

Artigos

Limestone and topdress nitrogen application improves the quality of *Peltophorum dubium* (Sprengel) Taubert (Fabaceae – Caesalpinioideae) seedlings

Aplicação de calcário e de nitrogênio em cobertura melhora a qualidade das mudas de *Peltophorum dubium* (Sprengel) Taubert (Fabaceae–Caesalpinioideae)

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ABSTRACT

The liming and mineral fertilization can improve the growth and quality of forest species seedlings. The effects of the application of nitrogen fertilizer rates and limestone on growth and quality of *Peltophorum dubium* (Sprengel) Taubert seedlings were investigated in this study. *Peltophorum dubium* plants were grown in 1.4-L polyethylene bags filled with sandy soil under greenhouse conditions. Treatments were arranged in a randomized block design in a 4 × 2 factorial: four of N application rates (0, 100, 200 and 300 mg dm⁻³) and application or non-application of limestone, with four replicates. The plant height, stem diameter, height/diameter ratio and number of leaves were measured at 30, 60, 90 and 120 days after emergence. At 120 days, root volume, shoot and root dry matter, N accumulation in shoots, shoot/root dry matter ratio, and Dickson quality index was also measured. The results reported that limestone and N fertilizer application have a positive effect on most of the growth and quality traits of *Peltophorum dubium* seedlings, and when *Peltophorum dubium* seedlings are produced in a substrate consisting of a sandy soil from Brazilian Cerrado, the limestone application and use of 200 mg N dm⁻³ in topdressing should be recommended to obtain high-quality seedlings.

Keywords: Canafistula; Dickson quality index; Liming; Nitrogen fertilization

RESUMO

A calagem e adubação mineral podem melhorar o crescimento e a qualidade das mudas de espécies florestais. Os efeitos da aplicação de adubação nitrogenada e calcário sobre o crescimento e a qualidade das mudas de canafístula [*Peltophorum dubium* (Sprengel) Taubert] foram investigados neste estudo. Plantas de *Peltophorum dubium* foram cultivadas em sacos de polietileno de 1,4 L, preenchidos com solo arenoso e mantidos em condições de casa de vegetação. Os tratamentos foram arranjados em blocos casualizados em esquema fatorial 4 × 2: quatro doses de N (0, 100, 200 e 300 mg dm⁻³) e aplicação ou não de calcário, com quatro repetições. A altura da planta, diâmetro do caule, relação altura/diâmetro e número de folhas foram mensurados aos 30, 60, 90 e 120 dias após a emergência. Aos 120 dias, também foram determinados o volume radicular, massa seca da parte aérea e das raízes, acúmulo de N na parte aérea, relação entre matéria seca da parte aérea/raiz e o índice de qualidade de Dickson. Os resultados reportaram que a aplicação de calcário e de fertilizante nitrogenado tem efeito benéfico sobre a maioria das características da parte aérea e das raízes das mudas de *Peltophorum dubium*, e quando as mudas de *Peltophorum dubium* são produzidas em um substrato constituído de um solo arenoso da região do Cerrado, a aplicação de calcário e o uso de 200 mg N dm⁻³ aplicado em cobertura deve ser recomendado para a obtenção de mudas de alta qualidade.

Palavras-chave: Canafístula; Índice de qualidade de Dickson; Calagem; Adubação nitrogenada

1 INTRODUCTION

The *Peltophorum dubium* (Sprengel) Taubert (Fabaceae – Caesalpinioideae), commonly known in Brazil as “canafístula” and “angicoamarelo”, is a native species of South America, with high economic potential for the wood industry, and is widely used in reforestation, recovery of degraded areas and ornamental afforestation of parks and public streets, mainly due to its fast-initial growth and rusticity (CARVALHO, 2003; LORENZI, 2008). In addition, the *Peltophorum dubium* is a tree species that has been cultivated in the forest-livestock integration system or in the single forest system as an option to replace *Eucalyptus* spp. (HEID *et al.*, 2016).

Understanding the nutritional requirement of the native species of the Brazilian Cerrado is important to optimize and improve the quality of the seedlings produced (SOUZA *et al.*, 2013). The successful establishment of a forest area, for commercial or conservation purposes, depends on the quality of the seedlings used (MARQUES *et al.*, 2009; DUTRA *et al.*, 2016). The production of quality forest seedlings can only

be obtained when edaphoclimatic conditions are adequate for the growth and development of the plants. Among these factors, environmental conditions, substrate preparation, and fertilization are considered the most important (CARVALHO *et al.*, 2016). However, according to Gonçalves *et al.* (2010), the production of forest seedlings is still difficult due to lack of information about the nutritional requirements of the species for seedling production and for the establishment and development of the plants in the field.

Although the native tree species of the Cerrado biome are considered to be adapted to acid soils and low natural fertility (HARIDASSAN, 2008), previous studies with limestone and mineral fertilizer application have reported that native species have distinct responses to the application of soil amendments and nitrogen fertilizer (ZUFFO *et al.*, 2017a). These authors showed that the application of limestone increased the root dry matter production of *Dipteryx alata* Vog. (Fabaceae) seedlings, while N fertilizer application resulted in increased chlorophyll content, leaf N concentration, plant height, and root volume. On the other hand, Falcão Neto *et al.* (2011) reported that N fertilizer topdressing is not required for the production of *Dipteryx lacunifera* Ducke (Fabaceae) seedlings grown in moderately acidic soils without the application of limestone; however, when limestone is applied to the soil, a N topdressing rate of 75 mg N dm⁻³ should be recommended for the production of *D. lacunifera* seedlings.

Acidic soils are characterized by low availability of nitrogen, phosphorus, potassium, calcium and magnesium, and high levels of aluminum and high phosphorus fixation capacity. Among these nutrients, N is one of the most important and most required for the growth and development of plants. Therefore, the correction of soil acidity with limestone and N fertilizer application are considered the main management practices to optimize the growth and quality of the forest seedlings (SOUZA *et al.*, 2013). However, the optimum rate of N fertilizer application for the production of high-quality *Peltophorum dubium* seedlings in acidic and limestone-corrected soils is still unknown.

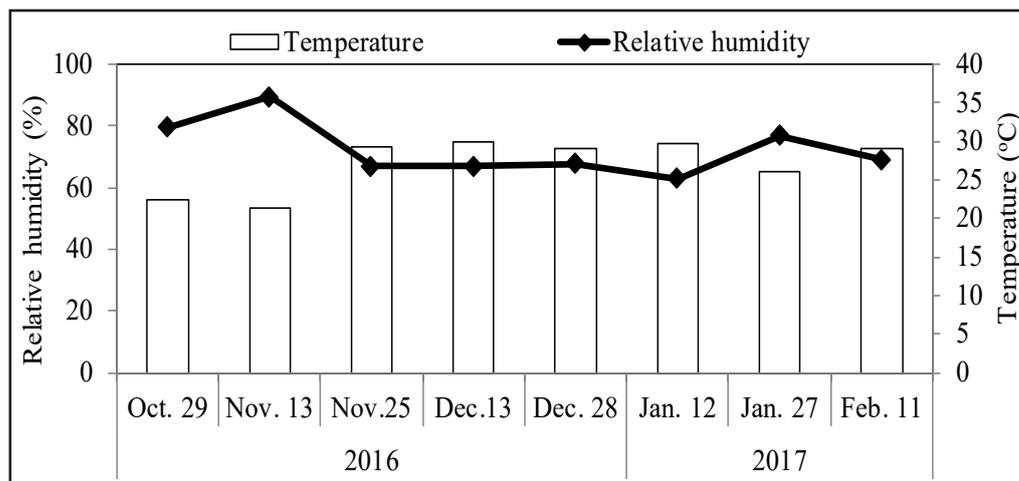
The objective of this study was to evaluate the effects of N fertilizer and limestone application on production of the *Peltophorum dubium* seedlings, and to estimate the optimal N topdressing rate for the production of high-quality seedlings.

2 MATERIAL AND METHODS

2.1 Plant material and growth conditions

Mature fruits of *Peltophorum dubium* were collected in August 2016, from the matrices trees established in a savannah area in the municipality of Cassilândia, located in the eastern region of the State of Mato Grosso do Sul, Brazil (19°05'20" S, 51°48'24" W, and altitude of 510 m). The regional climate, according to the Köppen classification, is Aw, characterized as tropical, with hot summers and a tendency towards high rainfall levels, and dry winters, with a dry season between May and September. The mean annual temperature is 24.1°C, with a minimum of 16.4°C (July) and a maximum of 28.6°C (January). Mean annual rainfall of 1,520 mm. Temperature and relative air humidity data were gathered during the experiment period from October 2016 to February 2017 (Figure 1).

Figure 1 – Mean temperature (°C) and relative air humidity (%) inside the greenhouse during the emergence and growth period of the *Peltophorum dubium* seedlings



Source: Authors (2019)

The seeds were manually extracted and previously selected, considering their size. Seeds were then subjected to the treatment of dormancy breaking by soaking

in hot water (95 °C) and cooled at room temperature (24 to 28°C) for 24 hours, as recommended by Zuffo *et al.* (2017b). Then, three seeds were sown at 2.0 cm depth in black polyethylene bags of 17.0 cm x 22.0 cm (1.4 dm³), filled with sandy soil. The use of 1.4 dm³ polyethylene bags was suitable for the production of high-quality *Peltophorum dubium* seedlings, as reported by Zuffo *et al.* (2018). After the establishment, the seedlings were thinned to one plant per container. The soil water content was maintained at 80% of the soil field capacity with daily irrigations.

The soil used in the experiment was collected from the 0 to 30 cm layer in a Neossolo Quartzarênico Órticolatossólico - RQo (SANTOS *et al.*, 2013) or typical Quartzipsamment (USDA, 2014), with 120 g kg⁻¹ of clay, 40 g kg⁻¹ of silt, and 840 g kg⁻¹ of sand. The occurrence of Quartzipsamments in the eastern region of the Mato Grosso do Sul state is common, and this class of soil has no restrictions for use and management (SANTOS *et al.*, 2013). A 150 dm³ portion of the soil was taken and then 1.10 g dm⁻³ of limestone (CaO 38%, MgO 11%, and CCE 85%) was applied to raise soil base saturation up to 70%. After liming, the soil was homogenized, moistened, and maintained in plastic bags for 30 days with water content at field capacity. The main soil chemical characteristics was done at the bulk soil and after limestone incubation time following the methodology proposed by Embrapa (2009) (Table 1). Another portion of soil did not receive limestone application and was used as a control treatment.

After the incubation period with limestone, the soil was fertilized with 400 mg P dm⁻³ as simple superphosphate (18% P₂O₅) and 100 mg K dm⁻³ as potassium chloride (60% K₂O). The simple superphosphate rate was incorporated into the total volume of the soil before sowing, while the potassium chloride was applied in topdressing at 15, 30 and 50 days after sowing (DAS) at 20%, 40%, and 40%, respectively, of the rate used. In this study, N fertilizer rates of 0, 100, 200 and 300 mg dm⁻³ were tested for the growth of *Peltophorum dubium* seedlings. The N rates as urea (45% N) were applied in topdressing at 10, 25 and 45 DAS at 20%, 40%, and 40%, respectively, of the rate evaluated. The urea rates per polyethylene bag (1.4 dm³) were applied by diluting the

amount of fertilizer in 20 mL of pure water. This solution was applied to one side of each plant. The fertilizer rates applied in this study were based on the recommendations of Malavolta (1980) for experiments in pots under greenhouse conditions.

Table 1 – Main chemical properties of the sandy soil used in the experiment before and after the application of limestone

Soil properties	pH	P _{Mehlich-1}	K ⁺	Ca ²⁺	Mg ²⁺	Al ³⁺	H+Al	OM
		mg dm ⁻³	cmol _c dm ⁻³					g kg ⁻¹
Before liming	4.6	8.30	0.05	1.30	0.20	0.31	3.30	11.1
After liming	5.9	10.70	0.08	2.20	0.70	0.00	1.02	12.7

Source: Authors (2019)

In where: H + Al = Potential acidity. OM = Organic matter.

2.2 Measuring seedling growth and quality

At 30, 60, 90 and 120 days after seedling emergence, the number of leaves, plant height, stem diameter and height/diameter ratio were measured. The plant height (PH, in cm) was measured using a millimeter ruler. The stem diameter (SD, in mm) was measured using a digital caliper with an accuracy of 0.01 mm. The height/diameter ratio (PH/SD) was obtained from the quotient between plant height (cm) and stem diameter (mm).

At 120 days after emergence, the plants then were separated into shoots and roots. Roots were removed from the containers and washed with water to remove soil adhered to the roots. Root volume (RV, cm³ plant⁻¹) was determined by water displacement using a calibrated cylinder of 100 mL. After, shoots and roots were oven-dried at 60°C for three days and then weighed. The results of shoot dry matter (SDM), root dry matter (RDM) and total dry matter (TDM) were expressed in grams per plant. The shoot/root dry matter ratio (SDM/RDM) was obtained from the quotient between shoot dry matter (g) and root dry matter (g). The Dickson quality index (DQI) was calculated using the following equation proposed by Dickson, Leaf and Hosner (1960): $DQI = TDM / [(PH/SD) + (SDM/RDM)]$.

The plant material from shoots was finely ground in a Willey mill, and the total N concentration (in g kg^{-1}) was determined by the Kjeldahl method with digestion in sulfuric acid solution and vapor distillation as described by Embrapa (2009). The amount of N accumulated in shoots (mg plant^{-1}) was calculated from the multiplication of shoot dry matter by the N concentration in shoots.

2.3 Experimental Design and Statistical Analyzes

The experiment was arranged in a randomized block design, in a 4 x 2 factorial scheme, with four rates of N fertilizer (0, 100, 200 and 300 mg dm^{-3}) and application or non-application of limestone, with four replicates. The rate of 300 mg dm^{-3} of N is the dose recommended by Malavolta (1980) for pot experiments. Each experimental unit consisted of five plastic bags containing one plant, totaling 20 seedlings per treatment.

Data were submitted to the tests of the normality of residues (Shapiro-Wilk test; $p > 0.05$) and homoscedasticity of variances (Levene test; $p > 0.05$). Root volume, root dry matter, shoot dry matter, and Dickson quality index data were transformed into $(x + 0.5)^{0.5}$ to satisfy the statistical hypotheses of normality and homoscedasticity. Then data were submitted to analysis of variance (ANOVA), and when significant, the means were compared by the F test at the 5% probability level, using the Sisvar[®] software, version 5.6 for Windows (Statistical Analysis Software, UFLA, Lavras, MG, BRA). Regression analysis was used for the N fertilizer rates, and significant equations (F-test; $p \leq 0.05$) with the highest coefficients of determination were adjusted. The analyses were performed using SigmaPlot[®] 11.0 software for Windows (Systat Software, Inc., San Jose, CA, USA).

3 RESULTS AND DISCUSSION

The results of ANOVA did not report significant effect ($p > 0.05$) of the interaction between limestone application and N fertilizer rates on any of the growth traits of the seedlings (Table 2). Similar results were reported by Zuffo *et al.* (2017a), which also did not find an interaction between limestone and N fertilizer application on the morphological characteristics of *Dipteryx alata* seedlings. The absence of significant

interaction between these factors indicates that the response of *Peltophorum dubium* seedlings to the application of N fertilizer rates was similar both in moderately acid soil without limestone and in soil corrected with limestone. Therefore, the results are presented separately for the effects of limestone application (Table 3) and N fertilizer topdressing rates (Figures 2 and 3) on the production of *Peltophorum dubium* seedlings.

Table 2 – Summary of the analysis of variance for the measurements of plant growth, nitrogen acquisition and quality indexes of the *Peltophorum dubium* seedlings as affected by limestone application and N fertilizer rates. Cassilândia, MS, Brazil. 2016/2017

Sources of variation	Probability > F ¹							
	30 DAE	60 DAE	90 DAE	120 DAE	30 DAE	60 DAE	90 DAE	120 DAE
	----- Plant height (PH) -----				----- Stem diameter (SD) -----			
Limestone (L)	0.015	0.031	0.235	0.229	0.024	<0.001	0.026	<0.001
Nitrogen rates (N)	0.217	<0.001	<0.001	<0.001	0.598	<0.001	<0.001	<0.001
L × N	0.684	0.315	0.554	0.280	0.737	0.206	0.156	0.065
CV (%)	13.37	10.89	5.02	9.35	16.90	8.90	20.20	7.65
	--- Height/diameter ratio (PH/SD) ---				----- Number of leaves -----			
Limestone (L)	0.599	0.599	0.599	0.599	<0.001	0.004	0.020	0.069
Nitrogen rates (N)	0.550	0.550	0.550	0.550	0.456	<0.001	0.040	0.090
L × N	0.459	0.459	0.459	0.459	0.569	0.754	0.154	0.409
CV (%)	9.30	9.30	9.30	9.30	3.63	4.53	4.55	8.69
Sources of variation	Probability > F ¹							
	----- 120 DAE -----							
	N accumulation in shoots	Root volume (RV)	Root dry matter (RDM)					
Limestone (L)	0.872	0.147	<0.001					
Nitrogen rates (N)	<0.001	<0.001	<0.001					
L × N	0.280	0.427	0.398					
CV (%)	19.63	10.48	8.29					
	Shoot dry matter (SDM)	SDM/RDM	Dickson quality index (DQI)					
Limestone (L)	<0.001	0.488	<0.001					
Nitrogen rates (N)	<0.001	<0.001	<0.001					
L × N	0.118	0.411	0.101					
CV (%)	7.66	13.18	18.88					

Source: Authors (2019)

In where: 1 Fisher-Snedecor F test. CV = Coefficient of variation. DAE = Days after emergence.

Table 3 – Effects of limestone application on plant height, stem diameter, height/diameter ratio (PH/SD) and the number of leaves at 30, 60, 90 and 120 days after emergence (DAE), and nitrogen accumulation, root volume, root dry matter, shoot dry matter, shoot/root dry matter (SDM/RDM), and Dickson quality index at 120 DAE of the *Peltophorum dubium* seedlings. Cassilândia, MS, Brazil. 2016/2017

Limestone	Days after emergence (DAE)							
	30	60	90	120	30	60	90	120
	Plant height (cm)				Stem diameter (mm)			
With	9.77 a	27.77 a	36.50 a	37.79 a	1.98 a	5.44 a	8.67 a	9.61 a
Without	8.62 b	25.41 b	35.00 a	36.28 a	1.71 b	4.77 b	7.31 b	8.43 b
	Height/diameter ratio (PH/SD)				Number of leaves			
With	4.97 a	5.07 a	4.17 a	3.89 a	6.02 a	10.20 a	8.88 a	8.18 a
Without	5.06 a	5.30 a	4.06 a	4.28 a	5.61 b	9.72 b	8.17 b	7.25 b
	Measurements at 120 DAE							
	Nitrogen accumulation (mg plant ⁻¹)		Root volume (cm ³ plant ⁻¹)		Root dry matter (g plant ⁻¹)			
With	270.91 a		28.06 a		6.29 a			
Without	274.01 a		25.34 a		5.18 b			
	Shoot dry matter (g plant ⁻¹)		SDM/RDM (g g ⁻¹)		Dickson quality index			
With	16.59 a		2.49 a		3.46 a			
Without	13.19 a		2.41 a		2.67 b			

Source: Authors (2019)

In where: Mean followed by distinct letters in the columns show significant differences by F test at the 5% probability level.

3.1 Effect of liming on the production of *Peltophorum dubium* seedlings

The correction of soil acidity with limestone resulted in higher plant height at 30 and 60 DAE, larger stem diameter and leaf number at 30, 60, 90 and 120 DAE, and higher root dry matter and Dickson quality index of the *Peltophorum dubium* seedlings at 120 DAE (Table 3). These results are similar to those obtained by Cruz *et al.* (2012), which reported that the limestone application resulted in the highest values of plant

height, stem diameter, root dry matter and Dickson quality index of the *Peltophorum dubium* seedlings at 120 DAE. In a moderately acidic soil from the Brazilian Cerrado, Zuffo *et al.* (2017a) also showed that the limestone application resulted in a positive response on the shoot and root growth of *Dipteryx alata* seedlings.

Although the *Peltophorum dubium* plants are considered rustic (LORENZI, 2008), the limestone application showed to be a limiting factor for plant height, number of leaves and stem diameter up to 60, 90 and 120 DAE, respectively (Table 3). At 120 DAE, the limestone application also significantly influenced the root dry matter and Dickson quality index. It is known that calcium is an element with a fundamental role in the development of roots (RITCHEY; SILVA; COSTA, 1982), therefore, the application of limestone resulted in greater root growth. This fact is also reinforced by the 11% increase in root volume, although there was no significant difference for the application or non-application of limestone (Table 3).

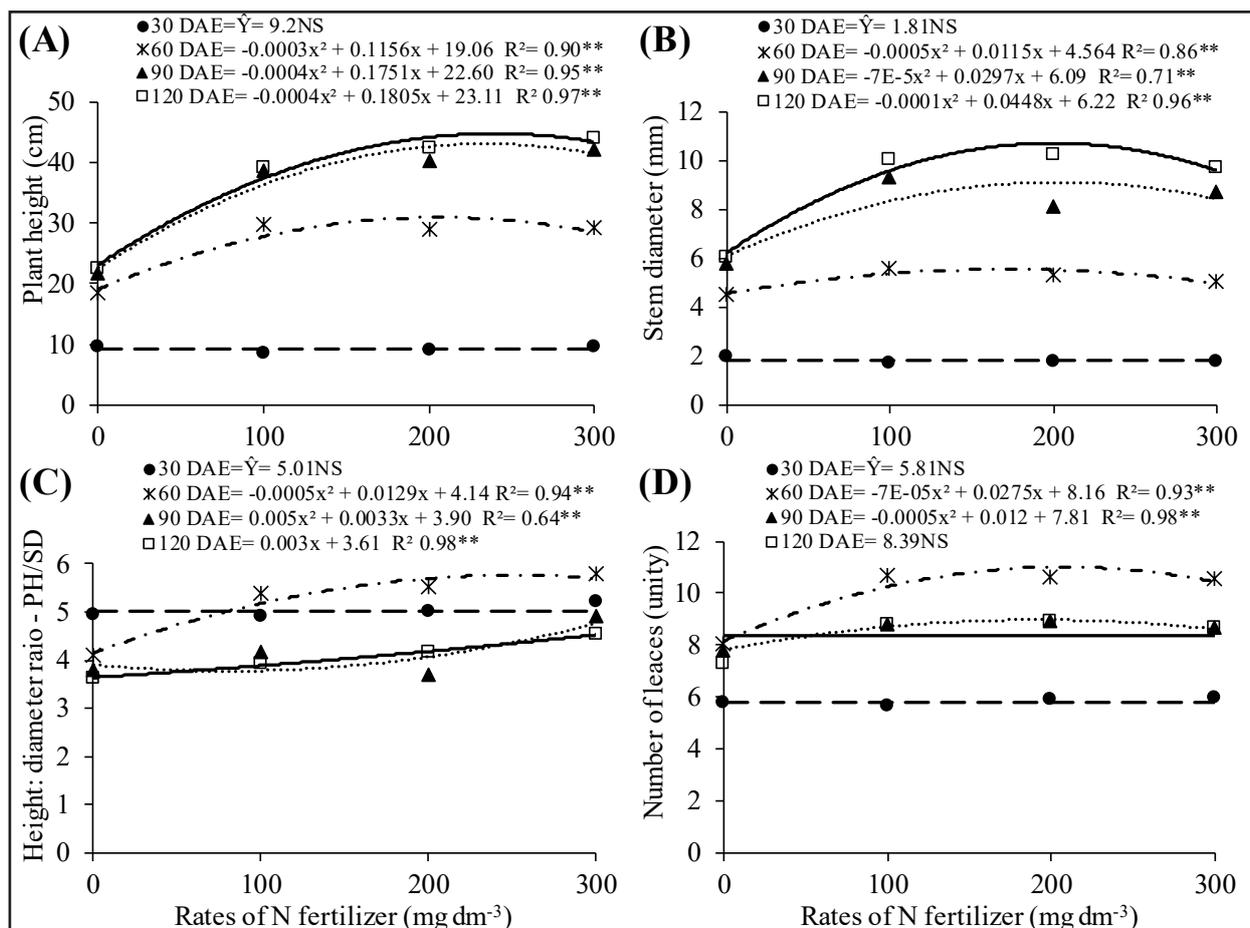
The Dickson quality index is an excellent indicator of the quality of the seedlings. Thus, it can be observed that *Peltophorum dubium* plants have a positive response to the application of limestone. This improvement in plant growth with the liming is associated with greater nutrient availability, especially calcium, magnesium, and phosphorus, and neutralization of toxic aluminum (Al^{3+}) in the soil (see, Table 1). These results indicate that the application of limestone is essential for better growth and quality of *Peltophorum dubium* seedlings when cultivated in sandy Cerrado soils.

3.2 Effect of nitrogen fertilizer rates on the production of *Peltophorum dubium* seedlings

Nitrogen is one of the nutrient required in larger amounts by plants, being part of several plant molecules and structures (TAIZ *et al.*, 2017). In general, the results showed that N deficiency limits growth and production of the *Peltophorum dubium*

seedlings. The absence of significant effect on plant height, stem diameter, height/diameter ratio (PH/SD), and leaf number at 30 DAE was due to the fact that only 60% of the N fertilizer rates were applied to date (Figure 2) since the N rates were applied three times. This effect is reinforced by the significant effects of N application (R^2 : 0.64; $p < 0.001$) on all growth traits of the seedlings at 60, 90 and 120 DAE, except for the number of leaves at 120 DAE.

Figure 2 – Effects of N application rates on plant height (A), stem diameter (B), height/diameter ratio - PH/SD (C) and number of leaves (D) at 30, 60, 90 and 120 days after emergence of the *Peltophorum dubium* seedlings. Cassilândia, MS, Brazil. 2016/2017



Source: Authors (2019)

Nitrogen fertilizer rates resulted in responses with effects of quadratic regression equations for plant height and stem diameter at 60, 90 and 120 DAE;

for the height/diameter ratio and number of leaves at 60 and 90 DAE; for root volume, root dry matter, shoot dry matter, height/diameter ratio and Dickson quality index at 120 DAE (Figures 2 and 3). In general, the application of 200 mg N dm⁻³ was the nutrient rate that resulted in the highest values of these seedling growth characteristics, suggesting that this N rate is the most adequate to optimize the growth of the *Peltophorum dubium* seedlings when grown in the sandy soil of the Cerrado region.

A growth response of *Peltophorum dubium* seedlings with the application of lower rates of N fertilizers was reported by Cruz *et al.* (2012), reported by Cruz *et al.* (2012), which showed that the application of 50 mg N dm⁻³ resulted in higher growth of *Peltophorum dubium* seedlings at 120 days; however, in this study the seedlings were grown in clay soil with a higher content of organic matter when compared to the sandy soils of the Cerrado, as used in this study (Table 1). In a clayey soil with low organic matter content (8.2 g kg⁻¹), Souza *et al.* (2013) showed that the maximum growth and quality of the *Peltophorum dubium* seedlings were obtained with the application of 75 mg N dm⁻³. Therefore, these distinct responses to N fertilization rates may be due to the different chemical properties of the soils used in these studies, especially N availability, and organic matter content. In these studies, the chemical and physical characteristics of the soils were distinct. According to Souza *et al.* (2013), the type of soil used as substrate in the production of forest seedlings is particularly important, since it may interfere in the nutrient uptake efficiency and plant growth responses, or even due to the genetic variability of the species.

The increase in seedling growth with the application of N fertilizer was expected, since this nutrient plays a fundamental role in physiologic metabolism, being part of several plant molecules and structures (Taiz *et al.*, 2017). Positive responses of N fertilization on the production of *Peltophorum dubium* seedlings

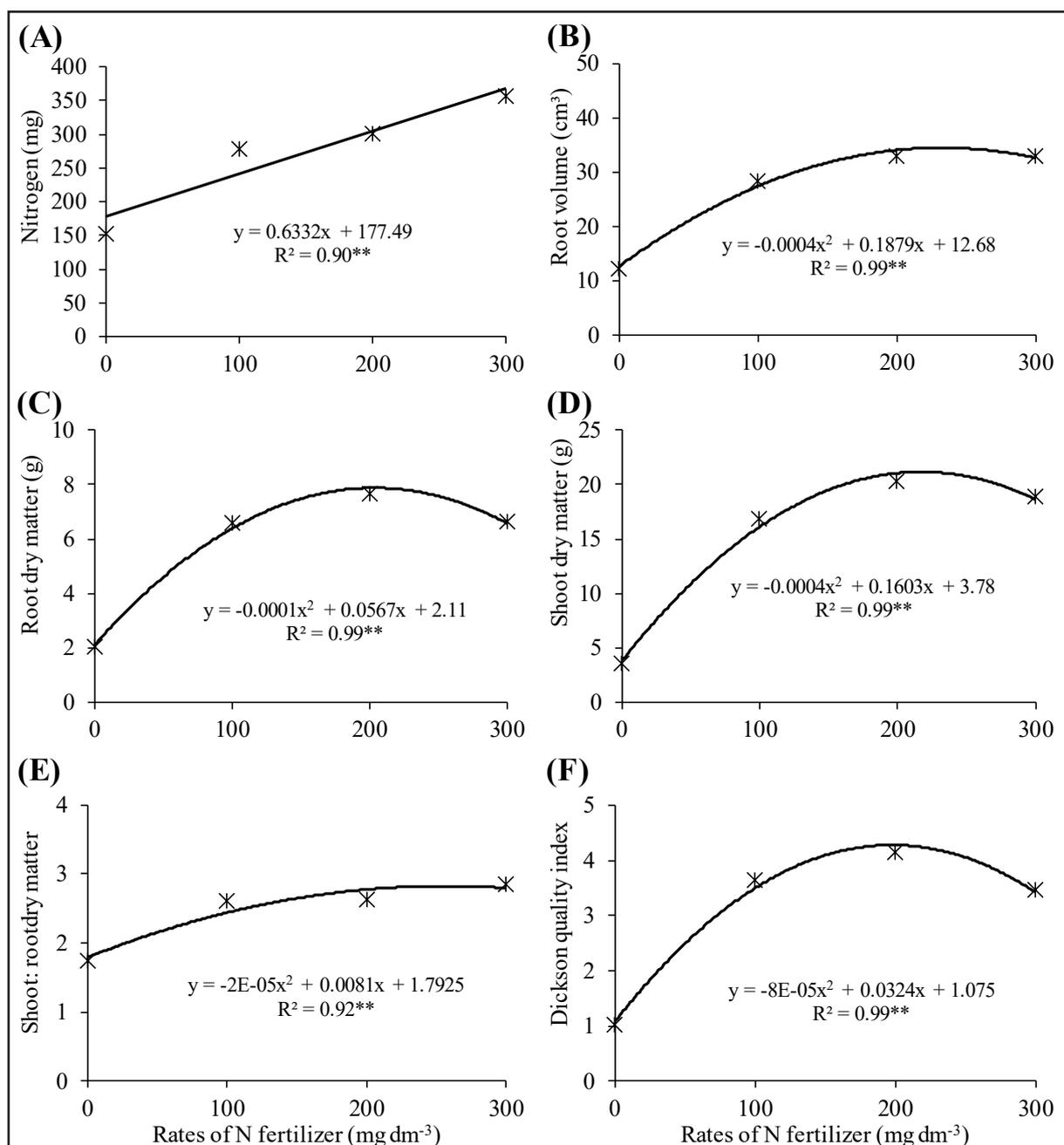
were reported by Cruz *et al.* (2012), Souza *et al.* (2013), and Soares *et al.* (2017). Therefore, it is evident that the N fertilizer application provides higher quality *Peltophorum dubium* seedlings, being necessary N fertilizations when the demand of the plant is greater than the supply by the substrate.

The height/diameter ratio (PH/SD) and N accumulation in shoots at 120 DAE had a linear response to the application of N fertilizer rates (Figure 2E and Figure 3A). The maximum accumulation of N was obtained with the application of 300 mg N dm⁻³ (Figures 3A). Zuffo *et al.* (2017a) also reported a higher N content in the shoots of *Dipteryx alata* seedlings when the seedlings were fertilized with 300 mg N dm⁻³. Nitrogen is part of the structure of the chlorophyll molecule, a molecule capable of converting sunlight energy into chemical energy (TAIZ *et al.*, 2017); therefore, chlorophyll is related to photosynthetic efficiency of plants. However, although the greatest accumulation of N was obtained with the application of 300 mg N dm⁻³, the nutrient rate that resulted in the better development and quality of the *Peltophorum dubium* seedlings was the application of 200 mg N dm⁻³. This fact may be due to the adequate content of N for this species were obtained when 200 mg N dm⁻³ was applied, and thus, although the higher rate resulted in greater accumulation of N, this did not reflect in a higher photosynthetic rate and, consequently greater photoassimilates production for the growth and development of plants.

In general, our results showed that limestone and N fertilizer application have a positive effect on most of the growth and quality traits of *Peltophorum dubium* seedlings, and when *Peltophorum dubium* seedlings are produced in a substrate consisting of a Cerrado sandy soil, the limestone application and use of 200 mg N dm⁻³ in topdressing should be recommended to obtain high-quality seedlings. These results confirmed those reported by Soares *et al.* (2017), who applied rates ranging from 0 to 200 mg N dm⁻³ from different sources of N fertilizer, and showed that

the optimum N fertilizer rate for the production of *Peltophorum dubium* seedlings grown in clay soil was 185 mg N dm⁻³.

Figure 3 – Effects of N application rates on nitrogen accumulation in shoots (A), root volume (B), root dry matter (C), shoot dry matter (D), shoot/root dry matter ratio (E), and Dickson quality index (F) of the *Peltophorum dubium* seedlings at 120 days after emergence. Cassilândia, MS, Brazil. 2016/2017



Source: Authors (2019)

4 CONCLUSIONS

The limestone application in a sandy soil of the Brazilian Cerrado has a beneficial effect on the shoot and root growth of the plants, resulting in higher quality *Peltophorum dubium* seedlings at 120 days.

The optimal N topdressing rate for the production of *Peltophorum dubium* seedlings grown in sandy soil from the Brazilian Cerrado region is 200 mg N dm⁻³.

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