



Morfologia da palma Miúda sob lâminas de água salina e doses de adubação orgânica no semiárido¹

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Resumo: Avaliaram-se os efeitos de lâminas de água salina e doses de adubação orgânica com esterco bovino, sobre as características morfológicas da palma Miúda (*Nopalea cochenillifera* Salm Dick) em cultivo adensado. Realizou-se o experimento na EMPARN (5°31'21" Sul e 36°23'14" Oeste). O solo foi classificado como Cambissolo Háptico Carbonático Típico e a água de irrigação C4S1T3 (5,25 dS.m⁻¹). Plantio no espaçamento 2,0 x 0,25 m. Utilizou-se o delineamento inteiramente casualizado em parcelas subdivididas, com as lâminas de água salina (0; 7,5; 15 e 30 mm mês⁻¹) em intervalo de 10 dias, como as parcelas principais e adubação orgânica (0, 25 e 50 Mg ha⁻¹ ano⁻¹), as subparcelas, com quatro repetições. Não houve influência da adubação orgânica com esterco bovino (P>0,05) sobre a maioria das variáveis estudadas. As lâminas de irrigação influenciaram significativamente (P<0,05) muitas das variáveis, promovendo altura e volume de plantas superiores, cladódios maiores e mais espessos.

Palavras-chave: *Cactaceae*, forragem, irrigação, *Nopalea*, salinidade

Morphology of prickly-pear cactus cv. *Miúda* irrigated with saline water levels and organic fertilization doses at Brazilian semi-arid

Abstract: The effects of different levels of saline water and manure organic fertilization on the morphological characteristics and forage productivity of prickly-pear cactus cv. *Miúda* (*Nopalea cochenillifera* Salm Dick) were evaluated. The experiment was conducted at the (EMPARN, 5°31'2" South and 36°23'14" West). The soil was classified as Typical Cambisol Haplicum Carbonate and the water used in irrigation, C4S1T3 (5.25 dS.m⁻¹), with planting spacing of 2.0 x 0.25 m. A completely randomized design in a split plot was used, where water levels (0, 7.5, 15.0 and 30.0 mm month⁻¹) with 10 days intervals, were the main plots and organic fertilization (0, 25 and 50 Mg ha⁻¹ yr⁻¹) the subplots, with four replicates. There was no influence (P>0.05) of organic fertilization on most variables, particularly in relation to forage yield. The water levels had a significant influence (P<0.05) on most variables, promoting higher height and volume of the plants, larger and thicker cladodes.

Keywords: *Cactaceae*, forage, irrigation, *Nopalea*, salinity

Introduction

Growing of cactus pear as forage has taken considerable share of demand for livestock forage in soil and climate conditions of the Northeast backlands, for being a xerophyte plant, with high water use efficiency, excellent nutritional value and productivity under a drip irrigation system up to 30 Mg ha⁻¹ year⁻¹ for the Brazilian semi-arid (LIMA et al., 2014).

However, at the core of the semi-arid, where the nights are warm with low humidity, climatic conditions are limiting to the full development of the cactus pear and may result in severe cladodes wilting even with death of plants, on the occasion of the opening of the stomata at night as is the case of backlands of Rio Grande do Norte State. This picture has been reverted when irrigation is used, even using minimal amounts of water, with a drip irrigation system, becoming an option for enabling technology for the cactus pear cultivation in these areas (LIMA et al., 2015). Therefore, the objective was evaluating the effects of different saline water levels and doses of organic fertilizing with cow manure, on the morphological characteristics of the prickly-pear cactus cv. *Miúda* (*Nopalea cochenillifera* Salm Dick) in dense cultivation in the central region of Rio Grande do Norte.

Material e Methods



The experiment was carried out at EMPARN Experimental Station (5° 21 ' 31 "South and 36° 23 ' 14" West). The soil was classified as Typical Carbonate Háplico Cambisol and the irrigation water as C4S1T3 (5.25 dS m⁻¹). The planting was performed in August 2012, on the spacing 2.0 x 0.25 m (20,000 plants ha⁻¹) in an area of 0.32 ha (74 m x 43 m). The treatments were initiated in November 2013 and a completely randomized design with split plots was used, with four levels of saline water (0; 7.5; 15 and 30 mm month⁻¹) in intervals of 10 days, as the main plots and the organic fertilizing with cow manure (0, 25 and 50 Mg ha⁻¹ year⁻¹), the subplots, with four replicates. The harvest was made in November 2014, preserving even the secondary cladode order. Rainfall within 12 months of the trial was 438.3 mm. The morphological characteristics were evaluated in third, fourth and fifth order for cladodes number, height and volume of the plant (height, length and width of the plant), length, width, perimeter and thickness of cladodes. The area of cladodes was calculated (AC = -211.5104 + 8.8649*P, where P = perimeter) and the cladode area index (CAI) = AC of a plant/soil area of a plant (SANTOS, 1992). The data were subjected to analysis of variance and regression, at 5% level of significance (SISVAR, 1996) and average comparisons of treatments by Tukey test (P < 0.05).

Results and Discussion

There was no interaction (P > 0.05) among the studied factors, saline water levels and doses of organic fertilizing with cow manure for most of the studied variables, with the exception of the perimeter and the area of cladodes (AC). Significant response was obtained from the organic fertilizer (P < 0.05) only to cladodes number, width and cladodes area index (CAI). There were isolated effects of saline water levels (P < 0.05) for height and volume of the plant, perimeter, length, width, thickness, area of cladodes (AC) and cladodes area index (CAI). In Table 1 are presented the height (cm) and the volume (m³) of prickly pear cactus cv *Miúda* with 12 months of regrowth in the different water levels applied. There was a positive linear effect of irrigation levels (P < 0.05) on the two variables. For the height the plants receiving 30 mm were higher than those receiving 7.5 mm and without irrigation and for the volume, the 30 mm blade was superior to the others.

Table 1. Height (cm) and volume (m³) of prickly pear cactus cv. *Miúda* at 12 months of regrowth in response to the of levels of saline water

Levels of water (mm month ⁻¹)	Height (cm)	Volume (m ³)
0	87,04 b	0,71 b
7,5	93,04 b	0,81 b
15	96,00 ab	0,84 b
30	107,13 a	1,24 a
CV (%)	6,29	23,67
Equation	Y = 87,22 + 0,654x (P<0,05)	Y = 0,67 + 0,017x (P<0,05)
r ²	0,99	0,92

Means followed by the same letter in column did not differ by Tukey test (P>0,05); r² – coefficient of determination

Although the high plating density applied allowed considerable space available to lateral plant growth, this vertical elongation, may have occurred not only due to irrigation, but also by cutting management, which preserved until the secondary cladodes, increasing the photosynthetic remaining areas, contributing to increased plant growth.

For the number of cladodes, there was a quadratic effect (P < 0.05) for the organic fertilization doses. It was obtained the greatest amount of articles when applying 50 Mg, average of 36.34 units; intermediate (31.13) in the absence of fertilization and the lowest (25.38) when using 25 Mg. Despite the inconsistency of the results of fertilization, in which the highest level of organic fertilizing overcomes the absence of fertilization, but this is above the average level of 25 Mg of manure, however, there was a 16.74% increase in the amount of articles compared the extremes of cow manure applications, denoting positive response trend of this variable to the application of fertilizer. As to the participation of cladodes by order position in plant, the averages were 15.49 for third, which corresponds to 50.00% of the total number of articles collected from the plant; 10.94 for fourth (35.31%) and 4.52 for fifth (14.59%).

The interaction to the perimeter of the cladodes variable was significant. Linear positive response was observed in relation to water levels, with largest perimeter to 30 mm level (54.83 cm) in relation to 0 and 7.5 mm levels (46.86 and 48.73 cm, respectively).

There was a positive linear effect of water levels (P < 0.05) on the length and width of the cladodes (cm) (Table 2), with further development of the cladodes in 30 mm level. Quadratic effect was observed (P < 0.05) of



water level on thickness of cladodes, being also thicker at 30 mm level with significant difference compared to treatment without irrigation due to the intense wilt of cladodes.

Table 2. Length (cm), width (cm) and thickness (mm) averages of cladodes from prickly pear cactus cv. *Miúda* at 12 months of regrowth in function of saline water levels.

Levels of water (mm month ⁻¹)	Length (cm)	Width (cm)	Thickness (mm)
0	20,28 c	10,22 b	7,89 c
7,5	21,45 bc	10,36 b	12,77 b
15	21,74 b	10,61 b	13,85 b
30	23,68 a	11,40 a	16,95 a
CV (%)	6,70	3,32	9,46
Equation	$Y = 20,36 + 0,109x$ (P<0,05)	$Y = 10,12 + 0,040x$ (P<0,05)	$Y = 8,23 + 0,552x - 0,0088x^2$ (P<0,05)
r ²	0,98	0,96	0,97

Means followed by the same letter in the column do not differ by Tukey test (P 0.05 >) r²-coefficient of determination

The results of morphology of prickly pear cactus cv. *Miúda* pointed out that there was no response of plants to the management applied, mainly to irrigation, contrary to the assertion of Mondragón-Jacobo & Pérez-González (2001), who claim that these parameters are more influenced by the genotype than for environmental manipulations.

For the area of cladode (AC) a significant interaction effect was observed (P<0.05) of the treatments on the basis of differentiated responses of water levels according to the different doses of organic fertilizer. There was a quadratic effect (P < 0.05) for fertilization when the water levels showed increasing linear effect (P < 0.05) for the different levels of fertilization. In the absence of fertilizer, values of AC were 200.35; 213.63 and 258.71 cm² in levels of 0; 7.5 and 30 mm and when with 50 Mg ha⁻¹ of manure the AC of 207.36; 227.28; 245.39 and 290.44 cm² were respectively for 0; 7.5; 15 and 30 mm of saline water applied.

As for the cladodes area index (CAI), increasing linear effect was observed (P < 0.05) for the water level. The CAI at 30 mm water level (1.93) differed significantly from the non-irrigated treatment (1.18). Irrigation in the higher level of water applied stimulated the vegetative development of prickly pear cactus cv. *Miúda* with an increase of 63.56% in CAI in relation to treatment not irrigated.

Conclusions

There was no influence of organic fertilizing with cow manure on most of the variables studied particularly in relation to green and dry matter production. The levels of irrigation with saline water had significant influence on many of the variables, promoted higher and more voluminous plants, larger and thicker cladodes, mainly in the 30 mm month⁻¹ water level. Only the continuity of research will evaluate the evolutions of responses to organic fertilizing and the saline water.

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