Ensaios e Ciência
ISSN 1415-6938 e ISSN 2178-695X

DOI: https://doi.org/10.17921/1415-6938.2025v29n4p906-920

Soil Texture, Planting Depth and Light Intensity Interference with Trapoeraba (*Commelina benghalensis* L.) growth

Interferência da Textura do Solo, Profundidade de Plantio e Luminosidade Sobre o Crescimento da Trapoeraba (Commelina benghalensis L.)

Received: August 7, 2025
Accepted: October 11, 2025

Bruno França da Trindade Lessa: Universidade Federal do Vale do São Francisco. PE, Brazil. E-mail: bruno.ftlessa@univasf.edu.br

Marcos Sales Rodrigues: Universidade Federal do Vale do São Francisco. PE, Brazil.

Gabriela Amaral Braga: Universidade Federal do Vale do São Francisco. PE, Brazil.

Bruna Santana de Melo: Universidade Federal do Vale do São Francisco. PE, Brazil.

Luiz Filipe Castro e Silva: Universidade Federal do Vale do São Francisco. PE, Brazil.

Ester Silva Regis: Universidade Federal do Vale do São Francisco. PE, Brazil.

Abstract

Trapoeraba (*Commelina benghalensis* L.) stands out as one of the main weeds in Brazilian agriculture due to its frequency and hard control. Understanding this species ecophysiology allows taking more accurate and sustainable management decisions. The aim of the present study is to assess *C. benghale*nsis growth and developmentby taking into consideration the influence of the soil type used as substrate, of both cuttings' planting depth and different light conditions. In order to do so, two separate experiments were conducted under a completely randomized design (bioassays I and II). Cuttings in bioassay I were transplanted into trays filled with four substrate types comprising different natural soil textures: S1 (sand), S2 (sandy soil), S3 (medium-textured soil) and S4 (clay soil). The effect of two light conditions (50% shade and full sun) and two planting depths (cuttings buried approximately 1 cm down in the soil and placed on soil surface) was assessed in bioassay II. The analyzed parameters included cutting length, number of leaves and shoots, fresh and dry matter, and leaf area. According to the results, *C. benghalensis* development was optimized by substrates with higher sand content under shading conditions. Growth did not differ between buried cuttings and those placed on soil surface. This information has highlighted the best environment types for trapoeraba infestation and they require adjustments in herbicide doses and mowing avoidance.

Keywords: Weed. Vegetative Propagation. Soil Particle Size. Light.

Resumo

A trapoeraba (*Commelina benghalensis* L.) destaca-se como uma das principais plantas daninhas da agricultura brasileira, devido à sua frequência e dificuldade de controle. Entender a ecofisiologia da espécie permite embasar decisões de manejo mais precisas e sustentáveis. O presente estudo teve como objetivo avaliar o crescimento e o desenvolvimento da espécie *C. benghalensis*, considerando a influência do tipo de solo utilizado como substrato, da profundidade de plantio das estacas e de diferentes condições de luminosidade. Para tal, foram conduzidos dois experimentos distintos, sob delineamento inteiramente casualizado (bioensaios I e II). No bioensaio I, as estacas foram transplantadas em bandejas contendo quatro tipos de substratos compostos por solo natural e distintas texturas: S1 (areia), S2 (solo arenoso), S3 (solo de textura média) e S4 (solo argiloso). No bioensaio II, avaliou-se o efeito de duas condições de luminosidade (50% de sombreamento e pleno sol) e duas profundidades de plantio (estacas enterradas, a cerca de 1 cm, e dispostas sobre a superfície do solo). Os parâmetros analisados incluíram: comprimento das estacas, número de folhas e brotações, massa de matéria fresca e seca, e área foliar. Os resultados indicaram que o desenvolvimento de *C. benghalensis* foi otimizado em substratos com maior teor de areia e sob condições de sombreamento. Quanto à profundidade de plantio, o crescimento não diferiu entre estacas enterradas e aquelas posicionadas sobre a superfície do solo. Tais informações revelam os tipos de ambiente mais propensos à infestação de trapoeraba, demandando ajustes de doses de herbicidas e devendo-se evitar práticas de roçadas.

Palavras-chave: Planta Daninha. Propagação Vegetativa. Partículas do Solo. Luz**.**

1 Introduction

Weed presence in crops leads to competition for water, light and nutrients (allelopathy), as well as to plant-development chemical inhibition (allelopathy), pest and disease harboring and products' commercial quality loss.

Weed features make them highly efficient in dissemining themselves and in capturing resources. Some these features are highly competitive aggressiveness, high seed production and longevity, besides different propagation mechanisms and some species' ease dispersal, which favor their fast establishment in commercial crops (Monquero, 2014).

Trapoeraba (*Commelina benghalensis* L.) is among the main weed species infesting Brazilian agricultural fields. It stands out for its frequency and hard control. This species is one of the most important for irrigated fruit growing, mainly for viticulture in São Francisco Valley region, Northeastern semi-arid region, where it is the most common weed (Lessa *et al.,* 2021).

Trapoeraba is a perennial herbaceous plant that reproduces itself through its seeds, through vegetative ways (branches or stolons) and, in some cases, through special seeds formed by cleistogamous underground flowers. It is a naturalized species also used for ornamental and medicinal purposes that prefers moist, shaded soils. Yet, it is able to host nematodes belonging to genus *Meloidogyne* (Lessa, 2021).

According to Lessa *et al.* (2021), its efficiency in vegetative propagation is one of the causes of trapoeraba spread and establishment in irrigated viticulture, in combination with mechanical control methods such as mowing, which means cutting the shoot and spreading the propagules on the soil. In addition, using the low-efficiency herbicides developed for this species, such as glyphosate, helps managing this species in commercial crops.

Thus, knowing weed species' ecology and biology is essential at the time to apply efficient economical management strategies based on low environmental impact. Accordingly, climatic, physiographic and biotic factors determine weeds' occurrence and permanence in agricultural fields.

Physiographic factors include features related to soil and topography; however, edaphic features are the main weed persistence determinants among them, since it exerts significant influence on weed species' dynamics and distribution (Concenço *et al*., 2014). Kalivas *et al.* (2012) observed a positive correlation between weeds and edaphoclimatic conditions. They reported that *Convolvulus arvensis* recorded the closest correlation with soil properties, mainly with clay content, in a study about plants' density and uniformity per sampling site. There is a gap in the understanding about the association between soil and C. *benghalensis.*

Metcalfe *et al.* (2016) also found positive correlations in this regard. Clay content and soil organic matter significantly influenced the distribution of *Alopecurus myosuroides* populations. Lessa *et al.* (2023) analyzed the distribution of some weed species in the Brazilian semiarid region, including *Cyperus rotundus* and *Euphorbia heterophylla,* and found that sand content was a key factor for their infestation dynamics.

Therefore, understanding the circumstances causing weeds to establish themselves in the environment is essential for devising the best management strategies based on using biological aspects and on their environmental association with the agrosystem advantages. Many factors can influence this process, mainly when it comes to the vegetative process. According to Vernier and Cardoso (2013), cuttings' rooting can be affected by factors like propagative material collection time, depth, parent plant age, phytosanitary and nutritional status, light, temperature, and substrate type and moisture content.

Thus, the aim of this study was to assess trapoeraba (*Commelina benghalensis* L.) growth as soil type, cuttings' planting depth and light intensity fuction.

2 Material and Methods

2.1 Study site

The experiments were conducted from February 2022 to August 2023 at the Agricultural Sciences Campus of Universidade Federal do Vale do São Francisco (UNIVASF) in Petrolina, Pernambuco State, Brazil, at geographical coordinates 09°19'14"S, 40°32'40"W, and altitude of 387 m. Petrolina City is in São Francisco mesoregion, Pernambuco State, in a semi-arid field. According to the Köppen classification, its climate is of the BSh' type with hot and dry weather (Alvares *et al*., 2013). Its mean annual temperature is 26.5 °C (Silva *et al*., 2022).

The bioassays were conducted with trapoeraba (*Commelina benghalensis* L.) cuttings collected from vigorous plants living in natural infestations in the educational orchard of the Fruit Growing Sector of UNIVASF Agricultural Sciences Campus. The branches were cut at the bottom with a bevel cut; three or four nodes were left, as well as a pair of expanded leaves. They were cut in half (Santos Júnior *et al*., 2013).

2.2 Experimental design

The sample unit in both experiments consisted of a plastic tray (43.5 x 29.6 x 7.5 cm) perforated at the bottom, planted with ten cuttings (Figure 1). The trays were arranged based on a completely randomized design, with five repetitions.

The trays were manually irrigated to keep at least 80% water retention capacity (WRC). In order to do so, the used substrate was subjected to WRC calculation (Takane; Yanagisawa; Góis, 2013). The trays' weight was measured every two days during the trails to check on the need for watering and its frequency.

Figure 1 - Natural trapoeraba infestation for the collection of propagative material (A), processed cuttings (B), cuttings planted in plastic trays (C) and under-development trapoeraba (D)

Source: the authors.

Bioassay I: Substrate comprising natural different-texture soils

The used soils were collected from three profiles presenting contrasting textures at UNIVASF Agricultural Sciences Campus in Petrolina City, Pernambuco State. Samples were collected from horizon C in Quartzarenic Neosol (sandy texture), and from horizon B in Yellow Argisol (medium texture) and Haplic Planosol (clayey texture), at the following depths: 30-90, 20-40 and 10-120 cm. (Santos *et al.,* 2018; Souza *et al.*, 2021; Silva *et al.,* 2017).

Table 1 provides the granulometric information of each profile. An additional treatment was used in addition to natural soils and it consisted of river medium-grain sand purchased from a hardware store.

Table 1 - Textural feature of soils used for substrate composition

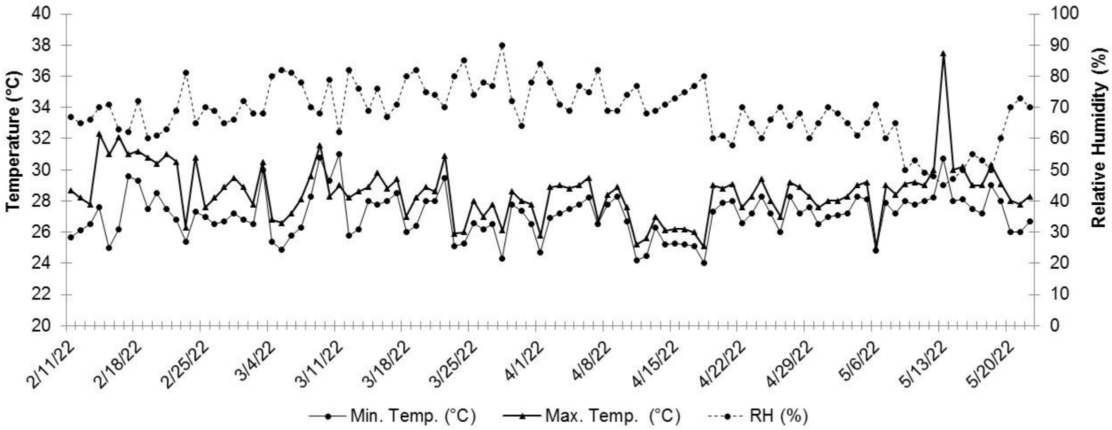
Horizon	Granulometric Information			Silt/Clay Ratio
	Areia total	Silte	Argila	
NEOSOL				
A	885	55	60	0,91
AC	902	44	54	0,82
C	892	31	77	0,41
ARGISOL				
A	873	55	72	0,76
AB	867	48	85	0,57
BA	866	55	79	0,69
Bt1	773	84	143	0,59
Bt2	743	84	173	0,49
PLANOSOL				
A	732	206	62	3,33
E	756	173	71	2,43
Bplanic1	530	116	354	0,33
Bplanic2	789	153	58	2,63

Source: Soil Physical Analysis Laboratory of Federal University of Vale do São Francisco. Analyses followed the pipette method described by Teixeira *et al*. (2017).

Each natural soil and sand were sieved and mixed with worm humus at 3soil:1humus ratio to ensure the minimum physical and chemical conditions for cuttings' development. The mixes were placed on trays arranged in a greenhouse under 50% shade. Seedlings or propagules that did not come from the planted cuttings were removed from the trays.

Figure 2 depicts the trials' temperature and relative humidity conditions. The following treatments were prepared: S1 (washed sand), S2 (Quartzarenic Neosol – sandy texture), S3 (Haplic Planosol – medium texture) and S4 (Yellow Argisol – clayey texture).

Figure 2 - Temperature and relative humidity conditions inside the greenhouse during the experimental period



Source: the authors.

The number of living cuttings (LC), leaves (NL) and shoots (NS) were counted at 15, 30, 45 and 60 days after planting (DAP), as well as the cunttings' length. The entire plant shoot was removed at 60 DAP to find fresh and dry matter, and the leaf area.

Leaf area (LA) was measured through the disc method by using a 16 mm diameter cutter. As many discs as possible were removed from each tray - 10 discs (2.01 cm^2) including the veins per tray was the standard. The samples were organized in kraft paper bags and taken to the oven at 70 °C for 72 h. An analytical scale was used to weight the leaf discs' mass. The leaf area per tray (plot) was calculated through Eq. 1 and mean leaf area (AF – Eq. 2) was also observed (Silva *et al.,* 2013).

$$LAT = ((DMl \times TAd)) / DMd \qquad \text{(Eq. 1)}$$
$$LA = LAT / NL \qquad \text{(Eq. 2)}$$

Whereing LAT is leaf area per tray, DMl is leaves' total dry mass, TAd is the discs' total area, DMd is the discs' dry mass, LA is leaf area and NL is the number of leaves in each tray.

Data were subjected to Kolmogorov-Smirnov normality test at5% probability. The Box-Cox transformation was used (Experiment I: Number of shoots; Experiment II: Number of leaves) in data that did not meet the normality assumption. Analysis of variance (ANOVA) was conducted under split-plot design (4 x 4), four substrates and four time periods to assess periodically the evaluated variables and for final assessments. ANOVA was carried out in a simple design. The means were compared through Tukey's test at 5% probability of error when the factors were significant. Time was assessed through polynomial regression. Nonparametric statistics were applied to data that did not fit the transformation (survival percentage). It was done through Kruskal-Wallis test at 5% probability of error.

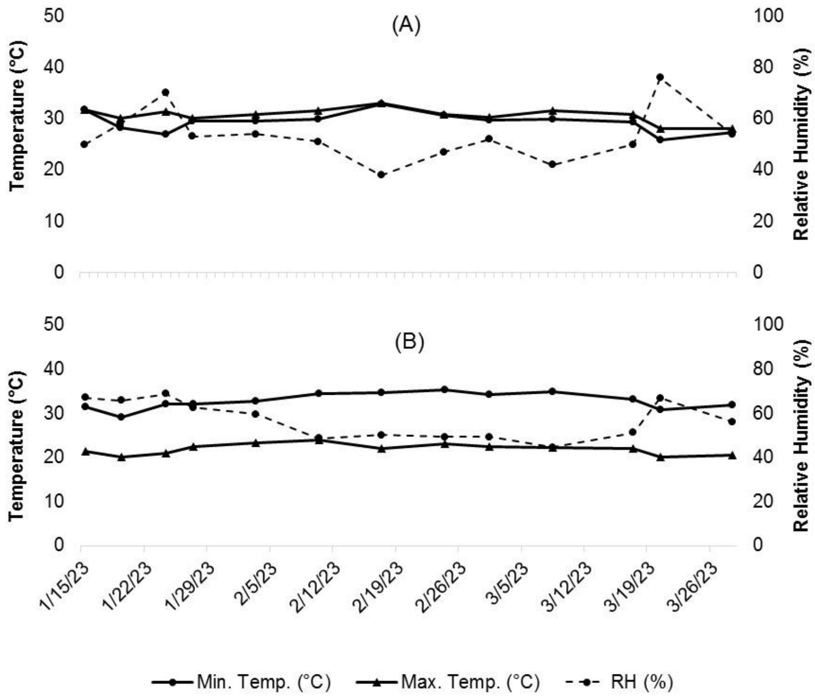
Statistical analyses were performed in Action Stat software, version 3.1 (Estatcamp Team, 2014) and in Sisvar 5.6 beta (Ferreira, 2011).

Bioassay II: Light intensity associated with planting depth

The cuttings were placed on trays filled with artificial substrate based on vermiculite and humusat 3:1 ratio in bioassay 2. The trays were placed in two different environments: 1) shade cloth (50% light block) and 2) full sun. In addition, two cutting–arrangement positions in the substrate were tested, namely: 1) under the substrate (buried about 1 cm down in the groung) and 2) on substrate surface.

Temperature and humidity inside the screen were recorded on a daily basis with the aid of a portable thermohygrometer. Meteorological data of full sun conditions were collected at the UNIVASF Meteorology Laboratory (Figure 3).

Figure 3 - Temperature and relative humidity conditions inside (A) and outside (B) the greenhouse during the experimental period



Source: the authors.

The following variables were measured between planting and 50 days after planting (DAP): numer of leaves, number of shoots, and braches' length and diameter. Subsequently, the plants were cut close to the substrate in order to determine the fresh and dry mass, as well as to measure the leaf area through the disc method (Silva *et al.,* 2013).

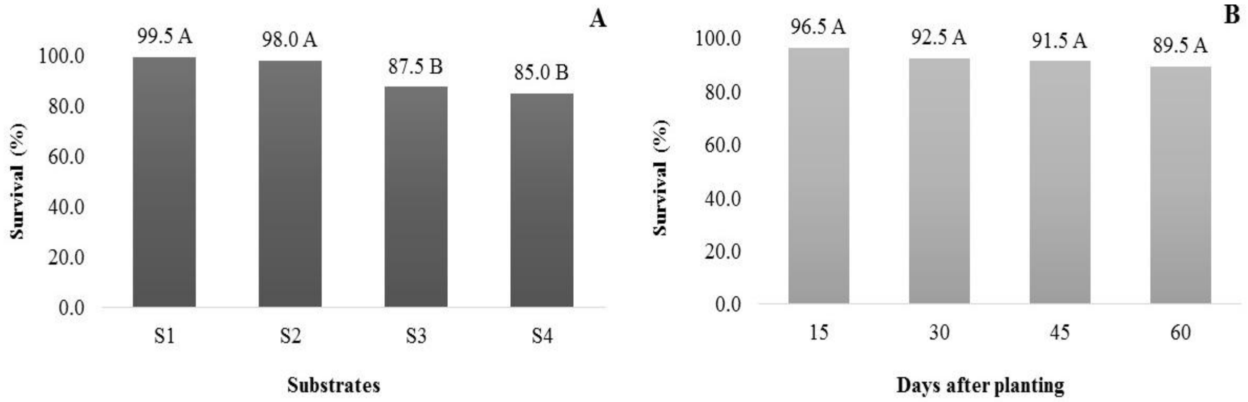
The collected data were subjected to normality and homogeneity variance tests. Analysis of variance (ANOVA) was conducted based on a split-plot design (2 x 2 x 6) to confirm the assumptions: two depths, two light conditions and six experimental times. Treatment means were compared through Tukey's test at 5% probability of error when factors were significant in the F-test. Polynomial regression analysis was adopted to assess growth behavior over time.

3 Results and Discussion

3.1 Bioassay I: Different soil textures

Survival rate higher than 98% was recorded for treatments S1 and S2. The other substrates (S3 and S4) accounted for slightly lower rates: 87% and 85%, respectively (Figure 4). Overall, high adhesion rates higher than 80% were observed. These findings confirm the relevance of vegetative propagation for C. *benghalensis* ecology and biology. Its combination with sexual propagation leads to high difficulty in controlling it in commercial crops and orchards (Costa *et al.*, 2021; Lessa *et al.*, 2021; Riar, 2024; Vicensi *et al.*, 2024).

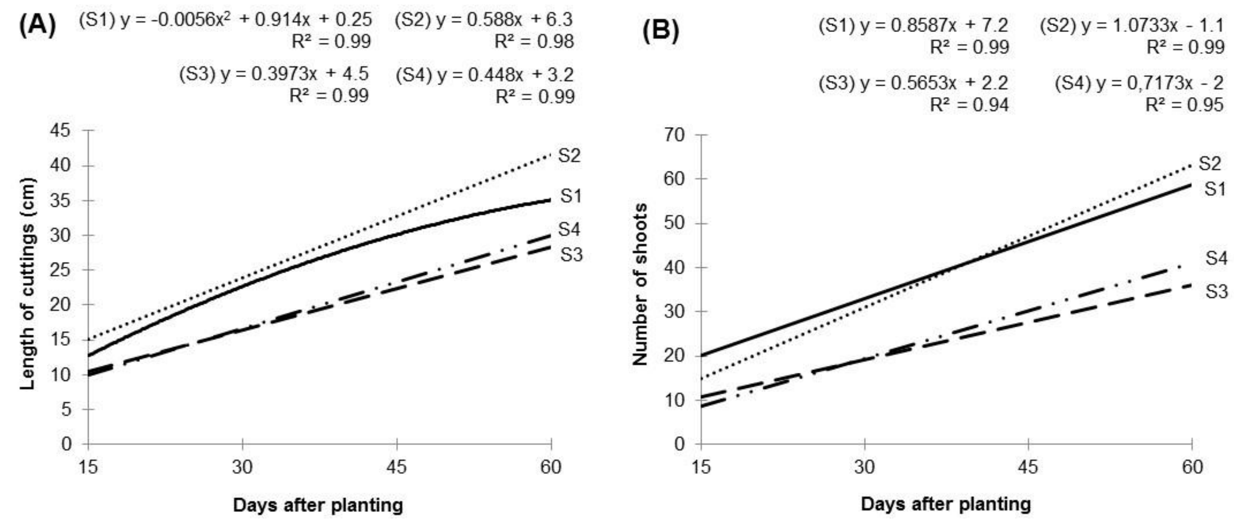
Figure 4 - Survival rate of trapoeraba (*Commelina benghalensis* L.) cuttings as function of different substrates (A) and experimental periods based on days after planting (B)



Abbreviations: S1: Sand; S2: Quartzarenic Neosol; S3: Yellow Argisol; and S4: Haplic Planosol. Means followed by the same letter did not statistically differ in the Kruskal-Wallis test at 5% probability of error.
Source: the authors.

According to the analysis of variance, there was significant experimental period effect ($p<0.05$) and interactions between substrate and time in all variables, except for number of leaves, which was only affected by the treatments. The breakdown point is shown in Figure 5 and in Table 2.

Figure 5 - Trapoeraba cutting length (A) and number of shoots (B) in different substrates as function of days after planting



Abbreviations: S1: Sand; S2: Quartzarenic Neosol; S3: Yellow Argisol; S4: Haplic Planosol.
Source: the authors.

Table 2 - Trapoeraba cuttings' mean length and number of shoots in t as function of different substrates in each experimental period

Cutting Length (cm)				
Substrates	**Days After Planting**			
	15	30	45	60
S1	13.40a	23.00ab	30.88ab	35.49ab
S2	14.33a	26.13a	33.25a	41.64a
S3	10.17a	17.73b	23.13b	28.16b
S4	9.54a	17.94b	24.33b	30.06b
Number of Shoots				
S1	20.8a	32.6a	42.4a	59.8a
S2	14.0ab	31.6ab	36.8ab	61.8a
S3	9.0b	20.0ab	22.2b	33.6b
S4	10.6b	18.6b	28.4ab	43.8ab

Abbreviations: S1: Sand; S2: Quartzarenic Neosol; S3: Yellow Argisol; S4: Haplic Planosol. Means followed by the same letters compare the different substrates and they did not statistically differ from each other in the Tukey's test at 5% probability level.
Source: the authors.

The collected data showed the best performance of substrates S1 and S2, both with sandy texture. According to Gomes *et al*. (2015), clay substrates have density and porosity features unfavorable for the cuttings' development. Therefore, assumingly, the higher aeration of sandier substrates led to higher oxygenation of forming roots, besides preventing rotting.

Substrates S1 and S2 also recorded the best cutting length (Figure 4A). Growth followed a quadratic regression model in S1, and it highlighted accelerated growth rate followed by both a plateau and a possible decline. Growth was adjusted to a linear model in the other substrates and it suggested constant increase over time. The quadratic behavior analysis applied to trapoeraba in sand showed maximum branch growth at 82 days after planting- it reached 37.5 cm in length (Figure 5A).

With respect to number of shoots, homogeneous behavior was observed among the different substrates; they fitted a linear growth model (Figure 5B). However, substrates S1 and S2 stood out for providing a larger number of shoots than the others.

The analysis of variance showed substrates' significant effect on fresh and dry stem and leaf mass and their combinations in all mentioned features. This outcome differed from leaf area, which did not show significant differences between treatments. According to Table 3, all the assessed parameters followed the same pattern, namely: sandier substrates always presented higher means than the clayier ones.

Table 3 - Trapoeraba stems and leaves' fresh and dry mass in different substrates 60 days after planting

Substratos	FSM	FFM	DSM	DFM
S1	63.78a	20.76a	15.66a	5.32a
S2	64.44a	19.36ab	9.84ab	5.21a
S3	30.12b	11.22c	6.42b	2.75b
S4	36.38ab	12.06bc	6.20b	3.66ab

S1: Sand; S2: Quartzarenic Neosol; S3: Yellow Argisol; S4: Haplic Planosol; FSM: Fresh stem mass, FFM: Fresh leaf mass, DSM: Dry stem mass, and DFM: Dry leaf mass. Means followed by the same letters in the column did not differ from each other in the Tukey's test at 5% significance.
Source: the authors.

Overall, *C. benghalensis* vegetative propagation and its post-sprouting growth were favored by sandy soil textures. Certain weeds' infestations were influenced by sand/clay content variations in agricultural soils, even when they propagated by the seeds. Rocha-Júnior (2009) recorded this same outcome for *Memora peregrina,* also known as ciganinha, when they assessed features such as leaf area and dry mass, and stem length and dry mass. According to them, this behavior is justified by the best oxygenation provided by the sandy texture; it also explains the better trapoeraba development in the present study.

The better performance observed in sandier substrates regards the higher aeration and drainage provided by this soil type. Sandy soils tend to favor the rhizosphere oxygenation, which is a crucial factor for plants' proper initial development. This higher oxygen availability in the roots stimulates root respiration, and favors shoot and root growth.

Millani *et al.* (2010) assessed *Ageratum conyzoides* L. under different substrates to corroborate the aforementioned information. They observed that the higher clay content led to lower plant growth. Similarly, Takahashi *et al.* (2022) concluded that *Spermacoce verticillata* has low emergence and lower initial growth when it is grown in clay soil.

It is worth noting that the presented results do not necessarily imply that the species loses its ability to spread in clay soils. Riar (2024) highlighted trapoeraba high soil-ecological plasticity, which points out its adaptability to different soil types be them light, medium or heavy. However, the present study categorically shows that trapoeraba prefers sandy substrates when it comes to vegetative propagation. Thus, trapoeraba infestation can be more intense in areas with light soil, mainly in perennial cropping systems where practices such as mowing are widely used (Lessa *et al.,* 2021).

3.2 Bioassay II: Light intensity associated with planting depth

Cutting length and number of leaves showed significant interactions under different light intensities and experimental periods. On the other hand, the number of shoots did not show significant interaction.

Cuttings position in the substrate did not was not significant for either number of shoots or leaves; it only affected cuttings length. This variable showed that different positions led to differences between each other; the buried cuttings recorded growth 23% higher than those on the surface (Table 4).

Table 4 - Cutting length (CL) and number of shoots (NS) as light intensity and planting depth function

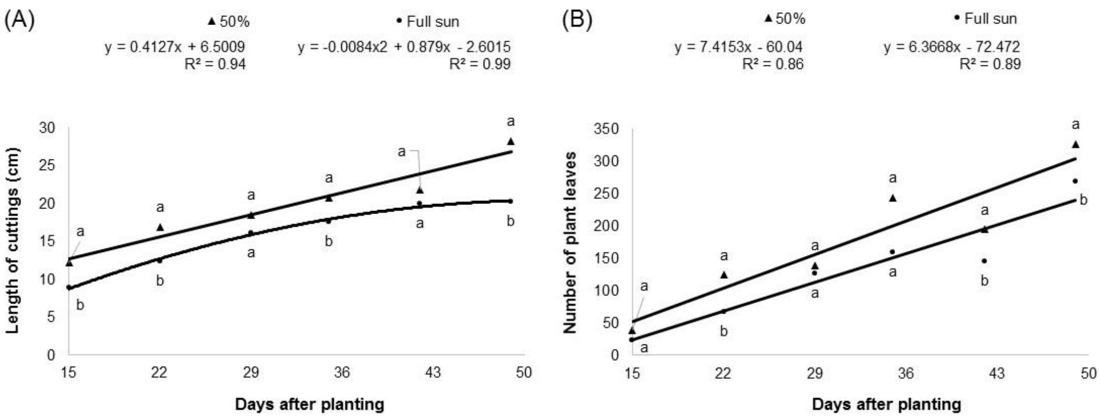
Light Intensity	**CL**	**NS**
50%	19.7a	15.31a
Full sun	15.8b	10.81b
Planting depth		
Buried	19.59a	14.15a
In surface	15.92b	11.98a

Means followed by the same letters in the column did not differ from each other in the Tukey's test at 5% significance.
Source: the authors.

Cuttings mean length and number of leaves showed significant interaction between the assessment periods and light levels. Detailed results are shown in Figure 6.

Both branch growth and number of leaves showed linear growth throughout the experimental periods, except for cuttings grown under full sun, which showed quadratic behavior. This finding mathematically shows that the cuttings would tend head towards maximum growth at 52 days (Figure 6A).

Figure 6 – Trapoeraba cuttings length (A) and number of leaves (B) at different experimental periods as light intensity function



Lowercase letters compare the two light intensities in the Tukey's test (5%) at each experimental period.
Source: the authors.

Factor 'light' recorded the most statistically significant parameters for mass features, except for

MFF and MFT. With respect to the position factor, only MFC and MFT were significant at 5%. None of the parameters were significant when it comes to interaction between light and position.

Based on Table 5, the amount of light inciding on trapoeraba has straight influence on its growth; trapoeraba exposion to high solar irradiance (full sun) is harmful. This effect can be explained by the intense radiation and high temperatures characteristic of the semi-arid Northeastern region, which can pose a challenge to C3 plants. Transpiration control under these conditions becomes less efficient and results in excessive water loss. In addition, high radiation can cause photo-oxidative damage to the photosynthetic apparatus, mainly photosystem II (PSII), which leads to temporary or permanent reduction in photosynthesis quantum efficiency (Taiz *et al.,* 2017). This behavior partly explains the high occurrence of trapoeraba in wine-growing areas in the semiarid region (Lessa *et al.,* 2021) due to the shade provided by vines artificial canopy due to the trellis system often used in this region.

Table 5 – Leaves and stem fresh and dry mass values, and leaf area per tray as light intensity function

Light intensity	**FLW**	**DLW**	**FSW**	**DSW**	**TFW**	**TDW**	**LAT**
	------------------------ g ------------------------						**cm^2**
50%	19.1a	3.2a	49.1a	7.6a	68.3a	10.8a	1009.6a
Full sun	15.4a	2.4b	35.0b	4.5b	50.4a	6.9b	619.1b

FLW: Fresh leaf weight, DLW: Dry leaf weight, FSW: Fresh stem weight, DSW: Dry stem weight, TFW: Total fresh weight, TDW: Total dry weight, LAT: Leaf area per tray. Means followed by the same letter in the column did not differ from each other in the Tukey's test at 5% probability of error.
Source: the authors.

The expected changes under shade conditions are: leaf blade area increase, larger number of stomata, leaf thickness decrease, epidermis thinner cuticle and less wax deposition, as cited by Santos Júnior *et al.* (2013). According to them, these changes are closely related to post-emergent herbicides' absorption and penetration, which enhances their effects and, consequently, improves the species control.

The environmental stress caused by the herein assessed natural conditions proved to be a determining factor for plant development. Costa *et al.* (2012) analyzed *Mentha piperita* vegetative growth and observed cuttings satisfactory development both in full sun and under 50% shade. However, their study was conducted in a region subjected to Cwa climate (humid subtropical altitude) with maximum temperature of 31 °C. On the other hand, the maximum temperature reached 35.4 °C in a region with Bsh climate (hot semi-arid) in the present study. It could have had straight impact on physiological processes such as photosynthesis, transpiration and water use efficiency. This outcome interferes with the species' growth and adaptation.

Table 6 shows the results for the already mentioned parameters regarding variable 'position'.

Accordingly, the buried cuttings only outperformed those placed on the surface in the MFC and MFT parameters. It can be inferred that the buried stems recorded better water retention because they were protected and had less contact with air and radiation. Thus, their fresh mass was preserved. However, samples' dry mass accumulation was always statistically similar, just as the leaf area. According to Riar (2024), cuttings only lose their propagation potential when they are buried more than 2 cm down in the soil/substrate. It is worth emphasizing that the lack of interaction between the factors 'depth' and 'light' allowed inferring that the initial benefit of water retention is not enough to overcome the negative effect of high radiation during vegetative growth, even when the cuttings are buried.

Table 6 – Leaves and stem fresh and dry mass values, and leaf area per tray, at 49 days after planting, based on variable 'planting depth'

Planting Depth	FLM	DLM	FSM	DSM	TFM	TDM	LAT
	--------------------------- g -------------------------						cm^2
Buried	19.4a	3.1a	49.6a	6.7a	68.9a	9.8a	925.2a
In Surface	15.2a	2.5a	34.5b	5.4a	49.8b	7.9a	703.5a

FLM: Fresh leaf mass, DLM: Dry leaf mass, FSM: Fresh stem mass, DSM: Dry stem mass, TFM: Total fresh mass, TDM: Total dry mass, LAT: Leaf area per tray. Means followed by the same letter in the column did not differ from each other in the Tukey's test at 5% probability.
Source: the authors.

4 Conclusion

Commelina benghalensis L. vegetative development is optimized by soils or substrates presenting higher sand content under shading conditions. Sprouting and growth are similar when it comes to planting depth, both in buried and surface cuttings.

This information reveals the environment types most prone to ragweed infestation giving its high potential for establishing itself in and interfering with light soils, and even under crops' canopy. This behavior requires adjustments to herbicide doses depending on soil type and on crop shading conditions. Yet, mowing practices should always be avoided.

References

ALVARES, C.A. *et al.* Köppen's climate classification map for Brazil. Meteorol. Z., v.22, n.6, p.711-728, 2013. doi: https://doi.org/10.1127/0941-2948/2013/0507

CONCENÇO, G. *et al.* Ciência das plantas daninhas: histórico, biologia, ecologia e fisiologia. Cap. 1. In: MONQUERO, P.A. *Aspectos da biologia e manejo das plantas daninhas*. São Carlos: RiMA Editora, 2014.

COSTA, A.G. *et al.* Crescimento vegetativo e produção de óleo essencial de hortelã-pimenta cultivada sob malhas. *Pesq. Agropec. Bras.*, v.47, n.4, p.534-540, 2012. doi: https://doi.org/10.1590/S0100-

204X2012000400009.

COSTA, A. G. F. *et al*. Interferência de *Commelina benghalensis* no crescimento inicial de Eucalyptus grandis no inverno e no verão. *Ciênc. Florest*., v.31, n.2, p.590-606, 2021. doi: https://doi.org/10.5902/1980509825556.

EQUIPE ESTATCAMP. *Software Action*. Estatcamp - Consultoria em estatística e qualidade, São Carlos - SP, Brasil. 2014. http://www.portalaction.combr/.

FERREIRA, D.F. Sisvar: A computer statistical analysis system. *Ciênc. Agrotec*., v.35, p.1039-1042, 2011. doi: https://doi.org/10.1590/S1413-70542011000600001.

GOMES, J.A.O. *et al.* Diferentes substratos na propagação por estaquia de assa-peixe (*Vernonia polyanthes* Less). *Rev. Bras. Plantas Med*., v.17, n.4, p.1159-1168, 2015. doi: https://doi.org/10.1590/1983-084X/15_008.

KALIVAS, D.P. *et al.* Regional mapping of perennial weeds in cotton with the use of geostatistics. *Weed Sci.*, v.60, n.2, p.233-243, 2012. doi: https://doi.org/10.1614/WS-D-11-00121.1

LESSA, B.F.T. *Plantas daninhas no Vale do São Francisco*: aspectos de manejo e guia ilustrado com espécies importantes *(viticultura)*. Petrolina: UNIVASF, 2021.

LESSA, B. F. T. *et al.* Weed phytosociology and distribution in vineyards in the São Francisco River Valley. *Rev. Caatinga*, v.34, n.1, p.132-143, 2021. doi: https://doi.org/10.1590/1983-21252021v34n114rc.

LESSA, B. F. T. *et al*. Weed spatial distribution as a function of soil properties in two distinct environments of the Brazilian semi-arid region. *An. Acad. Bras. Ciênc*., v. 95, n.4, e20190182, 2023. doi: http://10.1590/0001-3765202320190182.

METCALFE, H. *et al*. Designing a sampling scheme to reveal correlations between weeds and soil properties at multiple spatial scales. *Weed Res*, v.56, p.1-13, 2016. doi: https://doi.org/10.1111/wre.12184.

MILLANI, A.A. *et al.* Análise de crescimento e anatomia foliar da planta medicinal *Ageratum conyzoides* L. (*Asteraceae*) cultivada em diferentes substratos. *Rev. Bras. Plantas Med.*, v.12, p.127-134, 2010. doi: https://doi.org/10.1590/S1516-05722010000200001.

MONQUERO P.A. *Aspectos da biologia e manejo das plantas daninhas*. São Carlos: RiMa Editora, 2014.

RIAR, M. *Commelina benghalensis (wandering jew)*. CABI Compendium, 2024. doi: https://doi.org/10.1079/cabicompendium.14977.

ROCHA-JÚNIOR, E.O. *A textura do solo e o crescimento da ciganinha (Memora peregrina (Miers) Sandwith – Bignoniaceae)*. Campo Grande: Universidade Federal de Mato Grosso do Sul, 2009.

SANTOS, H.G. *et al. Sistema brasileiro de classificação de solos*. Brasília: Embrapa, 2018.

SANTOS JÚNIOR, A. *et al*. Manejo de tiririca e trapoeraba com glyphosate em ambientes sombreados. *Planta Daninha*, v.31, n. 1, 2013. doi: https://doi.org/10.1590/S0100-83582013000100023.

SOUZA, P. *et al*. Geoestatística multivariada para o delineamento de zonas de manejo para a alocação de experimentos agrícolas. *RCA*, v.44, n.2/3, p.101-113, 2021. doi: https://doi.org/10.19084/rca.18994.

SILVA, K.A. *et al*. Levantamento de solos utilizando geoestatística em uma área de experimentação agrícola em Petrolina-PE. *Com. Sci*., v.8, n.1, p.175-180, 2017. doi: https://doi.org/10.14295/CS.v8i1.2646.

SILVA, R.T.L. *et al*. Estimativa da área foliar de limoeiro-cravo usando dimensões lineares do limbo foliar. *Nucleus*, v.10, n.1, 2013. doi: https://doi.org/10.3738//1982.2278.812.

SILVA, S.D. *et al*. Aspectos morfofisiológicos de girassol ornamental cultivado em diferentes épocas de cultivo sob condições semiáridas. *Rev. Bras. Eng. Agríc. Ambient*., v.26, p.299-305, 2022. doi: https://doi.org/10.1590/1807-1929/agriambi.v26n4p299-305.

TAKANE, R.J.; YANAGISAWA, S.S.; GÓIS, E.A. *Técnicas em substrato para floricultura*. Fortaleza: LK Editora, 2013.

TAKAHASHI, C.N. *et al*. Emergência e crescimento inicial de vassourinha-de-botão em diferentes profundidades de semeadura e texturas de solo. *Ensaios Ciênc.*, v.26, n.3, p.314-320, 2022. doi: https://doi.org/10.17921/1415-6938.2022v26n3p314-327.

TAIZ, L. *et al. Fisiologia e desenvolvimento vegetal*. Porto Alegre: Artmed, 2017.

TEIXEIRA, P.C. *et al. Manual de métodos de análise de solo*. Brasília: Embrapa, 2017.

VICENSI, T. *et al.* Mixtures of Herbicides and Time of Application to Control *Commelina benghalensis* in Maize and Off-Season. *Outlooks Pest Manag*., v.35, n.2, p.81-88, 2024. doi: https://doi.org/10.1564/v35_apr_08.

VERNIER, R.M.; CARDOSO, S.B. Influência do ácido indol-butírico no enraizamento de estacas em espécies frutíferas e ornamentais. *REEC*, v.3, n.2, p.11-16, 2013.