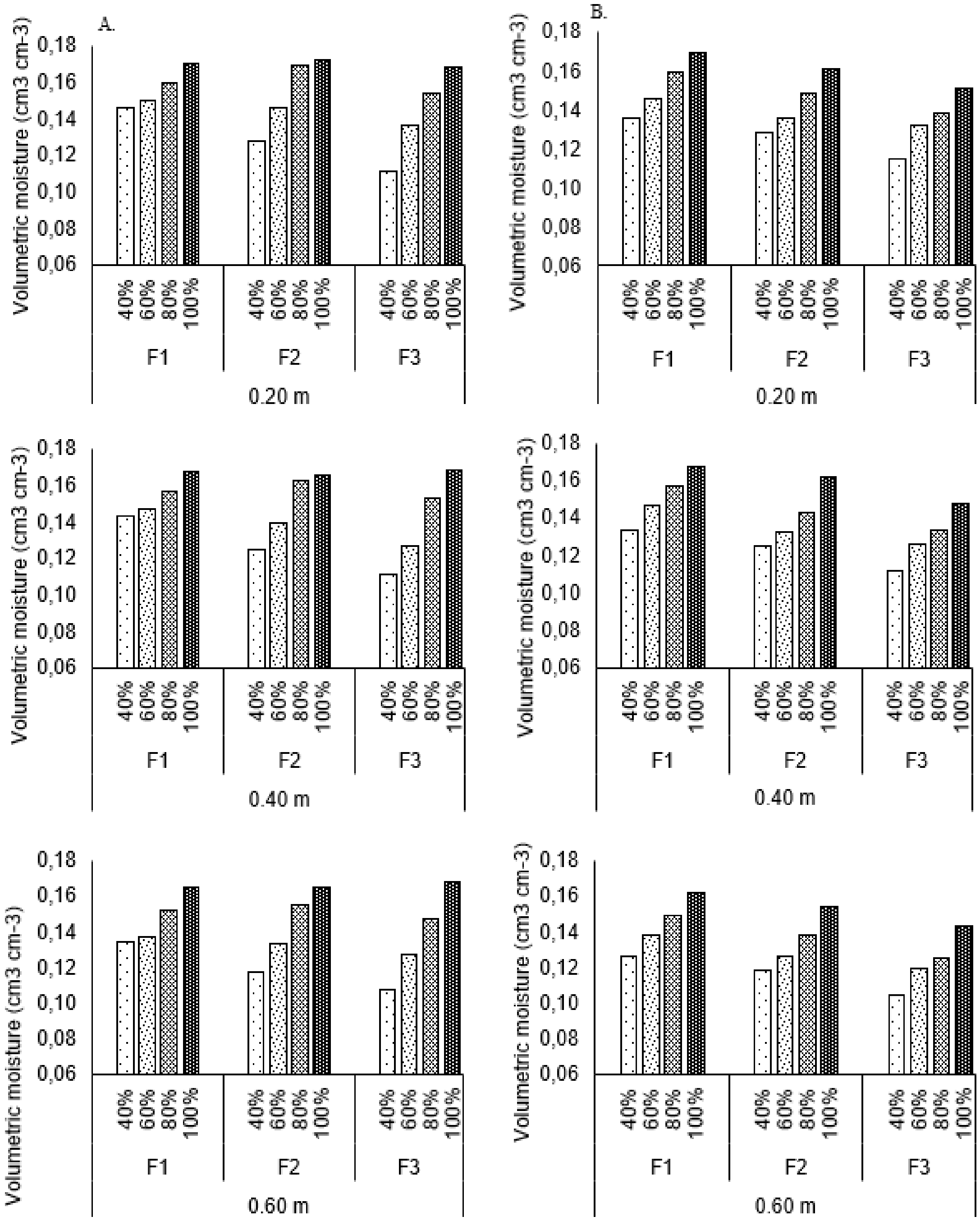
		Mean Squares			
VF	DF	FPP	FW	Yld	WUE
Block (B)	3	201.38^{ns}	5915.27^{ns}	48.27^{ns}	0.58^{ns}
Depth (D)	3	135.95*	1586.36*	13.05*	0.45*
Stage (S)	2	263.11*	10169.72*	153.16*	0.58*
Cycle (C)	1	56.25^{ns}	363704.1*	1162.8*	31.28*
F × D × C	6	44.55 ^{ns}	1284.49 ^{ns}	5.58 ^{ns}	0.07 ^{ns}
D × S	6	175.38*	4170.54*	40.48*	0.29 ^{ns}
D × C	3	52.69 ^{ns}	975.06 ^{ns}	8.63 ^{ns}	0.15 ^{ns}
S × C	2	4.66 ^{ns}	2752.37 ^{ns}	7.84 ^{ns}	0.07 ^{ns}
Error	69	114.84	2576.07	17.77	0.20
CV (%)		16.11	5.14	4.95	15.77

* - Significant at 0.05 probability by Tukey's test; FPP - Fruits per plant; FW - Fruit Weight; Yld - Yield; WUE - Water use efficiency; CV - coefficient of variation

Source: Authors.

It was observed that soil moisture decreased with the course of the phenological phases and with the increase in depth in treatments with water deficit (Figure 2).

Figure 2. Mean volumetric soil moisture submitted to different irrigation depths, at different phenological stages of the 'Kent' mango tree, at different depths, in the cultivation cycles of 2018 (A) and 2019 (B)



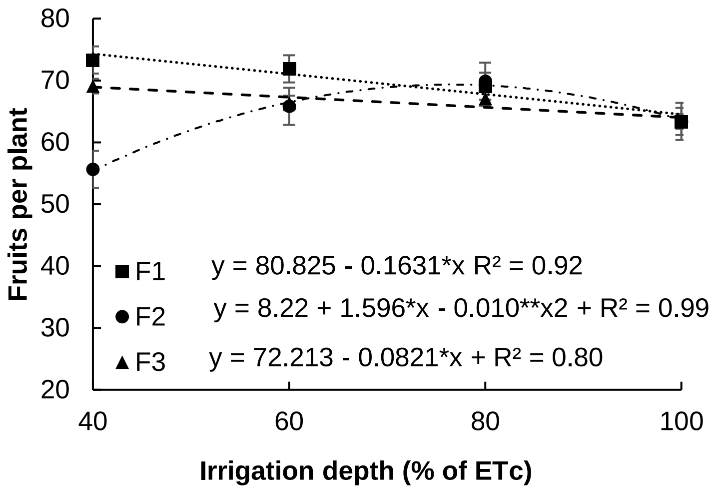
F1 – Flowering; F2 - Fruit growth; F3 - Fruit ripening

Source: Authors.

The soil moisture reduction during the phenological phases and with the increase in depth in treatments with water deficit showed a deficit in the soil water balance during the production cycle, which was more evident in the 40 and 60% ETc irrigation. Considering that the measurement of soil moisture was performed right before replacement irrigation, soil moisture contents remained high in the treatment with 100% ETc, even at the greatest depths, which suggests that this applied irrigation depth is greater than the real ETc.

Regarding the number of fruits per plant, there was interaction between irrigation depths x phenological stages, with no difference between the production cycles (Figure 3).

Figure 3. Number of fruits per plant of 'Kent' mango subjected to different irrigation depths in the flowering (F1), fruit growth (F2) and fruit maturation (F3) stages during two consecutive cycles (2018-2019)



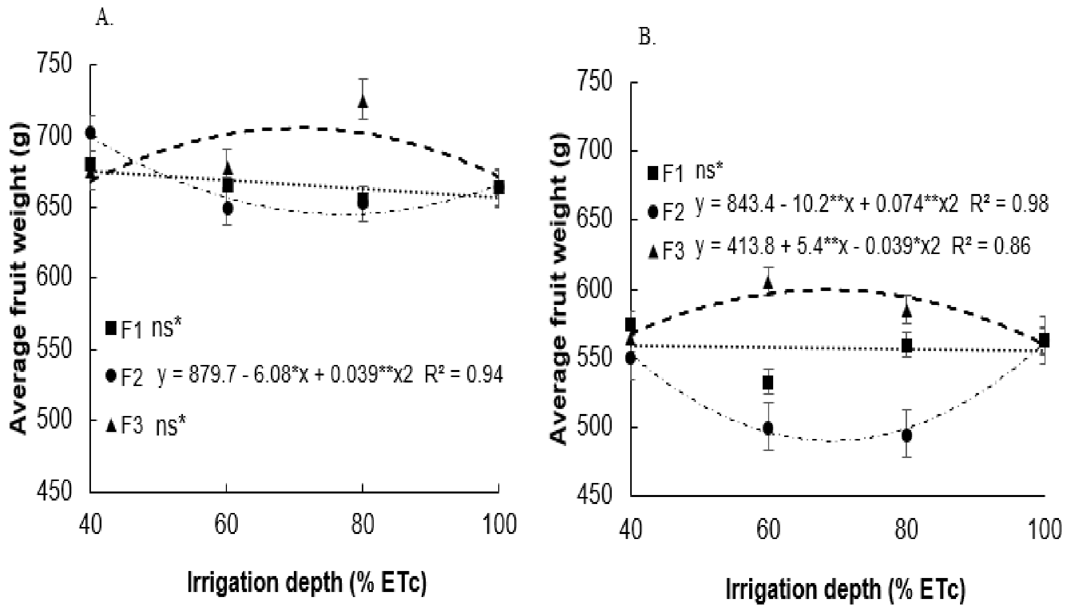
Vertical bars indicate the standard error of the means (n = 5.2). * Significant at 0.05 probability level. ** Significant at 0.05 probability level.
Source: Authors.

There was a linear increase in the number of fruits per plant with the reduction of irrigation depth from 100 to 40% of ETc in phases F1 and F3. In the fruiting stage, a maximum value of 69.5 fruits per plant was estimated for an irrigation depth of 76.7% ETc.

Reduction of irrigation depth in the flowering and fruit maturation stages increased the number of fruits of 'Kent' mango, indicating that water stress in its flowering stage favored flowering, resulting in the greater number of fruits, corroborating with Oliveira (2020). Both deficit and excess of water in the soil cause stress to plants, leading to stomatal closure (Campos et al., 2021), due to the production of abscisic acid resulting from water stress (Lamers et al., 2020), reducing the absorption of water and nutrients and promoting fruit fall (Wahdan, 2011). Therefore, the Kc used for the F1 and F3 stages was probably overestimated, which explains the linear reduction in the number of fruits when irrigation increased from 40 to 100% ETc. Considering the maximum number of fruits per plant obtained with irrigation of 76.7% of ETc in F2, higher or lower irrigation depths can be considered, respectively, as excessive and insufficient in this stage, since they cause stomatal closure, reducing photosynthetic production and hampering production, as reported by Simões et al. (2021).

An interaction of irrigation depths × phenological stages was observed for average fruit weight, with variation between the two cultivation cycles (Figure 4).

Figure 4. Average fruit weight of ‘Kent’ mango, subjected to different irrigation depths in the phenological stages of flowering (F1), fruit growth (F2) and fruit maturation (F3), in the cultivation cycles of 2018 (A) and 2019 (B)



Vertical bars indicate the standard error of the means (n = 36.7). ns - Not significant., * Significant at 0.05 probability level. ** Significant at 0.01 probability level.
Source: Authors.

For F1, it was not possible to adequately adjust the regression equations, being the estimated equations: y = + 687.32 - 0.3012x with R^2 = 0.57 in the first cycle and y = 561.75 - 0.0568x with R^2 = 0.55 in the second cycle. For F2, lower average fruit weights of 490 and 645 g were estimated for irrigation depths of 69 and 77% ETc in the first and second cycles, respectively. For F3, it was not possible to adequately adjust the regression equation in the first cycle, being the estimated equation: $y = -0{,}0398x^2 + 5{,}6248x + 506{,}9$ with R^2 = 0,448. In the second cycle, the higher average fruit weight of 509 g was estimated for the irrigation depth of 68% ETc in the second cycle.

The average fruit weight decreased with the application of water stress in the fruit growth stage from 60 to 100%, a result that corroborates with those reported by Levin et al. (2015). Under water stress conditions, plants tend to prevent water loss by partially closing their stomata, avoiding the reduction of water potential in their tissues, being an essential mechanism for survival (Lamers et al., 2020). Considering that mango fruits contain approximately 80% of water in their composition (Cunha et al., 2022), irrigation

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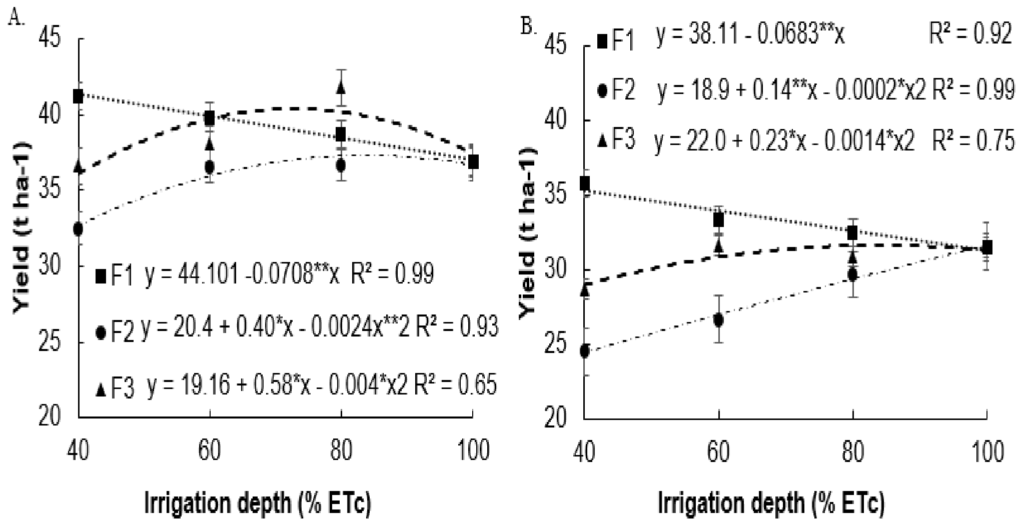
is fundamental in this stage. In the treatment with 40% ETc in the fruit growth stage, a trend of increase in fruit weight was observed, which can be explained by the lower number of fruits caused by this treatment, leading to a higher source-sink ratio, as observed by Oliveira et al. (2019).

In the first production cycle there were higher temperatures and global solar radiation, in addition to lower relative humidity, in the fruiting phase compared to the second cycle (Figure 1). Solar radiation enables the synthesis of ATP, being used in the Calvin and Benson cycle in the photoassimilates production, while the lower relative humidity of the air provides a greater difference in the intra- and extrafoliar moisture gradient, increasing plant transpiration and enabling greater CO_2 absorption by the leaves (Taiz & Zeiger, 2017) which probably resulted in greater stomatal conductance and photosynthesis of the plants, thus providing greater fruit mass, as observed by Almeida et al. (2020), who related increased gas exchange with increased solar radiation, providing greater production of 'Tommy' mango fruit.

Despite the oscillation in the average fruit weight with the application of water deficit, according to Brecht et al. (2011), the export market varies its demand from 400 to 900 g, depending on the consumer preference, and this standard is compatible with the average fruit weight obtained in the two production cycles.

Yield varied with the application of controlled water deficit and the production cycles evaluated (Figure 5).

Figure 5. Yield of 'Kent' mango subjected to different irrigation depths, in the phenological stages of flowering (F1), fruit growth (F2) and fruit maturation (F3), in the cultivation cycles of 2018 (A) and 2019 (B)



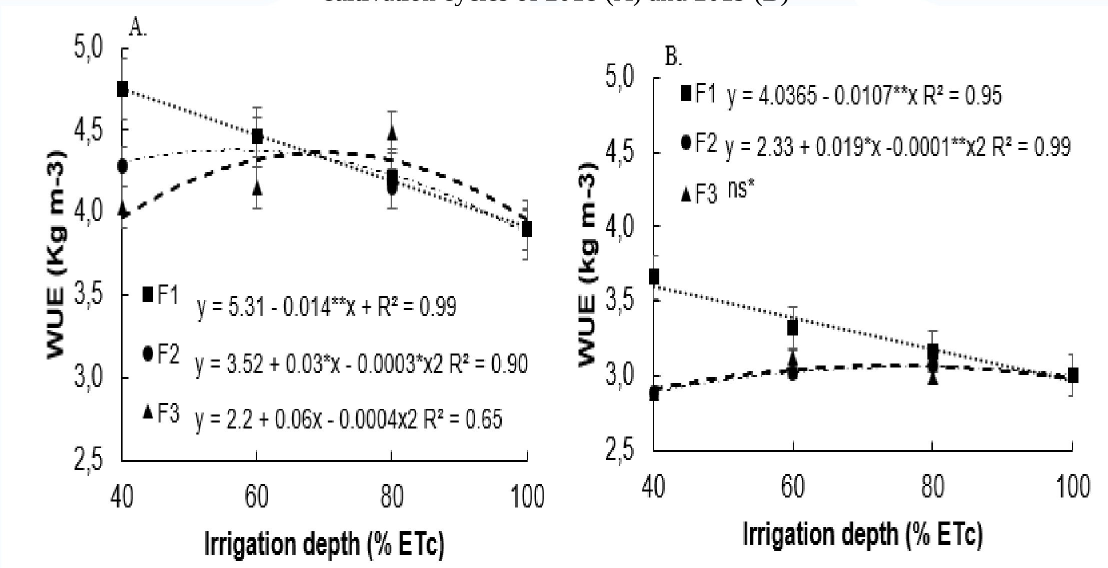
Vertical bars indicate the standard error of the means (n = 3.1). * Significant at 0.05 probability level. ** Significant at 0.01 probability level.
Source: Authors.

In the fruit growth stage, the maximum estimated yields were 37.3 t ha^{-1} for an irrigation depth of 83.9% ETc in the first production cycle and 32.2 t ha^{-1} for an irrigation depth of 100% ETc in the second production cycle. In the fruit maturation stage, the highest estimated yields were 40.33 t ha^{-1} for an irrigation depth of 72.7% ETc in the first cycle and 31.52 t ha^{-1} for an irrigation depth of 82.5% ETc in the second cycle.

Reduction of irrigation depth in the flowering stage resulted in a higher number of fruits, with no reduction in their average weight, leading to higher yield as irrigation depth decreased for both cultivation cycles. In general, the treatments that received water stress in the fruit growth period showed the lowest yields, pointing to high sensitivity to water stress during fruit growth. The highest temperature in the first cycle may have promoted greater gas exchange, resulting in higher yield. Another factor that may have contributed to this is the alternation of production, a characteristic of the mango crop (Oliveira et al., 2015). In addition, the first cycle had statistically the same number of fruits as the second one, with an average of 64.14 fruits per plant, and higher average fruit weight (674.86 g per fruit in the first cycle and 553.49 g per fruit in the second cycle), resulting in higher yield.

The water use efficiency was influenced by the irrigation depths, in the different phenological phases, in the two production cycles, with the highest value obtained with the lowest irrigation depth applied in the flowering stage (Figure 6).

Figure 6. Water use efficiency (WUE) in the cultivation of 'Kent' mango, subjected to different irrigation depths, in the phenological stages of flowering (F1), fruit growth (F2) and fruit maturation (F3), in the cultivation cycles of 2018 (A) and 2019 (B)



Vertical bars indicate the standard error of the means (n = 0.22). * Significant at 0.05 probability level. ** Significant at 0.01 probability level.
Source: Authors.

For the fruit growth stage, the highest estimated values of WUE were obtained with irrigation depths of 56.46% ETc in the first cycle and 77.35% ETc in the second cycle, respectively. For the fruit maturation stage, it is estimated that the highest WUE is obtained with irrigation depths of 69.68% ETc in the first cycle. In the second production cycle, it was not possible to adequately adjust the regression equation in the first cycle, being the estimated equation: $y = 2.32 + 0.021x - 0.0001x^2$ with $R^2 = 0.53$.

The highest mango yield was obtained when irrigation depths of 40% ETc were used in the flowering stage, which resulted in higher water use efficiency. Although the treatments with stress in the fruit growth stage resulted in lower yields, there was no difference in WUE compared to the treatments applied in the fruit maturation stage, since the fruit growth stage is longer than the fruit maturation stage, resulting in more days with water deficit, reducing the amount of water applied and thus increasing WUE. The result corroborates those reported by Spreer et al. (2009), who found greater water use efficiency in mango under conditions of water deficit in this stage.

Table 4 shows the results of the cost/benefit ratio analysis and the economic indicators for the treatments used in the experiment. In the first cycle, the highest total revenue is obtained with stress of 60% during flowering, R$ 75,808.00 per hectare, as it led to the highest yield. The second highest total revenue is obtained with stress of 20% during maturation, R$ 75,213.00. Regardless of the percentage of stress chosen, the fruit growth period does not produce interesting results from an economic point of view.

Table 4. Relative economic indicators (in R$) of 'Kent' mango under different stress levels during different stages of its cycle (two production cycles)

	Full irrigation	Stress during flowering			Stress during fruit growth			Stress during maturation		
		60%	40%	20%	60%	40%	20%	60%	40%	20%
1st Cycle										
Total Revenue	66,358	75,808	67,500	64,017	58,463	65,806	65,944	65,784	69,751	75,213
Water Expenses	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4
Electricity	918.58	843.62	868.51	893.78	738.26	798.24	858.23	883.40	893.46	905.90
Total Expenses	1,012.7	937.82	962.71	987.98	832.46	892.44	952.43	977.60	987.66	1,000.1
Net Revenue	65,345	74,870	66,538	63,029	57,630	64,914	64,991	64,806	68,763	74,213
Benefit/Cost	31.9	37.9	33.3	31.1	30.9	33.7	32.7	32.2	34.0	36.4
2nd Cycle										
Total Revenue	59,456	70,574	55,809	43,869	44,232	48,125	53,497	49,975	57,029	55,625
Water Expenses	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4	1,130.4
Electricity	1,023.56	952.81	976.39	999.97	826.15	891.95	957.75	970.27	988.03	1,005.79
Total Expenses	1,117.7	1,047.0	1,070.5	1,094.1	920.35	986.15	1,051.9	1,064.4	1082.23	1,099.99
Net Revenue	58,339	69,527	54,739	42,775	43,311	47,139	52,445	48,911	55,947	54,525
Benefit/Cost	26.2	33.4	26.0	20.0	22.1	23.3	25.1	23.3	26.4	25.6

Source: Research Data

In the case of irrigation expenses, the values increase linearly as evapotranspiration replacement increases, since it is basically a function of the cost of

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electricity and this depends on the volume of water used in irrigation. The point is that this higher cost will not always lead to higher yield. In the flowering period, yield decreases as the stress decreases and the expenses on irrigation increases. In the other two stages, yield increases when stress is reduced.

In the flowering stage, a stress level of 60% has two positive effects on the economic issue, both leading to the highest yield (and consequently revenue) and having a lower expense. The highest net revenues and benefit/cost ratios, likewise, are found in the flowering stage with a stress level of 60%.

For the second cycle, the analysis is similar, that is, the highest yield occurred in the flowering stage considering a stress level of 60%, as well as the highest total and net revenues and the highest benefit/cost ratio. Thus, from an economic point of view, the most feasible would be to consider stress in the flowering stage and, among the stress percentages, to consider the level of 60%.

4 CONCLUSIONS

The irrigations with 40% of the crop evapotranspiration in the flowering phase and 80% of the ETc in the growing and ripening phase of fruits provided greater production results, efficiency in water use and less cost/benefit ratio in the cultivation of 'Kent' mango tree in the Brazilian semiarid region.

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