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ASSESSMENT OF PLANT HEIGHT AND STEM DIAMETER OF PHYSIC NUT PLANTS UNDER SALT STRESS

MARIA BETÂNIA RODRIGUES SILVA¹; APARECIDA RODRIGUES NERY²; LUIS NERY
RODRIGUES³; PEDRO DANTAS FERNANDES⁴; JOSÉ DANTAS NETO⁵; RICARDO ALMEIDA
VIÉGAS⁶; LUCIANO BARRETO MENDES⁶; RENATO LIMA RAMOS⁶; HERMANN DA COSTA
CURVÊLO⁶

¹Researcher, PhD student, UAEAg/UFCG/Campina Grande - Brazil, E-mail: betaniars@hotmail.com

²Researcher, MSc student, UAEAg/UFCG/Campina Grande - Brazil

³Researcher, PhD student, UAEAg/UFCG/Campina Grande - Brazil

⁴Professor LEID/UAEAg/UFCG/Campina Grande - Brazil

⁵Professor LEID/UAEAg/UFCG/Campina Grande - Brazil

⁶Undergraduate student UAEAg/UFCG/Campina Grande - Brazil

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ABSTRACT: The physic nut (*Jatropha curcas L.*) is native specie from Brazil, belonging to the family Euphorbia. This study aimed to evaluate the plant height and stem diameter of the physic nut irrigated with water in different levels of salinity in five periods. The experiment was developed in lysimeters of drainage under protected environment at Federal University of Campina Grande (UFCG), Paraíba state, Brazil. The experiment was designed in randomized blocks with five levels of electrical conductivity in the irrigation water - CEai (0.60, 1.20, 1.80, 2.40 and 3.00 dS.m⁻¹, at 25 °C) with four replications. The experimental unit was composed by the average of two plants grown in separated lysimeters. The substrate soil used as was a podzolic, non-saline, sandy loam. The irrigation water used was prepared from solutions containing the salts NaCl, CaCl₂.2H₂O and MgCl₂.6H₂O in the proportion of 7:2:1 among them. The volumes of irrigation were determined through evapotranspiration. We studied the plant height and stem diameter at 144, 186, 228, 270 and 312 days after transplanting - DAT. The different levels of CEai promoted significant decrease, to the level of 1% probability, in the variable stem diameter in all analyzed periods; however this behavior was not observed for the plant height values, where no significant effect was found in the studied periods.

KEYWORDS: *Jatropha curcas L.*, salinity, plant height, stem diameter, irrigation.

INTRODUCTION: The physic nut (*Jatropha curcas L.*) is a plant of tropical origin, oil producer and well adapted to different regions of Brazil; farmers has been encouraged in recent years to grow this plant as an alternative for the supply of raw material for biodiesel production. This species is resistant to drought and is often grown in tropical countries like alive-land-divider; many parts of the plant are used in popular medicine as a remedy. It is also known as Indian nut, land-divider nut, white nut, Paraguayan nut, among others (Arruda et al., 2004). It has long production cycle that can reach 40 years and maintain the average yield of 2 tons ha⁻¹ (Azevedo, 2006). Some varieties can produce economically satisfactory income in high levels of salinity, while others may not even be developed. Among the various negative effects of salinity on crops, it can be highlighted the loss of productivity. Increased salinity decreases the osmotic potential of the soil solution and hinders the absorption of



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water by roots, at the same time that ions Na^+ and Cl^- accumulate in the leaves and affect the physiological processes of the plant (Lazof & Bernstein, 1999). This study aimed to assess the plant height and stem diameter of the plant physic nut (*Jatropha curcas L.*) under increasing levels of salinity in the irrigation water in five periods of growth.

METHODOLOGY: The experiment was conducted in lysimeters of drainage inside a greenhouse, which is located in the Center for Technology and Natural Resources - CTNR of Federal University of Campina Grande. The experiment was designed in randomized blocks, and its objective was to test five growing levels of electrical conductivity of the irrigation water - CEai (0.60, 1.20, 1.80, 2.40 and 3.00 $\text{dS}\cdot\text{m}^{-1}$, 25 °C) with four replications. The experimental unit was composed by the average of two plants grown in separated lysimeters. The physic nut seeds belonged to the variety FT-02. They were used in the production of the seedlings and then they were transferred by the Tamanduá Farm Institute -PB. These variety is part of the Program for Genetic Improvement of that Office. The substrate soil used as was a podzolic, non-saline, sandy loam. Plants were subjected to treatment with saline water 18 days after transplanting - DAT (37 days after sowing). The irrigation water used was prepared from solutions containing the salts NaCl , $\text{CaCl}_2\cdot 2\text{H}_2\text{O}$ and $\text{MgCl}_2\cdot 6\text{H}_2\text{O}$ in the proportion of 7:2:1 among them. The volumes of irrigation were determined through evapotranspiration. We analyzed the plants height and stem diameter into five distinct periods: 144, 186, 228, 270 and 312 DAT, according to what Benincasa (2003) did. Statistical analyses were performed according to conventional methods (analysis of variance 'F' test at the level of 5% probability) using the software ASSISTAT. The effects of 'CEai' on the variables plants height and stem diameter were analyzed by polynomial regressions (Ferreira, 2000).

RESULTS AND DISCUSSION: Table 1 presents the results of the analysis of variance for the plants height and stem diameter of the physic nut during the studied periods (144, 186, 228, 270 and 312 DAT). According to the results in Table 1, it is observed that the electrical conductivity of irrigation water (CEai) caused no significant effect on the plants height in any of the studied periods. However, for the variable stem diameter it was verified significant effect of the treatments at the level of 1% probability, in the five analyzed periods. The variation coefficients were considered suitable (low values) for both variables examined variables; this evidences a good experimental accuracy.

Table 1 - Analysis of variance for plants height and stem diameter of the physic nut plants during the studied periods (144, 186, 228, 270 and 312 DAT), depending on the electrical conductivity of irrigation water (CEai).

V.S.	D.O.F.	Plant height (cm)				
		144 DAT	186 DAT	228 DAT	270 DAT	312 DAT
CEai	4	107.42 ^{ns}	14.79 ^{ns}	12.11 ^{ns}	10.92 ^{ns}	14.14 ^{ns}
Blocks	3	148.51	86.97	80.55	128.85	171.85
Error	12	52.50	50.98	52.75	75.91	55.63
CV(%)	-	5.36	5.01	4.92	5.67	4.70
V.S.	D.O.F.	Stem diameter (mm)				
		144 DAT	186 DAT	228 DAT	270 DAT	312 DAT
CEai	4	7.62 **	8.76 **	23.90 **	111.95 **	134.90 **
Blocks	3	22.88	26.28	8.28	3.13	1.28
Error	12	2.05	4.36	3.84	5.19	5.58
CV(%)	-	3.01	4.16	3.61	3.75	3.69

** = F is significant at level of 1% of probability;

^{ns} = F is non significant.

Using up the regression process to analyze trends and behavior of the average values of the plants height and stem diameter at 144, 186, 228, 270 and 312 DAT, as shown in Figure 1, it appears that the obtained regression equations had high coefficients of determination, as found in Table 2.

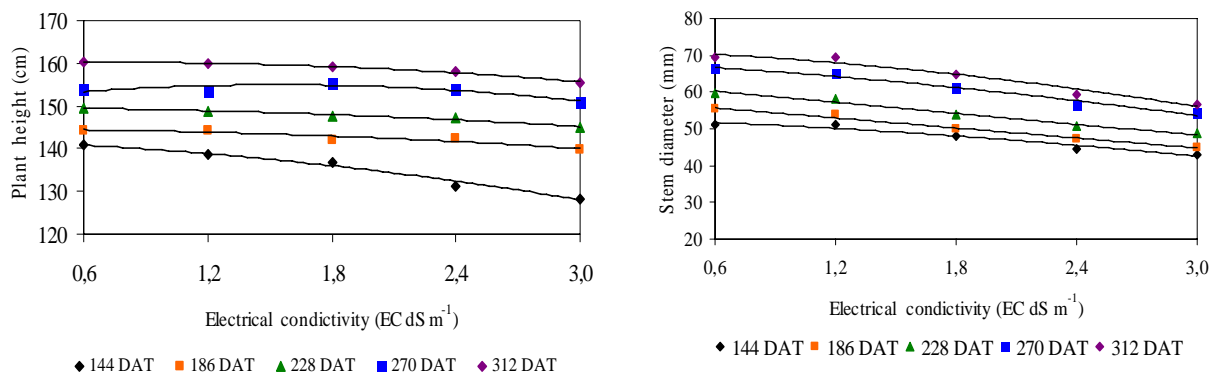


Figure 1 – Trends observed for the relationship between the analyzed variables (plants height and stem diameter) for physic nut plants at 144, 186, 228, 270 and 312 DAT, submitted to different CEai.

The best model of adjustment for these variables is the polynomial of second degree (Table 2), showing a decreasing trend with the increase in CEai. According to research done by Vale et al. (2004) the physic nut in its initial phase of growth showed to be sensitive to salt stress when irrigated with water of electrical conductivity in the range of zero to 4.20 dS.m⁻¹.

Table 2. Regression equations (polynomial of second degree) and coefficients of determination for the analyzed variables (plants height and stem diameter), according to the CEai in various periods of assessment.

DAT	Plant height (cm)	R ²
144	PH = -1,1161EC ² - 1,3363EC + 142,05	0,9818
186	PH = -0,5208EC ² + 0,0208EC + 144,63	0,8699
228	PH = -0,4712EC ² - 0,0744EC + 149,65	0,9658
270	PH = -1,7857EC ² + 5,5119EC + 150,73	0,8065
312	PH = -0,8929EC ² + 1,3393EC + 159,7	0,9971
DAT	Stem diameter (mm)	R ²
144	SD = 0,6324EC ² - 1,5586EC + 52,923	0,9568
186	SD = 0,0025EC ² - 4,5485EC + 58,433	0,9843
228	SD = 0,0992EC ² - 5,3571EC + 63,515	0,9795
270	SD = -0,754EC ² - 2,7607EC + 68,654	0,9730
312	SD = -1,1533EC ² - 1,7878EC + 71,803	0,9593

CONCLUSION: (1) The plants height of the physic nut in the five periods analyzed was not affected by the salinity of irrigation water. (2) The different types of electrical conductivity of irrigation water (CEai) promoted significant decrease to the level of 1% probability on stem diameter of the physic nut plants in all studied periods.

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