

## Development of *Datura metel* in different pot sizes

Desenvolvimento de *Datura metel* em diferentes tamanhos de vasos

Desarrollo de *Datura metel* en diferentes tamaños de macetas

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### Angela Maria dos Santos Pessoa

ORCID: <https://orcid.org/0000-0002-7393-984X>  
Universidade Federal do Ceará, Brazil  
E-mail: [angelapessoapb@gmail.com](mailto:angelapessoapb@gmail.com)

### Elizanilda Ramalho do Rêgo

ORCID: <https://orcid.org/0000-0001-7376-7569>  
Universidade Federal da Paraíba, Brazil  
E-mail: [elizanilda@cca.ufpb.br](mailto:elizanilda@cca.ufpb.br)

### Geovana Priscilla da Silva

ORCID: <https://orcid.org/0000-0001-6641-1759>  
Universidade Federal da Paraíba, Brazil  
E-mail: [geovanasilva.agro@gmail.com](mailto:geovanasilva.agro@gmail.com)

### Jose Ayrton Moraes de Lima

ORCID: <https://orcid.org/0000-0002-6210-162X>  
Universidade Federal da Paraíba, Brazil  
E-mail: [aironmoraes2007@hotmail.com](mailto:aironmoraes2007@hotmail.com)

### Bruna Regina dos Santos Silva

ORCID: <https://orcid.org/0000-0001-7957-3386>  
Universidade Federal da Paraíba, Brazil  
E-mail: [bruna-reggina@hotmail.com](mailto:bruna-reggina@hotmail.com)

### Mailson Monteiro do Rêgo

ORCID: <https://orcid.org/0000-0003-3096-6992>  
Universidade Federal da Paraíba, Brasil  
E-mail: [mailson@cca.ufpb.br](mailto:mailson@cca.ufpb.br)

### Abstract

*Datura metel* L. belongs to Solanaceae family and presents medicinal and ornamental potential. The use of *D. metel* as an ornamental plant is still unexplored, however there is a need to gather more information about this species planting, especially for pot cultivation. This study aimed to verify the effects of different pot sizes in the development of *D. metel*, in order to enable the use of this species in the potted flower market. The work was conducted in a greenhouse at the Biotechnology Department located at Center of Agricultural Sciences of the Federal University of Paraíba (CCA-UFPB), Areia, PB, Brazil. The experimental design used was completely randomized with 3 treatments (pot sizes: T1 = 0.82 dm<sup>3</sup>, T2 = 1.55 dm<sup>3</sup> e T3 = 3.68 dm<sup>3</sup>) and 10 replications. The variables analyzed were: plant height, stem diameter, canopy diameter, number of ramifications, leaf length, leaf width, leaf number, flower number, flower length, flower diameter, chlorophyll *a* e chlorophyll *b*. The data obtained was submitted to analysis of variance and later on clustered based Tukey's test (5%). All the analyses were made on GENES software. There is variation between treatments for characteristics evaluated. Treatments 2 (1.55dm<sup>3</sup>) and 3 (3.68dm<sup>3</sup>) had similar values and the highest mean values for the characteristics of plant height, number of leaves and chlorophyll *b*. The size of the vase influences the development of the Angel's trumpet (*D. metel*). Pot size influences *D. metel* development. The medium size recipient (1.55 dm<sup>3</sup>) is recommended for cultivation of *D. metel* because it presents ideal plant development, such as plant height and number of leaves, for use with ornamental species pots.

**Keywords:** *Datura metel*; Angel's trumpet; Plant growth; Ornamental plant; Recipients.

### Resumo

*Datura metel* L. é uma espécie pertencente à família Solanaceae e apresenta potencial medicinal e ornamental. O uso de *D. metel* como planta ornamental ainda é um pouco explorado, porém é necessário reunir mais informações sobre o plantio dessa espécie, principalmente para o cultivo em vasos. Este trabalho teve como objetivo verificar os efeitos de diferentes tamanhos de vasos no desenvolvimento de *D. metel*, a fim de viabilizar a utilização desta espécie no mercado de flores em vasos. O trabalho foi conduzido em casa de vegetação no departamento de Biotecnologia localizado no Centro de Ciências Agrárias da Universidade Federal da Paraíba (CCA-UFPB), Areia, PB, Brasil. O delineamento experimental foi inteiramente casualizado com 3 tratamentos (tamanhos de vasos: T1 = 0.82 dm<sup>3</sup>, T2 = 1.55 dm<sup>3</sup> e T3 = 3.68 dm<sup>3</sup>) e 10 repetições. As variáveis analisadas foram: altura da planta, diâmetro do caule, diâmetro da copa, número de ramificações, comprimento da folha, largura da folha, número da folha, número da flor, comprimento da flor, diâmetro da flor, clorofila *a* e clorofila *b*. Os dados obtidos foram submetidos à análise de variância e posteriormente ao teste de Tukey de agrupamento (5%). Todas as análises foram feitas no software GENES. Os tratamentos 2 (1.55dm<sup>3</sup>) e 3 (3.68dm<sup>3</sup>) apresentam valores semelhantes e os maiores valores médios para as características altura de planta, número de folhas e clorofila *b*. O tamanho do vaso influencia o desenvolvimento de *D. metel*. O recipiente de tamanho médio (1,55 dm<sup>3</sup>) é recomendado para cultivo de *D. metel* por apresentar

condições do desenvolvimento da planta, como altura de planta e número de folhas, para uso em vasos de espécies ornamentais.

**Palavras-chave:** Datura metel; Angel's trumpet; Crescimento vegetal; Planta ornamental; Recipientes.

### Resumen

*Datura metel* L. es una especie que pertenece a la familia de las solanáceas y presenta potencial medicinal y ornamental. El uso de *D. metel* como planta ornamental está todavía un poco inexplorado, sin embargo, es necesario recopilar más información sobre la plantación de esta especie, especialmente para el cultivo en macetas. Este estudio tuvo como objetivo verificar los efectos de diferentes tamaños de maceta en el desarrollo de *D. metel*, con el fin de permitir el uso de esta especie en el mercado de flores en maceta. El trabajo se realizó en un invernadero en el departamento de Biotecnología ubicado en el Centro de Ciencias Agrícolas de la Universidad Federal de Paraíba (Centro de Ciencias Agrícolas de la Universidad Federal de Paraíba - CCA-UFPB), Areia, PB, Brasil. El diseño experimental fue completamente al azar con 3 tratamientos (tamaños de macetas: T1 = 0,82 dm<sup>3</sup>, T2 = 1,55 dm<sup>3</sup> y T3 = 3,68 dm<sup>3</sup>) y 10 repeticiones. Las variables analizadas fueron: altura de la planta, diámetro del tallo, diámetro del dosel, número de ramificaciones, largo de la hoja, ancho de la hoja, número de hojas, número de flores, largo de las flores, diámetro de las flores, cromofila a y cromofila b. Los datos obtenidos se sometieron a un análisis de varianza y posteriormente a la prueba de Tukey basada en clústeres (5%). Todos los análisis se realizaron en el software GENES. Los tratamientos 2 (1.55 dm<sup>3</sup>) y 3 (3.68 dm<sup>3</sup>) tienen valores similares y los valores medios más altos para las características de altura de planta, número de hojas y clorofila b. El tamaño de la maceta influye en el desarrollo de *D. metel*. El recipiente de tamaño mediano (1.55 dm<sup>3</sup>) se recomienda para el cultivo de *D. metel* porque presenta condiciones de desarrollo de la planta, como altura de planta y número de hojas, para uso con macetas de especies ornamentales.

**Palabras clave:** Datura metel; Angel's trumpet; Crescimento vegetal; Planta ornamental; Destinatarios.

## 1. Introduction

*Datura metel* L. is a species from the Solanaceae family used in medicine as it presents substances with great anesthetic potential (Liu et al, 2020) and promising in the psoriasis treatment (Yan et al., 2019). Commonly known 'Devil's Trumpet' or 'Angel's Trumpet', (Tohmé, 2014), it is a bush naturalized in Brazil with distribution in the Northeast among states of Alagoas, Bahia, Ceará, Maranhão, Pernambuco e Piauí (Stehmann et al., 2015).

This species produces chemical compounds to defend itself from predators and pathogens and due to that may also be toxic and irritable for other organisms, including human beings (Trancrã et al., 2017). This species may also be used as an ornamental plant like *Datura suaveolens* Humb. & Bonpl. ex Willd. (Solanaceae), popularly known as trombeta, trombeta-de-anjo ('Angel's Trumpet'), trombeteira, cartucheira, zabumba and saia-branca (Silva et al., 2015). Despite the toxicity, many are cultivated as ornamental plants due to their beauty and differ from other plants for its flower colors, shapes and overall aspects (Teixeira, 2020).

Currently, drastic changes occurred in population habits due to social isolation needed to prevent COVID-19. Practices such as flower contemplation stand out and are seen as self-care, called hortitherapy (Reis et al., 2020). Hortitherapy is a form of connection with nature, especially in times of social distancing in internal spaces. Besides the dependency between humans and plants when it comes to nutrition, oxygen supply, fuel and also medicine (Odeh e Guy, 2017), this relationship may go far beyond. Plants can be cultivated for its aesthetical characteristics. Ornamenting internal spaces has stand out even more in the last few years and it is not considered unnecessary because activities like gardening can be occupational therapy (Reis et al., 2020).

Floriculture market in Brazil has increased 10% in 2020, mainly in green plants and potted plants (IBRAFLO, 2020). However, more information is essential about species planting in different size recipients, with the possibility to enhance this sector. Recipient dimensions influences in quality and production costs as well as in water and nutrients availability, architecture of root system, transportation and distribution (Carneiro, 1987). Barroso et al. (2012) highlighted a plant height/pot height ratio may vary from 1.5 to 2.0 in ornamental pepper and that ratio must to be considered since the plant architecture and pot size is an important element in determining quality of an ornamental species and it interfere in consumer preference.

An ornamental plant can have its growth harmonized through several factors, including the size of containers. Different genotypes, even those with more expressive growth, can be grown in pots, with their size monitored, in order to obtain a harmony of the plant, and even a better efficiency in the production of the aerial part (Pinto et al., 2010). Pirola et al. (2015) reported that countless materials can be used as a container in the development of chrysanthemum and pansy, ornamental species of great importance in the market, demonstrating that each container has a different influence on the root development of plants, consequently providing the largest total length of the plants. plants

Concerning these characteristics, the development of scientific work related to pot adaptation, more efficient cultivation techniques that can guarantee lower production costs, becomes important. This study aimed to verify the effects of different pot sizes in the development of *D. metel*, in order to enable the use of this species in the potted flower market.

## 2. Material and Methods

Seeds of *Datura metel* were collected in a yard, from fruits of a single plant in the Bonfim settlement, municipality of Alagoinha (06° 57 '00" S, 35° 32' 42" W and altitude of 133 m), Paraíba, Brazil. This research was conducted in a greenhouse at the Biotechnology Department located at Center of Agricultural Sciences of the Federal University of Paraíba (CCA-UFPB), Areia, PB, Brazil.

Seeds were sown in styrofoam (polystyrene) plates, containing 128 cells filled with commercial substrate Plantmax®. When the plants had six permanent leaves they were transplanted to different plastic pots containing the same substrate.

The experimental design used was completely randomized with three pots sizes (treatments) T1 = 0.82 dm<sup>3</sup>, T2 = 1.55 dm<sup>3</sup> e T3 = 3.68 dm<sup>3</sup> and 10 replications, one plant per pot. The plants were irrigated manually and daily, based on field capacity, to maintain adequate humidity until full bloom.

Evaluations were made in flowering period. The variables analyzed were: The variables analyzed were: Plant height (PH), stem diameter (SD), canopy diameter (CD), number of ramifications (NOR), leaf length (LL), leaf width (LW), leaf number (LN), flower number (FN), flower length (FL), flower diameter (FL), chlorophyll *a* (CLa) and chlorophyll *b* (CLb).

Measurements were made using a digital pachymeter (Digital Pachymeter Leetools®) and a graduated ruler. Values referring to quantity were taken by counting. Chlorophyll content were measured with a digital chlorophyll meter (ClorofiLOG -FALKER®).

The data was submitted to analysis of variance and later on Tukey's test (5%). All analyses were made on GENES software (Cruz, 2016).

## 3. Results and Discussion

The PH, SD, CD, NOR, LL, LW, LN, FN, and CLb presented significant differences (p≤0.01) among treatments (Table 1), showing that pot volume influenced on *D. metel* development.

The variables FN, FL and CLa were not significant, (Table 1) which means that plant presented similar behaviors regardless of the applied treatment.

Even though plants presented a reduced size, due to pot diameter, flowers remained big which was disproportional to the pot and plant sizes (Figure 1), decreasing its aesthetical value and making them undesirable for commercialization as ornamental plants in small pots (0.82 dm<sup>3</sup>). Even though plants presented a reduced size, due to pot diameter, flowers remained which was disproportional to the pot and plant sizes (Figure 1), decreasing its aesthetical value and making them undesirable for commercialization as ornamental plants in small pots (0.82 dm<sup>3</sup>). The treatment 1 (pot of 9,1 cm height) the plants had a height of 32.45 cm and flowers of 18.21 cm, while in treatments 2 (pot of 10,5 cm height) and 3 (15 cm height), they had plants with 47.52 cm and 52, 86 cm and flowers with 18.24 cm and 17.90 cm, respectively.

**Table 1.** Analyses of variance summary: mean square and coefficient of variation (CV%) for *Datura metel* characteristics cultivated in different pot sizes.

S.V.	FD	Characteristics / Mean Squares					
		PH	SD	SD	NOR	LL	LW
Treatments	2	1120.31**	0.51**	1981.11**	73.23**	581.76**	107.80**
Error	27	45.55	0.01	26.07	1.75	8.61	3.39
Total	29	-	-	--	-	-	-
CV (%)	-	15.24	9.26	9.55	45.16	9.39	11.11

  

S.V.	FD	Characteristics / Mean Squares					
		LN	FN	FL	FD	CLa	CLb
Treatments	2	864.30**	5.20**	0.25 <sup>ns</sup>	0.96 <sup>ns</sup>	0.32 <sup>ns</sup>	59.70**
Error	27	29.99	0.90	5.72	10.70	37.46	7.83
Total	29	-	-	-	-	-	-
CV (%)	-	32.79	43.21	13.20	20.88	5.79	15.64

\*\* Significant at 1% by the F test. Plant height= PH, stem diameter = SD, canopy diameter = CD, number of ramifications = NOR, leaf length = LL, leaf width = LW, leaf number = LN, flower number = FN, flower length = FL, flower diameter = FL, chlorophyll *a* = CLa and chlorophyll *b* =CL b. Source: Authors.

The coefficient of variation varied from 5.79% to 45.1%, for the characteristics: chlorophyll *a* and number of ramifications, respectively (Table 1). Some authors report that CV values vary according to the species and variable studied (Silva et al., 2011; Werner et al., 2012; Almeida et al., 2014), like observed in this paper. In this case the traits with higher CV values were number of ramification and flower length despite this the differences among treatments were highly significant showing that the variation among treatments were higher than the environment variation (Table 1).

**Figure 1.** *Datura metel* plants produced in different pot sizes. A: 0.82 dm<sup>3</sup>; B: 1.55 dm<sup>3</sup> and C: T3 = 3.68 dm<sup>3</sup>.



Source: Authors.

For plant height, leaf number, flower number and chlorophyll *b*, treatment 1 (pots with 0.82dm<sup>3</sup>) presented the smallest mean values of 32.45, 8.50, 1.40 and 15.18, respectively (Table 2).

The height of the plants decreased around 20 cm when compared to published works, e.g., *Datura fastuosa* height varies from 0.50 to 1.5 m (Al-Snafi, 2017). This fact makes pot size an alternative for reducing plant size, as a small pot may limit plant development by the volume of substrate used (Almeida et al., 2014). Pot size determines plant growth, altering the relationship intake/consumption (Campos e Ronchi, 2015). A small recipient implicates in a small amount of substrate and therefore, a decrease in water and nutrients availability for the plant. By reducing resources availability these pots generally prevent root growth and reduces photosynthesis probably for the total nutrient availability (Poorter et al., 2012).

Treatments 2 (1.55dm<sup>3</sup>) and 3 (3.68dm<sup>3</sup>) presented similar values and the greatest mean values for the characteristics: plant height (47.51 and 52.86), leaf number (2.80 and 2.40) and chlorophyll *b* (18.55 and 19.93) (Table 2). Therefore, *D. metel* production is recommended in the 1.55 dm<sup>3</sup> pot as it presented the same performance as treatment 3 for those characteristics and needs a smaller volume of substrate. Determination of pot volume is important for each plant species because it affects plant growth, especially in protected environment (Guerra et al., 2020), however, pot size has had few reports in scientific literature and usually is not mentioned in papers (Poorter et al., 2012).

The largest mean values were found in treatment 3 for stem diameter, canopy diameter, number of ramifications, leaf length, leaf width and leaf number, with 1.25 (cm), 65.95 (cm), 5.90 (cm), 38.54 (cm), 19.72 (cm) e 26.80 (cm), respectively (Table 2). This shows that pot size influenced plant development regarding these traits.

In potted plants it is important to have small sized and compact plants with good ramification, characteristics that vary according to several factors like cultivar and pot size (Pinto et al., 2003). Therefore, the correct pot choice is decisive to recommending an ornamental plant for cultivation in vases.

The choice of pot size for plant production is important because it influences several aspects and may impact the percentage of survival in the field and crop yielding, also influencing in root and aerial part growth (Lima et al., 2006), like observed in this work.

**Table 2.** Mean values for the evaluated characteristics of *Datura metel* depending on pot size.

Treatments	Characteristics				
	PH (cm)	SD (cm)	CD (cm)	NOR	LL (cm)
T1	32.45b	0.80c	38.20c	0.60c	23.32c
T2	47.52a	1.06b	56.20b	2.30b	31.82b
T3	52.86a	1.25a	65.95a	5.90a	38.54a

  

Treatments	Characteristics			
	LW (cm)	LN	FN	CLb
T1	13.17c	8.50c	1.40b	15.18b
T2	16.85b	14.80b	2.80a	18.55a
T3	19.72a	26.80a	2.40ab	19.93a

Means followed by the same letter in the vertical column represent treatments that are not statistically different. Plant height = PH, Stem diameter = SD, Canopy Diameter = CD, Number of Ramifications = NOR, Leaf Length = LL, Leaf Width = LW, Leaf Number = LN, Flower Number = FN and Chlorophyll b = CLb. Source: Authors.

#### 4. Conclusion

Pot size has an influence on saia-roxa's (*Datura metel*) development.

Medium size recipients (1.55 dm<sup>3</sup>) and large size (3.68 dm<sup>3</sup>) enabled better development for saia-roxa (*D. metel*).

The medium size recipient (1.55 dm<sup>3</sup>) is recommended for cultivation of *D. metel* because it presents ideal plant development, such as plant height and number of leaves, for use with ornamental species pots.

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