Growth and organic solutes accumulation in seedlings of Caatinga tree species in response of water deficit and potassium

Drought stress negatively influences a variety of essential physiological process for plant growth and biomass production, and potassium contributes to the absorption of water and maintaining cell turgor, being crucial to understand the seedlings water stress responses. This research aimed to verify the effects to water deficiency and potassium on the growth and accumulation of organic solutes in *Myracrodruon urundeuva*, *Libidibia ferrea*, and *Mimosa tenuiflora*. The treatments were distributed in a 3 x 3 factorial scheme, with three water levels (100%pc - control, 50%pc - moderate water deficit, and 25%pc - severe water deficit) and three doses of potassium (0, 97.5 and 195 mg dm⁻³ K). The plants were sown in black plastic bags, containing 5 kg of soil. Were evaluated plant height, stem diameter, and leaf concentrations of total soluble sugars, total free amino acids, and proteins. The water deficit caused a reduction in the growth of *M. urundeuva* and *M. tenuiflora* plants, regardless of the added potassium. The plants of *M. urundeuva* and *M. tenuiflora* were not demanding in potassium, while potassium fertilization with 97.5 mg dm⁻³ K favored *L. ferrea* plants, especially when kept under moderate water deficit. The moderate water deficit promoted accumulation of total free amino acids and soluble proteins in *M. urundeuva*, while in *L. ferrea* there was accumulation of total free amino acids under severe water deficit. Increase in the potassium promoted reduction in the concentrations of total soluble sugars and soluble proteins.

Keywords: Mineral Nutrition; Osmotic Adjustment; Water Stress.

Crescimento e acúmulo de solutos orgânicos em mudas de espécies arbóreas da Caatinga em resposta ao déficit hídrico e potássio

O estresse hídrico influencia negativamente uma variedade de processos fisiológicos essenciais para o crescimento das plantas e a produção de biomassa, e o potássio contribui para a absorção de água e, assim, mantém o turgor celular, sendo crucial para entender as respostas das mudas ao estresse hídrico. Nesse contexto, esta pesquisa teve como objetivo verificar os efeitos da deficiência de água e potássio no crescimento e acúmulo de solutos orgânicos em *Myracrodruon urundeuva*, *Libidibia ferrea* e *Mimosa tenuiflora*. Os tratamentos foram distribuídos em esquema fatorial 3 x 3, com três níveis de água (100% cp - controle, 50% cp - déficit hídrico moderado e 25% cp - déficit hídrico severo) e três doses de potássio (0, 97,5 e 195 mg dm⁻³ K). As plantas foram semeadas em sacos plásticos pretos, contendo 5 kg de solo. Foram avaliadas a altura da planta, o diâmetro do caule e as concentrações foliares de açúcares solúveis totais, aminoácidos livres totais e proteínas. O déficit hídrico causou uma redução no crescimento das plantas de *M. urundeuva* e *M. tenuiflora*, independentemente da adição de potássio. As plantas de *M. urundeuva* e *M. tenuiflora* não exigiam potássio, enquanto a fertilização com 97,5 mg dm⁻³ K favoreceu as plantas de *L. ferrea*, principalmente quando mantidas em déficit hídrico moderado. O déficit moderado de água promoveu o acúmulo de aminoácidos livres totais e proteínas solúveis em *M. urundeuva*, enquanto em *L. ferrea* houve acúmulo de aminoácidos livres totais sob déficit hídrico grave. O aumento do potássio promoveu redução nas concentrações de açúcares solúveis totais e proteínas solúveis.

Palavras-chave: Ajustamento Osmótico; Estresse Hídrico; Nutrição Mineral.

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INTRODUCTION

The climate changes resulting from global warming will promote an increase in cycles, intensity and periods of drought (IPCC, 2014), affecting the composition, structure and production of forests (ALLEN et al., 2010).

The semiarid region located in the northeast region of Brazil, is characterized by a period of 3 to 5 months of rain, irregularly distributed, with high temperatures and light intensity, causing high evaporation rates, remaining in the vegetation subject to a water deficit during most of the year (TROVÃO et al., 2007). The Caatinga, located in this semi-arid region, is a tropical forest with a dry climate, with 844,453 km² (BRASIL, 2008; GUSMÃO et al., 2016), has a typical vegetation, with particular, ecological and mainly floristic characteristics, characterized by branched trees and shrubs, with deciduous foliage in the dry season, in addition to the wide variety of bromeliads and spiny cacti (MAIA, 2004; QUEIROZ et al., 2005). To survive under such conditions, during the rainy season, Caatinga vegetation develops resources that allow maximum absorption and accumulation of water, such as deep root system and tuberous root, and during the period of low water availability, the reduction in loss of water, including stomatal closure, high water use efficiency and osmotic adjustment (ALVES et al., 2009b; BARROS et al., 2013).

In order to ensure water absorption and, in this way, maintain cellular water status without affecting metabolism, plants develop osmotic adjustment through the synthesis and accumulation of low molecular weight metabolites (DICHIO et al., 2009; NIO et al., 2011). The amount and type of accumulated solute depends on the plant species and the length of the deficit period. Among the metabolites that contribute to osmotic adjustment, soluble sugars and amino acids such as glycine betaine (RHODES et al., 1993) and proline (SZABADOS et al., 2010; ALBUQUERQUE et al., 2013) can be mentioned.

In addition to these solutes, some ions such as K⁺ act to exert this osmotic effect within plants (BATTIE-LACLAU et al., 2014), contributing to the absorption of water and thus maintaining cell turgor, which guarantees the maintenance of the necessary physiological processes the plants. Research indicates that potassium has produced positive effects in mitigating the effects of water deficit on plant development (MONDINI et al., 2019), however studies with this scope for species in the Caatinga are still incipient.

However, potassium excess interferes in other cations absorption (PRADO, 2008; TAIZ et al., 2013), and under high concentrations, it can have a harmful effect on the plant, affecting cell membranes or proteins structures (MELO et al., 2020). The potassium chloride osmotic effects has been noticed, causing plasmolysis, reducing germination (OLIVEIRA et al., 2019), survival and growth and biomass production of plants (MELO et al., 2020).

The *Libidibia ferrea* (Mart. Ex Tul), *Mimosa tenuiflora* (Willd), from the family Fabaceae, and *Myracrodruon urundeuva* Fr. Allemão, family Anacardiaceae, are representative of the Caatinga, being widely distributed. *L. ferrea* is a colonizer of secondary stages (LORENZI, 2008) while *M. tenuiflora* is a pioneer species (AZEVEDO et al., 2012), both are used for energy purposes and wood production (CARVALHO, 2003; OLIVEIRA, 2003; LORENZI, 2008), in addition to having medicinal properties (SAMPAIO et al., 2009; OLIVEIRA

et al., 2010) and the restoration of degraded areas (AZEVEDO et al., 2012; JESUS et al., 2017). *M. urundeuva* is a colonizer of late secondary stages (LORENZI, 2008), has pharmacological properties (LUCENA et al., 2011; RIBEIRO et al., 2014) and high wood potential, in addition to being used for the production of tannin, used in leather tanning (MONTEIRO et al., 2005). Due to its diversity of uses, it was explored in an intense and indiscriminate manner in the semi-arid region of Brazil, which resulted in its inclusion in the official list of the Ministério do Meio Ambiente of endangered species (BRASIL, 2008).

Despite the high biological importance for the Caatinga, little is known about the physiological responses of these species under water deficit, especially during the seedling phase the most vulnerable phase of the forest tree life (JAMNICKÁ et al., 2019). Due to its climatic and pedological characteristics, the semi-arid region where the Caatinga is inserted presents itself as extremely susceptible to the changes resulting from the climate changes expected as a result of global warming. Thus, understanding the strategies used by the species of the Caatinga is essential to maintain the biodiversity of this biome in future scenarios.

In this context, this research aimed to evaluate growth and organic solutes accumulations in three species in Caatinga plants under water deficit, fertilized with potassium.

MATERIALS E METHODS

The research was carried out in Forest Nursery of the Academic Unity of Forest Engineering, Universidade Federal de Campina Grande, Patos, Paraíba State, Brazil (7°03'34" S, 37°16'30" O), in lateral screened structure and plastic cover.

The seeds came from were obtained from trees growing on the *Campus*, and before sowing, the seeds of *L. ferrea* and *M. tenuiflora* were subjected to break of tegumentary dormancy using sulfuric acid for 30 minutes (ALVES et al., 2009a) and immersion in hot water (85 °C) for 30 seconds (BAKKE et al., 2006). They were sown in black plastic bags, containing 5 kg of soil from the 0.0-0,20 m in ground spoil layer. The chemical analysis indicated that the soil had pH (H₂O) 6.5; P (Mehlich) 2.9 mg kg⁻¹; Ca 5.0 cmol_c dm⁻³; Mg 2.0 cmol_c dm⁻³; K 0,7 cmol_c dm⁻³; H + Al 0.22 cmol_c dm⁻³; and T 94.1 cmol_c dm⁻³. Before seed planting, soil was fertilized with N and P according to the recommendation of Furtini Neto et al. (1999). Fertilization with K was carried out according to the treatments to be tested, using potassium chloride (KCl). Fifteen days after emergence (DAE), thinning was carried out, leaving the seedling more vigorous.

To reach the humidity levels, two pots were irrigated until the substrate saturation, and water was not added. Then, they were placed for leaching, and after observing that there was no more leaching, the pots were weighed on a scale, corresponding to the weight at 100% pc (substrate under pot capacity), and based on this, the other pots weight was determined. The substrate moisture level control was carried out every five days by weighing in digital balance (0.1g), replacing the water necessary to reach the proposed moisture levels. Irrigation was performed between 4:30 pm and 5:00 pm, according to the water regime.

The treatments were distributed in a completely randomized design, in 3 x 3 factorial scheme, with three water levels (100%pc - control, 50%pc - moderate water deficit (MD), and 25%pc - severe water deficit (SD)) and three doses of potassium (0, 97.5 and 195 mg dm⁻³ K), with four replications.

The water treatments started 45 DAE, and at the end of the experiment (135 DAE) morphological attributes were evaluated. Height was measured from the apical bud of the plant to the soil surface using a millimeter ruler, and the stem diameter was measured with a digital caliper (accuracy of 0.01 mm).

In order to the biochemical analysis, 200 mg of leaf fresh mass was macerated in 12 mL of MCW (methanol: chloroform: water), in 12:5:3 proportion, according to Bieleski et al. (1966). Leaf concentrations of total soluble sugars (SS) (YEMM et al., 1954), total free amino acids (AA) (YEMM et al., 1955) and proteins (PROT) (BRADFORD, 1976) were carried.

The data were subjected to analysis of variance (ANOVA), and the means compared using Tukey's test ($p \leq 0,05$) in SISVAR statistical program, version 5.6 (FERREIRA, 2011).

RESULTS AND DISCUSSION

Plant height and stem diameter

The water deficit promoted plant height reduction in *M. urundeuva* and *M. tenuiflora*, in potassium fertilization treatments (Table 1). However, in *L. ferrea*, statistical equality was found between the control treatments and moderate water deficit, at doses 0 and 195 mg dm⁻³ K. In addition, at 97.5 mg dm⁻³ K, plants under moderate water deficit presented greater height. These data show that these plants tolerated the humidity condition of the substrate by 50%pc, regardless of the K supply. However, the reduction in water availability to 25%pc affected these plants more severely, with an average reduction of 44% in height, whereas in *M. urundeuva* and *M. tenuiflora* it was 38% and 34%, respectively, compared to treatment at 50%pc.

Comparing the treatments of K (Tabel 1), within each water level, it is noticed that the supply of K did not positively influence the height of plants, in *M. urundeuva* and *M. tenuiflora*, occurring a reduction with the increase of K. Possibly the K soil content was sufficient for the plants to be able to grow properly, and that the addition of this nutrient to the soil may have caused an osmotic effect, resulting in a reduction in plant height. In contrast, in *L. ferrea*, the addition of K was not harmful to the plants because, even under conditions of water deficit, there was statistical equality in the height of the plants between the treatments of K.

In the stem diameter, similar to that seen at plant height, there was a progressive reduction in *M. urundeuva* and *M. tenuiflora* with water deficit, in all potassium fertilization treatments (Table 2). In *L. ferrea*, statistical equality was found between the treatments 100%pc and 50%pc, also at 0 and 195 mg dm⁻³ K, and the largest stem diameter was obtained at 97.5 mg dm⁻³ K in plants at 50%pc (Table 2). Comparing the K treatments, within each water level, reduction in the stem diameter in *M. urundeuva* is observed and no effect in *M. tenuiflora* with the supply of potassium. However, in *L. ferrea*, there was a positive influence, with an increase in stem diameter as the K level increased.

Decrease in the growth parameters reported above can be explained by the effects of low water availability in the processes of cell elongation and division, in addition to stomatal closure and a consequent

decrease in photosynthesis and assimilates production. Water stress, depending on its intensity and duration, can cause a decrease in cells water content, resulting in less turgor pressure and a decrease in cell expansion and division and, consequently, in the growth of organs and plants (CHAVES et al., 2002; CHAVES et al., 2003). In addition, under conditions of low water availability, occur stomata closure, reducing water loss through transpiration (JIN et al., 2011; WANG et al., 2013; SHABALA et al., 2014), maintaining leaf water balance and preventing tissue death from dehydration (PEAK et al., 2004). However, such a strategy results in limiting the assimilation of CO₂, resulting in a decrease in the photosynthetic rate and, consequently, in the production of carbohydrates and plant growth (PEEVA et al., 2009; CHAVES et al., 2009; HU et al., 2010). Reduction in plant growth due to water deficit is widely reported in the literature, and in *Guazuma ulmifolia* Lam plants, a 50% and 32% decrease in plant height and stem diameter, respectively, when water availability is reported imposed was 25%pc (SCALON et al., 2011). Likewise, water deficiency resulted in decreases of 44% and 48% in plant height and 25% and 31% in stem diameter, when the plants were kept at 25%pc, in relation to the control treatment in *Cnidoscolus quercifolius* (Pohl.) (RAMOS et al., 2019).

Tabel 1: Plants height (cm) of *Myracrodruon urundeuva*, *Libidibia ferrea*. and *Mimosa tenuiflora* under water levels and potassium fertilization.

Water level (%pc)	<i>Myracrodruon urundeuva</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	28.9 aA	28.2 aA	23.6 aA
50 (MD)	21.5 bA	19.4 bB	14.1 bB
25 (SD)	15.9 bA	10.4 cB	8.5 cB
Water level (%pc)	<i>Libidibia ferrea</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	72.5 aA	61.1 bA	66.0 aA
50 (MD)	69.6 aA	69.0 aA	64.6 aA
25 (SD)	38.5 bA	37.2 cA	38.4 bA
Water level (%pc)	<i>Mimosa tenuiflora</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	71.3 aA	61.2 aB	59.0 aB
50 (MD)	61.2 bA	55.1 bB	52.5 bB
25 (SD)	41.6 cA	39.6 cA	31.0 cB

Capital letters compare K doses, within each water regime; lowercase letters compare water regimes in each dose of K (Tukey P≤0,05).

Tabel 2: Stem diameter (mm) of *Myracrodruon urundeuva*, *Libidibia ferrea*, and *Mimosa tenuiflora* under water levels and potassium fertilization.

Water level (%pc)	<i>Myracrodruon urundeuva</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	3.67 aA	2.99 aB	2.88 aB
50 (MD)	2.64 bA	2.00 bA	2.43 aA
25 (SD)	1.81 cA	1.74 cA	1.27 bB
Water level (%pc)	<i>Libidibia ferrea</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	2.82 aB	2.88 bB	3.57 aA
50 (MD)	2.03 aB	3.91 aA	3.77 aA
25 (SD)	1.12 cB	2.69 bA	2.90 bA
Water level (%pc)	<i>Mimosa tenuiflora</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	4.23 aA	4.59 aA	4.66 aA
50 (MD)	4.16 aA	4.47 aA	4.31 aA
25 (SD)	2.99 bA	2.86 bA	2.53 bA

Capital letters compare K doses, within each water regime; lowercase letters compare water regimes in each dose of K (Tukey P≤0,05).

As for plant height (Table 1) and stem diameter reductions (Table 2) seen in *M. urundeuva* and *M. tenuiflora* as a consequence of K supply, it is believed that it may have been the result of an osmotic effect, which decreased the availability of water to plants, resulting in water deficit, and decreased plant growth. Possibly the K soil content was sufficient to maintain the plants growth and the additional supply of this nutrient resulted in damage to the growth parameters presented. Although it is an essential nutrient for plant growth, high doses of K can reduce growth due to osmotic effect or toxicity (FREIRE *et al.*, 2003; MELO *et al.*, 2020).

In contrast, in *L. ferrea*, the addition of K did not significantly affect the plants height (Table 1), but promoted an increase in the stem diameter (Table 2), possibly acting as an osmoregulator, allowing greater water absorption and facilitating the increase in stem diameter. Thus, it can be inferred that this species is more demanding in K than *M. urundeuva* and *M. tenuiflora*. The larger stem diameter can contribute to an increase in the vigor and quality of the seedlings, increasing the possibility of successful seedling after transplanting to the field. The K⁺ acts as an osmoregulatory ion, decreasing the cells osmotic potential, promoting the absorption of water by the roots, which guarantees the maintenance of cell turgor and the continuity of important physiological processes in the plant such as photosynthesis (ANDRÉS *et al.*, 2014; LU *et al.*, 2019). A positive effect of K addition by increasing the stem diameter was also reported in *Eucalyptus grandis* x *Eucalyptus urophylla* clones (D'AVILA *et al.*, 2011), and *Platymenia foliolosa* Benth (DUARTE *et al.*, 2015).

Organics solutes

There was a significant effect of treatments in AA, but in isolation, in *M. urundeuva* and *L. ferrea*. There is statistical equality between the treatments 100%pc and 25%pc, with the highest concentration of AA in plants at 50%pc, in *M. urundeuva*, while in *L. ferrea*, it was verified at 25%pc (Table 3), representing an average increase of 55% in relation to other water treatments. Regarding potassium fertilization, there was a progressive increase in AA with an increase in the dose of K in *M. urundeuva*, corresponding to an increase of 35% and 39%, respectively in treatments 97.5 and 195 mg dm⁻³ K, compared to treatment who did not receive K supplementation (Table 4).

Tabel 3: Total free amino acids content in *Myracrodruon urundeuva* e *Libidibia ferrea* under water levels.

Water level (%pc)	Aminoacids (µg gMF ⁻¹)	
	<i>Myracrodruon urundeuva</i>	<i>Libidibia ferrea</i>
100 (control)	467.9 b	580.4 b
50 (MD)	599.3 a	552.2 b
25 (SD)	419.4 c	875.3 a

Letters compare water regimes (Tukey P≤0,05).

Tabel 4: Total free amino acids content in *Myracrodruon urundeuva* under potassium fertilization.

K (mg dm ⁻³ K)	Aminoacids (µg gMF ⁻¹)
0	356.1 c
97.5	545.3 b
195	585.2 a

Letters compare potassium doses (Tukey (P≤0,05)).

Regarding the concentration of proteins, the plants of *M. urundeuva* maintained at the water regime 50%pc presented the highest values, with statistical equality between the treatments 100%pc and 25%pc (Table 5). Regarding potassium fertilization, plants at 97.5 mg dm⁻³ K had the lowest protein concentration, with statistical equality between treatments 0 and 195 mg dm⁻³ K.

In *L. ferrea*, there was no statistical difference between water levels, in treatments 0 and 195 mg dm⁻³ K, and at 97.5 mg dm⁻³ K, in control plants and at 25%pc the PROT values were higher than those under 50%pc (Table 6).

Tabel 5: Protein content in *Myracrodruon urundeuva* under water levels and potassium fertilization.

Water level (%pc)	Protein (µg gMF ⁻¹)
100 (control)	19.43 c
50 (MD)	23.65 a
25 (SD)	21.19 b
Doses de K (mg dm ⁻³ K)	Protein (µg gMF ⁻¹)
0	22.95 a
97.5	18.91 b
195	22.42 a

Letters compare water regimes and potassium doses (Tukey P≤0,05).

Tabel 6: Protein content in *Libidibia ferrea* e *Mimosa tenuiflora* under water levels and potassium fertilization.

Water level (%pc)	<i>Libidibia ferrea</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	21.7 aB	24.2 aA	19.2 aB
50 (MD)	22.6 aA	19.6 bB	19.4 aB
25 (SD)	20.3 aA	22.3 aA	20.6 aA
Water level (%pc)	<i>Mimosa tenuiflora</i>		
	0 mg dm ⁻³ K	97.5 mg dm ⁻³ K	195 mg dm ⁻³ K
100 (control)	20.4 aA	24.8 aA	21.1 bA
50 (MD)	22.9 aB	22.4 aB	27.1 aA
25 (SD)	23.9 aA	19.8 aA	21.5 bA

Capital letters compare K doses, within each water regime; lowercase letters compare water regimes in each dose of K (Tukey P≤0,05).

An increase in K doses caused a reduction in PROT, except for those maintained at 25%pc, in which there was statistical equality between K. doses. In *M. tenuiflora*, a significant effect of water levels was observed only in plants that received 195 mg dm⁻³ K, with a higher concentration of PROT at 50%pc. In relation to K, an increase in protein concentration was observed as the dose of this nutrient increased, only in plants maintained under moderate water deficit (Table 6).

In relation to SS, a significant effect was observed only in the potassium doses in *M. tenuiflora*, with reduction as the dose supplied increased (Table 7). Compared with treatment without potassium, there was a decrease of 36% and 43% in the concentration of AST, respectively, in treatments 97.5 and 195 mg dm⁻³ K.

Tabel 7: Soluble sugar content in *Mimosa tenuiflora* under potassium fertilization.

K (mg dm ⁻³ K)	Soluble sugar (µg gMF ⁻¹)
0	43.13 a
97.5	27.41 b
195	24.61 b

Letters compare potassium doses (Tukey P≤0,05).

In this study, it seems that there was no osmotic adjustment capable of maintaining plant growth, as in treatments where solutes increased (Tables 3 to 6) there was a reduction in growth (Tables 1, 2). Possibly,

the accumulation of solutes only ensured that the plants kept the tissues hydrated, preventing their death, allowing the maintenance of vital biochemical processes. The accumulation of osmotically active solutes guarantees the absorption of water by plants, providing cell turgor and the maintenance of cell metabolism, preventing the death of the plant (FLEXAS et al., 2002; COSTA et al., 2015). However, the type and concentration of the solute seem to vary from species to species, and plants can accumulate or degrade solutes depending on stress and their own physiological capacity/plasticity. Silva (2011) reported a significant increase in the protein content of *Ziziphus joazeiro* (Mart.) plants submitted to water stress, whereas Costa et al. (2015) found that water deficiency in *M. urundeuva* did not influence the concentration of these solutes. In contrast, in *Tectona grandis* (L.) Lechinowski et al. (2007) reported a 95% reduction in the total soluble protein content, and attributed it to an increase in proteolytic activity or a decrease in their synthesis. External factors such as reduced water availability may result in increased cell protein biosynthesis (CHERNYAD'EV, 2005), considered as stress proteins, which are highly hydrophilic proteins, acting as stabilizers, preventing enzymatic inactivation (KOSOVÀ et al., 2010; CHIAPPETTA et al., 2015).

Elevations in the concentrations of total amino acids and total soluble sugars under water deficiency conditions were verified in *Z. joazeiro* (SILVA, 2011), and *Moringa oleifera* Lam (RIVAS et al., 2013). It has been shown that proline is the main amino acid that accumulates under water deficient conditions, as reported by Albuquerque et al. (2013) in *Khaya ivorensis* (A. Chev.) and Oliveira et al. (2017) in *Anadenanthera colubrina* (Vell.) Brenan. This accumulation is seen by some researchers as a compensatory strategy, because proline is a beneficial osmotic regulator, because, in addition to promoting osmotic regulation, it is able to stabilize protein synthesis by eliminating reactive oxygen species (ROS) (KISHOR et al., 2014). Proline has other important characteristics such as high solubility, which makes it an important osmotic agent (LERUDULIER et al., 1984), and is compartmentalized in the mitochondria releasing energy in the form of FADH₂ and NADPH (SZABADOS et al., 2010).

CONCLUSIONS

Under water deficit condition, *Myracrocuon urundeuva* and *Mimosa tenuiflora* plants had reduction in growth, regardless of the added potassium, while potassium fertilization with 97.5 mg dm⁻³ K favored *Libidibia ferrea* plants, especially when kept under moderate water deficit. The water deficit promotes total free amino acids and soluble proteins accumulations in *Myracrocuon urundeuva* and *Libidibia ferrea*.

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