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Development of seedlings of red pitaya (*Hylocereus undatus* Haw) in different substrate volumes

Renata Aparecida de Andrade*, Antonio Baldo Geraldo Martins and Marco Túlio Habib Silva

*Departamento de Produção Vegetal, Faculdade de Ciências Agrárias e Veterinárias de Jaboticabal, Universidade Estadual Paulista "Júlio de Mesquita Filho", Via de acesso Prof. Paulo Donato Castellane, s/n, 14884-900, Jaboticabal, São Paulo, Brazil. *Author for correspondence. E-mail: reandrad@fcav.unesp.br*

ABSTRACT. With the ever-increasing search for alternatives by producers and demand for exotic fruits by consumers, the market for fruits species has grown considerably. In this context, the pitaya has been sought not only for its exotic appearance, but also for its organoleptic characteristics. The present research was conducted with the objective of evaluating the influence of the substrate volume in the development of seedlings of red pitaya, by using polystyrene trays expanded with different volumes of cells: 10, 15, 30 and 65 mL. The evaluations, conducted during 90 days, evaluated: survival percentage; number and height of stems (cm); largest root length (cm); fresh and dry masses of the stems and roots (g). The delineation was entirely randomized. The values of survival percentage were transformed in arc sin and the averages were compared by the Tukey test at 5%. The survival and vegetative development for seedlings of red pitaya were directly proportional to the volume of the substrate used. In order to form seedlings of red pitaya from seeds, the use of containers with 65 mL of capacity is recommended.

Key words: seeds, stems, growth, height.

RESUMO. Desenvolvimento de mudas de pitaya vermelha (*Hylocereus undatus* Haw) em diferentes volumes de substrato. Com a procura cada vez maior de alternativas por parte dos produtores rurais e de frutas exóticas pelos consumidores, o mercado de frutíferas tem crescido consideravelmente. Neste contexto, a pitaya vem sendo procurada não apenas pelo exotismo de sua aparência, como também por suas características organoléticas. O presente trabalho foi realizado objetivando avaliar a influência do volume de substrato no desenvolvimento de mudas de pitaya vermelha, utilizando-se bandejas de poliestireno expandido com diferentes volumes de células: 10, 15, 30 e 65 mL. As avaliações, realizadas aos 90 dias, foram quanto: porcentagem de sobrevivência; ao número e altura dos cladódios (cm), ao comprimento da maior raiz (cm); às massas fresca e seca dos cladódios e das raízes (gramas). O delineamento experimental foi inteiramente casualizado. Os dados de porcentagem de sobrevivência foram transformados em *arc sen* $\sqrt{x/100}$ para fins de análise estatística e as médias comparadas pelo teste de Tukey, a 5% de probabilidade. A sobrevivência e o desenvolvimento vegetativo das mudas de pitaya vermelha através de sementes foram diretamente proporcionais ao volume de substrato usado no experimento. Para formação de mudas de pitaya vermelha através de sementes é recomendado o uso de containeres com capacidade de 65 mL.

Palavras-chave: sementes, cladódios, crescimento, altura.

Introduction

The ever-increasing search for alternatives by producers and demand for exotic fruits by consumers has led to a rise in the market for exotic species previously unknown and/or little cultivated in Brazil, such as the pitaya, which has shown great potential in the domestic and foreign markets.

The red pitaya (Hylocereus undatus Haw) is a cactaceous species native to the Americas, being found in Costa Rica, Venezuela, Panama, Uruguay, Brazil, Colombia and Mexico. It is a perennial plant, with abundant fibrous roots, also developing numerous adventitious roots that help it obtain and fixate nutrients; stems are triangular, succulent and feature thorns with 2 to 4 mm wide. The flower is a hermaphrodite, with white coloration, large (measure 20 – 30 cm wide) and blooms at night. The fruits are red on the outside, very attractive to the consumer, with a white pulp featuring a pleasant flavor, lightly sweet, with a great number of little seeds of black coloration (Canto, 1993).

According to Canto (1993), there is great variability among the species in relation to fruit size and color. The fruits of Hylocereus costaricensis present red coloration on the skin and in the pulp; in Selenicereus megalanthus, known as "Colombian pitaya", the pulp is white while on the outside the fruit is yellow; and in Selenicereus setaceus, the skin is red and the pulp white, like in H. undatus, but the fruit is smaller and has thorns.

The propagation of pitaya is commonly performed by cutting, using the sexual method with the objective of obtaining variability in improvement programs (Pimenta, 1990). There are some distinct varieties, in regards not only to productivity, but also in respect to resistance and/or tolerance to environmental conditions and phytopathogenic organisms.

Some types and sizes of containers can be used in the production of seedlings. In other studies, it was verified that containers with a greater volume of substrate show a tendency to produce more vigorous seedlings (Vianna, 1964; Godoy and Godoy Júnior, 1965; Silveira et al., 1973; Besagoitia, 1980).

In choosing a container, the following must be considered: cost, material, size, shape, ease of use and weight (Gonçalves, 1995). The most commonly used containers in seedling production of several species are polyethylene trays are (Weston and Zandstra, 1989; Masson et al., 1991), polypropylene trays (Aguiar and Monogios, 1988; Verdial et al., 1998), small paper cups (Martins et al., 1998), polyethylene bags (Graff et al., 1995) and dibble tubes (Aguiar et al., 1992).

The size of the container must allow for good development of the root system, to promote good performance of the future plant (Leskovar and Stoffela, 1995).

Larger containers allow for a greater volume of the roots, increasing the area of nutrient absorption. According to Nesmith and Duval (1998), as cited by Pereira and Martinez (1999), the absorption of nutrients is affected by the restriction of root development, caused by the size of the container.

The substrate use in the container during the permanence of the seedlings must feature satisfactory physical, chemical and biological characteristics enabling rapid growth, good dry matter content in the root and air parts, among other features (Yamanishi *et al.*, 2004, cited by Nomura *et al*., 2008).

The introduction of new species, considered exotic in the Brazilian fruiticulture, creates the need for studies on new propagation methods, new varieties and seedling formation. Although commercial propagation of pitaya can be done using cuttings, the present work was conducted with the aim to promote genetic improvement studies, where the formation of seedlings by seeds is used.

Material and methods

The experiment was carried out in a lath house (50% luminosity), belonging to the Department of Crop Science at the Faculdade de Ciências Agrárias e Veterinárias – Unesp – Jaboticabal Campus/São Paulo State, Brazil.

The study made use of seedlings obtained through the germination of seeds extracted from a mature red pitaya fruit, collected from a commercial orchard in which H. undatus and H. costaricensis are planted side by side. They were transferred to trays of expanded polystyrene with different volumes of cells, in which the following were defined as treatments: 1) 288 cells with 10 mL of volume, in pyramidal form, with 4 cm of height and a square upper extremity with 2 cm in each side; 2) 200 cells with 15 mL of volume, in pyramidal form, with 5 cm of height and a square upper extremity with 2.5 cm in each side; 3) 128 cells with 30 mL of volume, in pyramidal form, with 6 cm of height and a square upper extremity with 3.5 cm in each side; and 4) 128 cells with 65 mL of volume, in pyramidal form, with 11.5 cm of height and a square upper extremity with 3.5 cm in each side. Plantimax© was used as vegetable substrate, with irrigations to maintain humidity. For each treatment, 5 replications were conducted, with 15 seedlings in each. The evaluations, conducted 90 days after transplanting, evaluated: survival percentage; number and height of stems (cm); largest root length (cm); fresh and dry masses of the stems and roots (g).

The design was entirely randomized, and a regression analysis was conducted with the values of survival percentage.

Results and discussion

The results obtained for stem height (Figure 1) verified better development of seedlings when a larger container was used, in agreement with findings for papaya (Mendonça et al., 2003), cucumber (Seabra Jr et al., 2004) and açaí palm (Queiroz and Melém Jr, 2001).

The same influence was observed for the variable number of stems formed (Figure 2) and root length (Figure 3).

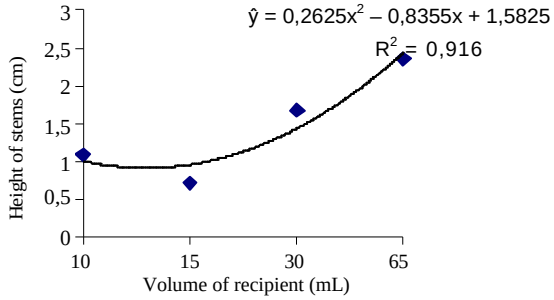

Figure 1. Regression analysis of stem height (cm) of red pitaya as a function of container volume, 90 days after transplanting.

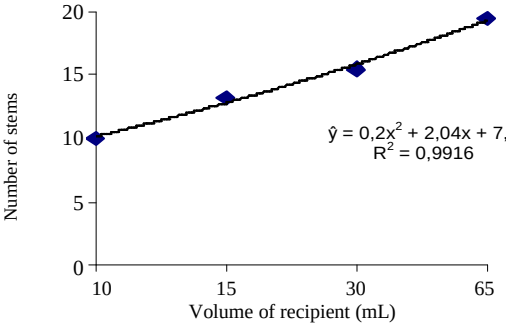

Figure 2. Regression analysis to number of stems of red pitaya in function of the container volume, 90 days after the transplanting.

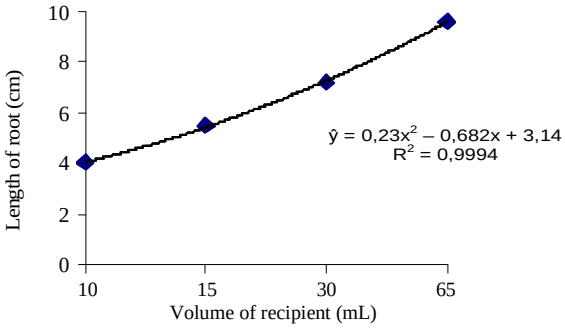

Figure 3. Regression analysis of root length (cm) of red pitaya as a function of container volume, 90 days after transplanting.

However, in relation to the fresh and dry masses of stems, it was observed that the containers with larger volumes of substrate (30 and 65 mL) differed from the containers with lower volume (10 and 15 mL), which showed lower values (Figure 4).

For the fresh mass of roots, there was a significant difference between the container with a larger volume of substrate and the others; however, the same did not occur with dry mass, for which there was a significant difference only between containers 4 (larger volume) and 1 (lower volume), as can be seen in Figure 5.

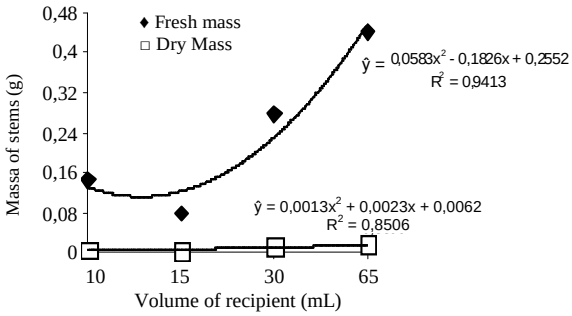

Figure 4. Regression analysis of fresh and dry masses (g) of the stems of red pitaya as a function of container volume, 90 days after transplanting.

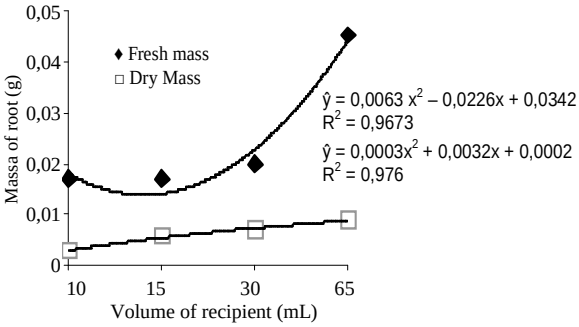

Figure 5. Regression analysis of the fresh and dry masses (g) of the roots of red pitaya as a function of container volume, 90 days after transplanting.

The study verified a smaller survival rate for seedlings in containers where a lower volume of substrate was used (Figure 6), in agreement with the results of Jungk (1975), as cited by Menezes Jr. et al. (2000), who used fewer cells and verified weaker development of the root system in seedlings. Therefore, the survival of the seedlings of red pitaya, originated from seeds, was proportional to the volume of substrate used.

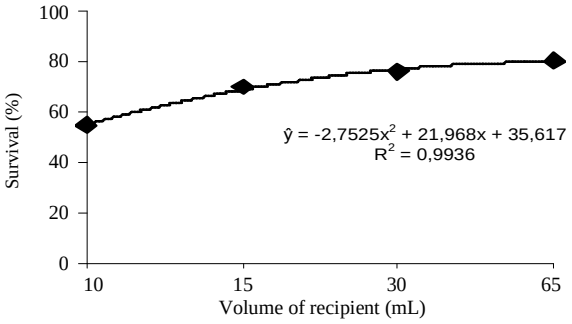

Figure 6. Regression analysis of seedling survival percentage of red pitaya as a function of container volume, 90 days after transplanting.

Conclusion

Under the conditions in which the experiment was conducted, it can be concluded that:

- the volume of substrate available to seedlings of red pitaya, originated from seeds, has direct influence on the quality of plants, by accelerating development;

- in order to obtain seedlings of red pitaya from seeds, the use of containers with 65 mL of capacity is recommended.

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