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LEVELS OF EVAPOTRANSPIRTION REPOSITION FOR THE PHYSIC NUT IRRIGATED WITH EFFLUENT OF DOMESTIC SEWAGE[1]

MARIA BETÂNIA RODRIGUES SILVA[2]; APARECIDA RODRIGUES NERY[3]; LUIS NERY RODRIGUES[3]; PEDRO DANTAS FERNANDES[4]; JOSÉ DANTAS NETO[4]; RICARDO ALMEIDA VIÉGAS[5]; LUCIANO BARRETO MENDES[6]; RENATO LIMA RAMOS[6]; HERMANN DA COSTA CURVÊLO[6]

[1]**Part of the doctoral thesis to be presented by the first author to the Agricultural Engineering Graduate Programme at UFCG / CTRN**
[2] Researcher, PhD, UEAg/CTRN/UFCG/Campina Grande – Brazil. E-mail: betaniars@hotmal.com
[3]Researcher, Msc, UEAg/CTRN/UFCG/Campina Grande – Brazil.
[4]Researcher, PhD, UEAg/CTRN/UFCG/Campina Grande – Brazil. E-mail: pdantas@deag.ufcg.edu.br
[5] Researcher, PhD, UEF/CTRN/UFCG/Campina Grande – Brazil.
[6]Graduate Student DEAg/CTRN/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. The purpose of this research was to study the effects of different water content of the soil under the variables plants height and stem diameter of the physic nut irrigated with effluent of domestic sewage in five periods of growth. The experiment was developed in lysimeters of drainage under protected environment at CTRN / UFCG. The statistical design was used in randomized blocks with four replications. Five levels of replacement of water (ER) were studied (ER_1 = 0.25; ER_2 = 0.50; ER_3 = 0.75, ER_4 = 1.00 and ER_5= 1.25 of evapotranspiration). We studied the plants height and stem diameter at 144, 186, 228, 270 and 312 days after transplanting - DAT. 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. Irrigations were performed after each two days period, the volume of water used in each treatment was determined by water balance, which was based on the ER_4 level, 100% replacement of evapotranspiration, ETc = I - D, where Etc = evapotranspiration of culture (Liters), I = applied volume (Liters) and D = drained volume (Liters). Hydric stress affected both analyzed variables (plant height and stem diameter) in all studied periods, while significant decline of the variables occurred at the level of 1% probability.
KEYWORDS: *Jatropha curcas L.*, plant height, stem diameter, hydric stress.

INTRODUCTION: The application of sewage effluent in the soil is an effective way to control the pollution and a viable alternative to increase water availability in arid and semi-arid areas. The greatest benefits of this kind of reuse are related to economic aspects, environmental and public health. During the last two decades, the use of sewage water for crops irrigation increased significantly because of the following factors: increasing difficulty to identify alternative sources of water for irrigation, high cost of fertilizers, risks to public health and impacts on the soil are minimal if the appropriate precautions are taken effectively; and the high costs of treatment systems, which are necessary for discharge of effluents into bodies receivers; the socio-cultural acceptance of sewage effluent reusing for agricultural purposes.(Hespanhol. 2003; Sousa and Leite 2003).

Among the sources of biomass readily available, vegetable oils have been widely investigated as candidates for renewable energy programs, because they provide a decentralized generation of energy. Also, growing oil producers species is an alternative for family farming, creating better conditions of life in poor areas, enhancing regional capabilities and offering alternatives to economic problems and socio-environmental (Ramos et al. 2003).

In this context, the physic nut (*Jatropha curcas L.*) has been considered one of the promising species for the production of biodiesel in Brazil, because its oil characteristics indicate favorable of an energy balance / economic. It is also known as Indian nut, land-divider nut, white nut, Paraguayan nut, among others, the physic nut belongs to the family Euprhorbiaceae and it iss found in almost all intertropical regions (Arruda et al., 2004). This paper has as objective to analyze the effects on plant height and stem diameter of physic nut plants when irrigated with different levels of domestic sewage effluent water during five periods of growth.

MATERIAL AND METHODS: The experiment was conducted in lysímetros of drainage located in a protected environment of the Center for Technology and Natural Resources – CTNR at Federal University of Campina Grande. The experimental site has the following geographic coordinates: 07º 13' of South latitude and 35° 53' of West longitude and average altitude of 550 m. The experiment was designed in randomized blocks with four replications; we studied five levels of water replacement -ER (ER_1 = 0.25; ER_2 = 0.50; ER_3 = 0.75, ER_4 = 1.00 and = ER_5 1.25 of evapotranspiration). 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 experimental unit was composed by the average of two plants grown in separated lysimeters. And the substrate soil used as was a podzolic, non-saline, sandy loam.

Plants were subjected to treatment with domestic sewage effluent, 18 days after transplanting - DAT (37 days after sowing). Irrigations were performed after each two days period, the volume of water used in each treatment was determined by water balance, which was based on the ER_4 level, 100% replacement of evapotranspiration, ETc = I - D, where Etc = evapotranspiration of culture (Liters), I = applied volume (Liters) and D = drained volume (Liters). We analyzed plants height and stem diameter during five periods, 144, 186, 228, 270 and 312 DAT, as stated by Benincasa (2003). Statistical analyses were performed according to conventional methods (analysis of variance through 'F' test at the level of 5% probability) using the software ASSISTAT. The effects of treatments on the studied variables were analyzed by polynomial regression (Ferreira. 2000).

RESULTS E DISCUSSIONS: Analyzing the results described in Table 1, it can be observed the analysis of variance for plants height and stem diameter of the physic nut studied during the periods: 144, 186, 228, 270 and 312 DAT under five levels of evapotranspiration replosition (ER). As shown in Table 1, water stress caused significant effect on plants height and stem diameter, during the five evaluated periods at the level of 1% probability. The coefficients of variation were considered appropriate for both variables, which characterized 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 five levels of Five levels of replacement of water ER.

S.O.V.		Plant Height (cm)				
		144 DAT	186 DAT	228 DAT	270 DAT	312 DAT
ER	4	1700.54**	1648.01**	3249.53**	3355.70**	3100.70**
Blocks	3	383.81*	392.14^{ns}	117.38^{ns}	140.32^{ns}	106.98^{ns}
Error	12	84.72	196.56	207.47	176.90	189.62
CV(%)	-	6.49	8.93	8.50	7.50	7.2
S.O.V.	GL	Stem diameter (mm)				
		144 DAT	186 DAT	228 DAT	270 DAT	312 DAT
ER	4	247.67**	374.94**	558.74**	580.20**	571.45**
Blocks	3	5.00^{ns}	3.11^{ns}	3.49^{ns}	17.82^{ns}	12.89^{ns}
Error	12	3.50	1.78	2.06	5.44	18.90
CV(%)	-	3.92	2.57	2.54	3.83	6.64

** = F is significant at level of 1% of probability;
* = F is significant at level of 5% of probability;
ns = F is non significant.

Using up the regression process to analyze trends and behavior of the average values of plants height and stem diameter at 144, 186, 228, 270 and 312 DAT (as it can be seen in Figure 1), it seems that data for the two variables during the five studied periods had high coefficients of determination, as found in Table 2.

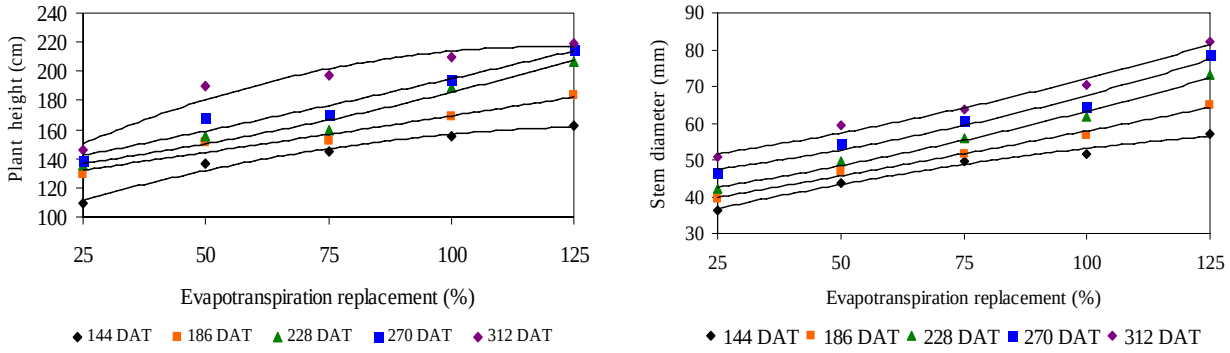

Figure 1 – Trends observed for the relationship between the analyzed variables (plants height and stem diameter) for physic nut plants at 144, 186, 228, 270 and 312 DAT, submitted to different ER levels.

The best adjustment model for these variables is the polynomial of second degree (Table 2), showing upward trend with the increasing replacement of evapotranspiration of culture (ETc).

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

DAT	Plant height (cm)	R^2
144	$PH = -0.0041ER^2 + 1.1096ER + 86.45$	0.9754
186	$PH = 0.0002ER^2 + 0.471ER + 120.28$	0.952
228	$PH = 0.0023ER^2 + 0.3651ER + 126.28$	0.9729
270	$PH = 0.0007ER^2 + 0.6168ER + 126.48$	0.9596
312	$PH = -0.0072ER^2 + 1.746ER + 111.18$	0.9539
DAT	**Stem diameter (mm)**	**R^2**
144	$SD = -0.0009ER^2 + 0.3276ER + 29.143$	0.9864
186	$SD = 0.0001ER^2 + 0.2214ER + 34.218$	0.9903
228	$SD = 0.0009ER^2 + 0.1675ER + 37.905$	0.9906
270	$SD = 0.0012ER^2 + 0.1126ER + 43.948$	0.9733
312	$SD = 0.001ER^2 + 0.1527ER + 47.258$	0.9829

CONCLUSIONS: Hydric stress variables affected plants height and stem diameter of the physic nut in the five studied periods, it was noted a significant decline occurring at the level of 1% probability for both variables.

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