

INFLUENCE OF DIFFERENT PARTS OF CUTTINGS AND SUBSTRATES ON VEGETATIVE PROPAGATION OF *PERESKIA ACULEATA* MILLER

INFLUÊNCIA DE DIFERENTES PARTES DE ESTACAS E SUBSTRATOS NA PROPAGAÇÃO VEGETATIVA DE *PERESKIA ACULEATA* MILLER

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ABSTRACT: *Pereskia aculeata* Miller, commonly known as ora-pro-nóbis in some regions of Brazil, is a plant that stands out due to its high protein content, presenting great potential for use. There is an increasing interest in the use of ora-pro-nóbis as raw material by the food industry like as concentrate form (dehydrated and ground) or for direct consumption as leafy vegetables by the population. So, it is important to know the best way to propagate this species. This study was carried out to evaluate the influence of cutting position from stem and the substrate type under growth and development of ora-pro-nóbis during seedlings production. For increasing the seedlings production to supply the demand and the lack of scientific studies on this theme, this study is important to development research to vegetative propagation and substrate to produce ora-pro-nóbis seedlings. For vegetative propagation three types of cutting were used: apical, median and from the basal part of the stem. The cuttings were planted in four types of substrate: S₁ = soil; S₂ = soil + clean sand (1:1); S₃ = soil + clean sand + cattle manure (2:1:1) and S₄ = Bioplant[®] commercial substrate. Sixty days after the experiment was set up, the cuttings were examined considering: the Soil Plant Analysis Development (SPAD) index, the number of leaves, the number of shoots, root length, and dry and fresh mass from the root and from the aerial part. The physiological maturation of the stem and the tested substrate type showed differences on the quality of the cutting. The cutting originated from the basal and medium part harvested from the branch of the year and the substrate soil + sand + manure allowed the best growth and development of the ora-pro-nóbis seedlings.

KEYWORDS: Ora-pro-nóbis. Vegetative propagation. Cutting. SPAD. Non-conventional edible plant.

INTRODUCTION

Ora-pro-nóbis stands out as a plant with high protein content, presenting great usage potential and easy production, contributing to a greater food safety. It is a perennial plant, could reach 10 m of length, climbing plant, but could grow without support. Leaves are lanceolate, and dark-green shiny, succulents with presence of mucilage. The flowers are white and small, and the fruits are little yellow berries (BRASIL, 2010).

The plant has minerals (calcium, magnesium, manganese and zinc), vitamins (A, C and folic acid), amino acids, especially tryptophan (TAKEITI et al., 2009). The unawareness about the plant, its utility and means of consumption, connected to "modern" tendencies, lead to a reduced use of it and of many plants which were part of the daily food intake of the rural and urban population.

The non-conventional edible plants (henceforth referred to as PANCs) are important to complement the food intake and support the familial economy of traditional and deprived population (SOUZA et al., 2009).

In native species of little agronomic knowledge, it is necessary to identify the factors that affect the vegetative germination and/or propagation (BLANK et al., 2003). Even though the plant can sexually propagate itself, vegetative propagation has uncountable benefits, as it is a technique that is simple, fast, cheap, able of producing many new plants in a short time and with greater uniformity, and it also maintains the genetic characteristics of the donor plant (HARTMANN; KESTER, 1981).

Among the methods of vegetative propagation, the cutting technique is still the one with the greatest economic feasibility for the establishment of clonal planting, being vastly used

for fruit, medicinal and ornamental plants. The technique consists in removing stem segments from the mother-plant that, under proper conditions, form roots, creating a new plant identical to the originating one (HARTMANN et al., 2002). Special attention must be paid to the substrate choice, as it is one of factors to exert the most influence, especially in germination, emergency and rooting phases. It has some physical, chemical and biological characteristics which should offer the best conditions for sprouting and helps in the cuttings' development (ANDRIOLO, 2000; MINAMI; PUCHALA, 2000).

Considering the increasing interest on the ora-pro-nóbis as raw material by food industry in the concentrated form (dehydrated and ground) or the consume by population as leafy vegetable, is important to know the best way for propagation this specie (MADEIRA et al., 2016). To supply the demand of ora-pro-nobis seedlings and considering the lack of scientific studies about this theme, it is important developing research to vegetative propagation and substrate to produce ora-pro-nóbis seedlings. Because part of plants can response as different ways to substrate and vegetative propagation.

Thus, this study was carried out to analyze the influence of the substrate type and of the position of the cutting removed from the stem over the growth and development of ora-pro-nóbis during the seedling production.

MATERIAL AND METHODS

The studies were performed in the experimental area of the State University of Minas Gerais (UEMG), Ituiutaba campus, from October to December of 2015. Ituiutaba is located in the region of Triângulo Mineiro in the state of Minas Gerais, at an altitude of 560m. The climate is classified by Köppen as "AW", hot and humid.

The experiment was conducted in completely randomized design (CRD), hose being three types of cuttings and four different substrates, with four repetitions. Each portion had five black polyethylene bags with 10 cm width, 15 cm length and 0,10 cm thickness.

For vegetative propagation, cuttings from three stock plants cultivated in UEMG were used (latitude 18°58'18"S, longitude 49°23'51"W) and the material was collected in October. Voucher specimen of the species are deposited on Herbarium Uberlandense (HUFU) of the Federal University of Uberlândia (UFU), under the entry number HUFU 22511. The cuttings were removed from the stems

that sprouted on that same year, consisting of three types of cuttings: apical, from the apex of stem, median, from the medium third, and from the basal part of the stem. The cuttings were removed in the morning. The leaves and side stalks were removed, and the aculeus remained. Later, a bevel cut was made on the superior part and a cross-cut on the inferior part; the cuttings were cut with a length of 25 cm; both were performed with the cuttings immersed in distilled water to avoid tissue embolism. The medium diameter was 0.4, 0.6 and 0.7 cm, and bud numbers were 11.8, 9.4 and 8.3 for apical, median and basal portion from stem, respectively.

The cuttings were planted vertically, one per container. When planted, they measured 20 cm and were inserted to 5 cm deep. The planting of the cuttings was accomplished in four types of substrates: S₁ = soil; S₂ = soil + clean sand (1:1); S₃ = soil + clean sand + cattle manure (2:1:1) and S₄ = Bioplant[®] commercial substrate. The substrates were prepared by manual homogenization.

Substrates such as soil, sand and manure used in this work for the multiplication of ora-pro-nóbis have low acquisition costs, easy availability of acquisition and transportation. For Lima et al. (2001), the substrates used in the propagation of plants must have absence of pathogens, rich in essential nutrients, good texture and structure, allowing the development of plants. The commercial substrate selected was one easily found in the local market, and which has good physical structure and chemical composition.

The soil was collected in the underground (ravine) in the region of Ituiutaba. The cattle manure was collected in the rural area and composted for 90 days. After homogenization, all the substrates went to the Laboratório de Análises de Solos, a soil test laboratory from UFU, for physical-chemical description. The results of the physical analysis of the prepared substrates are on Table 1, and the commercial substrate porosity is on Table 2. Tables 3 and 4 show the results of the chemical analysis of the substrates used in this study.

After the planting, the cuttings were kept on a nursery covered by a 150 µm polyethylene film with 75% transparency, and, around it, an 80% shading screen was used. They were irrigated once a day by a micro sprinkler irrigation system, this was done for 20 minutes in the morning, and with a volume of 15mm³. The temperature and relative humidity of the environment were checked throughout the experiment, as was the substrate temperature and humidity, using Inconterm[®] thermo hygrometer.

Table 1. Physical analysis of substrates that were used in the experiment.

Substrate	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)
S ₁	14.9	33.6	14.6	36.8
S+A ₂	50.0	19.5	1.4	29.1
S+A+E ₃	48.4	25.5	7.7	18.4

S₁ = Soil; S + A₂ = Soil + Sand; S + A + E₃ = Soil + Sand + Cattle Manure.

Table 2. Porosity of Bioplant[®], the commercial substrate.

Porosity	Total
Total Porosity (%)	71.58
Macroporosity (%)	28.48
Microporosity (%)	44.45
CMRA ¹ mL 55 cm ⁻³	24.47

CMRA¹ = Maximum Water Holding Capacity.

Sixty days after setting up the experiment, the polyethylene containers with the cuttings were taken to the Sugarcane Production Quality Laboratory of UEMG (Laboratório de Qualidade na Produção Sucroalcooleira da UEMG), in Ituiutaba campus. In the lab, the cuttings were extracted from the polyethylene containers and evaluated according to: the Soil Plant Analysis Development (SPAD) index, number of leaves, number of shoots, root length, and dry and fresh mass of the aerial part and root.

The total chlorophyll was determined by the Chlorophyll Meter Spad-502 (Konica Minolta[®], Japan). Evaluations were conducted in plots with five plants. The measurements were made on three stems per plant, and the chlorophyll content of the median parts of each stem originated from basal buds, auxiliary buds, and apical buds was quantified. The average of the sampled leaves was calculated after the reading.

Table 3. Chemical analysis of substrates.

Substrate	pH	P	K	S	Ca ²⁺	Mg ²⁺	Al ³⁺	B	Cu	Fe	Mn	Zn	MO ₄	CO ₅
	H ₂ O	----mg/dm ³ ----			----Cmol/dm ³ ----			-----mg/dm ³ -----					---dag /kg ⁻¹ -	
S ₁	5.1	0.9	24.0	3.0	0.3	0.1	0.2	0.05	0.6	6.0	6.0	0.3	1.2	0.7
S+A ₂	5.3	1.0	26.0	2.0	0.6	0.1	0.0	0.06	0.6	6.0	6.7	0.2	1.0	0.6
S+A+E ₃	7.4	17.0	266.0	8.0	2.1	1.0	0.0	0.48	0.9	9.0	12.3	3.8	5.0	2.9
Bioplant [®]	5.2	308.9	835.6	na	8.84	4.33	0.3	na ₆	na	na	na	na	24.0	15.0

S₁ = Soil; S + A₂ = Soil + Sand; S + A + E₃ = Soil + Sand + Cattle Manure; OM = organic material; CO₅ = organic carbon; na₆ = not analyzed.

Table 4. Chemical analysis of substrates - part 2.

Substrate	H+Al ₄	SB ₅	T ₆	t ₇	V ₈	m ₉
	-----Cmolc/dm ³ -----				-----(%)-----	
S ₁	1.50	0.46	1.96	0.61	24.0	25.0
S+A ₂	1.00	0.77	1.77	0.77	44.0	0.0
S+A+E ₃	0.90	3.78	4.68	3.78	81.0	0.0
Bioplant [®]	7.72	15.3	23.02	15.6	66.46	2.0

S₁ = Soil; S + A₂ = Soil + Sand; S + A + E₃ = Soil + Sand + Cattle Manure; H + Al₄ = potential acidity; SB₅ = sum of the bases; T₆ = cation exchange capacity; t₇ = effective cation exchange capacity; V₈ = base saturation; m₉ = aluminum saturation.

The number of leaves was counted in all different treatments on every plant of the plot.

The total number of shoots per plant was computed by counting the newly-formed shoots at the end of the experiment. In order to calculate the length of the shoot, all shoots sprouting from the plants of experimental plots were measured from cutting to the apex of the new stalk with a

millimeter ruler and the results were presented in centimeters (cm).

To determine the fresh and dry weight, four plants per plot were used. The roots were extracted from their bags with the stem and the substrate and washed in running water over a nylon mesh until they were visibly free of substrate. To quantify the fresh weight, the plants were divided into roots,

stems (main stem + stalks) and leaves. After that, each part was separately weighted by a digital Tecnal® Mark 500 scale, with accuracy of 0.1 g.

The root length was measured with a millimeter ruler, from the base of the cutting to the apical parts of the longest root, and the results were presented in centimeters (cm). Hereupon, the fresh vegetal material was packed inside paper bags and it was put to dry at 70°C in a drying oven (Tecnal® TE-394/2) for 48 hours, wherein it achieved the stability of the dry weight. The results were presented in grams (g).

The data obtained in the experiment underwent analysis of variance and the average figures were compared by the Scott-Knot test at 5% probability, using the Sisvar software (FERREIRA, 2011).

RESULTS AND DISCUSSION

Table 5. SPAD index determined – sixty days after setting up the experiment – on parts of the base, middle, and apex of cuttings that stemmed from the basal part, median part, and apical part of the mother-plant of ora-pro-nóbis (*Pereskia aculeata*).

Cuttings	SPAD _{base}	SPAD _{middle}	SPAD _{apex}
Basal	32.594±6.0 a	28.675±6.6 a	22.540±7.1 a
Median	27.845±7.8 b	26.341±9.6 a	20.282±8.2 a
Apical	25.159±5.5 b	23.770±4.9 a	17.721±4.3 b

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knot test at 5% probability.

Evaluating the SPAD index of the cuttings originated from different positions of the mother-plant's stem and propagated in different substrates, the smallest values were noticed on cuttings that were propagated in the commercial substrate (Bioplant®), independently of the physiological maturation of the stem. In contrast, the highest values were obtained on cuttings propagated in the remnant substrates; still they did not present statistic difference between them. (Table 6). This lower value of the SPAD index for the Bioplant®

The minimum temperature inside the greenhouse was ± 20 °C, whereas the maximum temperature was ± 40 °C. The relative humidity underwent huge oscillations during the experiment and the average value was 48%.

According to the measurements of both the temperature and the humidity of the substrate, they exerted no influence on the results. The substrates maximum humidity remained about 90%.

Based on the results from the middle leaves of the stem, it is possible to infer that the measurement of the SPAD index, in this case, can be made at any position of the cutting, since no statistical variations was noticed on chlorophyll contents in the leaves from this part of the stem. Concerning the values obtained from the apex of the leaves, neither the basal zone and median zone showed any differences among the present total chlorophyll contents, deviating just from the apical zone (Table 5).

commercial substrate (Table 6) may have occurred due to the high organic matter content of this material (Table 3), which in the process of decomposition and mineralization there was nitrogen consumption by the microorganisms, causing deficiency for the plant, since the seedlings developed chlorosis in the older leaves at the end of the experiment. Ferreira et al. (2006) working with tomato verified increasing in the total chlorophyll, according to the nitrogen supply and increase of organic matter mineralization in the substrate.

Table 6. SPAD index determined – sixty days after setting up the experiment – on parts of the base, middle and apex of ora-pro-nóbis cuttings, which were cultivated in the following substrates: Soil (S), Soil + Sand (S + A), Soil + Sand + Manure (S + A + E), and the commercial substrate (Bioplant®).

Substrates	SPAD _{base}	SPAD _{middle}	SPAD _{apex}
S	28.553±6.2 a	27.313±5.3 a	22.350±5.8 a
S+A	32.372±5.6 a	31.007±5.1 a	25.308±4.4 a
S+A+E	29.377±9.1 a	28.015±9.2 a	20.658±6.7 a
Bioplant®	23.823±4.8 b	18.713±2.4 b	12.408±2.5 b

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knot test at 5% probability.

The production of the number of leaves and root length (Table 7) of the ora-pro-nóbis was significantly affected by the physiological maturation of the cutting used to propagate the saplings. The cutting derivative from the basal part

of the ora-pro-nóbis stem provided a greater sprouting of leaves in comparison to the cuttings obtained from the median part and the apical part of the stem. There was no significant difference in the number of new shoots.

Table 7. Number of leaves, number of shoots, and root length (cm) – sixty days after setting up the experiment – were determined on cuttings that derived from the basal part, median part, and apical part of the mother plant of the ora-pro-nóbis.

Cuttings	N. of leaves	N. of shoots	Root length (cm)
Basal	21.162±5.4 a	3.887±0.9 a	21.532±2.9 a
Median	17.950±6.9 b	3.562±1.2 a	18.810±7.4 a
Apical	14.762±6.9 b	3.725±2.7 a	17.739±4.5 b

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knot test at 5% probability.

The sprouting is an important variable in the study cutting rooting, because shoots and leaves allows a greater photoassimilates production and auxin syntesis that are essential factors for adventitious root emission and plant growth (CARVALHO, 2015). In ora-pro-nóbis the sprout is response to photoassimilate accumulated on the stem (tabelas 7 e 8), because these sprouts did not reflect in the number of leaves for median and apical cutting that obtained the lowest mean for these parameters. The basal and median cutting did not differ statistically for the root length, and the apical part of the branch had the lowest mean. The carbohydrate content in apical cuttings influences their rooting capacity and vegeTable metabolism, since it is a basic source of energy (LIMA et al., 2006; SANTOS et al., 2016).

The number of buds and root length did not differ between the four tested substrates. The number of leaves produced by ora-pro-nóbis cuttings was highest in the commercial substrate and

soil+sand+manure cattle when compared to others (Table 8). The organic matter contente in the commercial substrate amd soil+sand+manure cattle, provided a higher emission of leaves in cutting of ora-pro-nóbis, The organic matter content in the commercial substrate and soil + sand + manure, provided a higher emission of leaves in cuttings of ora-pro-nóbis, because the organic matter has surface charges that contribute to the increase of the cation exchange capacity (CTC) and, due to its high reactivity, regulates the availability of various nutrients that favor the growth characteristics of plants. Guimarães (2015) reported an increase in the number of leaves of ora-pro-nóbis, with the increase of the doses of organic fertilization. Corrêa et al. (2010) emphasizes that manure is an organic component that provides several benefits to the substrate, such as improving physical conditions, including aeration and drainage, and contain essential nutrients that are released to plants quickly.

Table 8. Number of leaves, number of shoots and given root length (cm) – sixty days after experiment installation – in *Pereskia aculeata* cuttings cultivated in the following substrates: soil (S), soil + sand (S + A), soil + sand + manure (S + A + E) and commercial substrate (Bioplant®).

Substrate	N. of leaves	N. of shoots	Root length (cm)
S	13.837±3.8 b	3.333±0.8 a	21.039±4.0 a
S+A	16.133±5.3 b	4.317±2.9 a	19.073±4.3 a
S+A+E	19.850±8.7 a	2.983±1.1 a	16.706±8.3 a
Bioplant®	22.067±6.0 a	4.267±1.0 a	20.625±3.2 a

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knott test at 5% probability.

Cavalcanti and Resende (2007) found similar results in researches carried out with the following cactaceae cultivated in different substrates (sand, sand + manure, soil + sand, soil + manure, and soil): *Cereus jamacaru* (Miller), *Pilosocereus pachycladus* (Ritter), *Melocactus bahiensis*

(Luetzelb), *Pilosocereus gounellei* (Byles & Rowley). Substrates that contained bovine manure presented the highest averages of plants length, which vouches for of the presence of nutrients found in manure.

Cutting obtained from the basal and median portions did not differ statistically from one another for the variables: fresh mass of leaf and stem, leaf dry mass, stem and root, and had significant performance in relation to propagated cuttings of the apical part of the branch (Table 9). Less lignified cuttings, as is the apical's case, presents a higher concentration of phenolic compounds in tissues (FAIVRE-RAMPANT et al., 2002), making the rooting more difficult.

Such fresh mass gain from basal and median parts is due to the increase in cutting lignification and these parts' capacity of retaining water. Regarding dry mass gain from basal part, they were already lignified. In other words, they presented a higher ratio of dry mass all along.

Regarding stem dry mass, the three stem parts differed among themselves. For the dry matter gain of the basal part, this part of the branch was already lignified, and with greater dry matter since the beginning of the planting, that were added with its shoots. According to Pacheco (2008), although coarse cutting have lignified tissues with a higher content of peroxidases and indoleacetic acid oxidase, both involved in the degradation of

indoleacetic acid in inactive conjugates, these may be benefited by the greater availability of stored carbohydrate. In the case of acerola was observed a higher accumulation of shoot dry weight in cuttings collected from the median and basal positions compared to those harvested in the apical part of the branches (LIMA et al., 2006). Maia et al. (2008) obtained greater accumulation of shoot dry mass in cutting harvested from the basal position in the production of *Hyptis suaveolens* (L.) seedling.

The importance of carbohydrates relates to the availability of starch for degradation in soluble sugars and to the maintenance of cuttings metabolic activities (FANG et al., 2007). Studies suggests that soluble sugars can increase the number of roots and influence the formation of organs and tissues (GIBSON, 2005). Regarding leaves dry mass, there was no difference among the three stem parts.

The values obtained indicate that the *Pereskia aculeata* leaves contain about 90% water in their composition. Barbosa (2012) found relative water content of 89.37% within 72 hours of *Pereskia aculeata* leaves storage after hydrocooling and storage in plastic packaging, values similar to those found in this paper.

Table 9. Fresh and dry mass of leaf, stem and root determined – sixty days after experiment installation in basal, median and apical part cuttings from the *Pereskia aculeata* mother-plant plant.

Cuttings	FM _{leaf}	FM _{stem}	FM _{root}	DM _{leaf}	DM _{stem}	DM _{root}
Basal	12.352±7.2 a	9.949±1.6 a	3.677±2.1 a	1.470±0.7 a	2.825±0.5 a	2.166±1.1 a
Median	12.645±7.7 a	9.175±1.3 a	4.520±2.5 a	1.505±0.9 a	2.174±0.4 b	2.460±1.7 a
Apical	9.193±6.5 b	4.592±0.9 b	3.773±3.2 a	1.057±0.7 b	1.073±0.2 c	1.374±1.1 b

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knott test at 5% probability.

Substrates affected fresh and dry mass gain of *Pereskia aculeata* leaves, stem, and root (Table 10).

Table 10. Fresh and dry mass of leaf, stem and root determined – sixty days after experiment was set up – in *Pereskia aculeata* cuttings cultivated in the following substrates: soil (S), soil + sand (S + A), soil + sand + manure (S + A + E) and commercial substrate (Bioplant®).

Substrate	FM _{leaf}	FM _{stem}	FM _{root}	DM _{leaf}	DM _{stem}	DM _{root}
S	4.852±1.5 c	7.169±2.8 a	2.522±1.2 b	0.643±0.2 c	1.908±0.8 b	1.009±0.4 b
S+A	5.042±1.7 c	7.857±3.0 a	2.601±1.5 b	0.701±0.3 c	2.246±0.9 a	1.533±0.6 b
S+A+E	19.073±3.8 a	8.155±2.9 a	7.810±1.6 a	2.241±0.5 a	1.804±0.8 b	3.924±1.3 a
Bioplant®	16.621±4.1 b	8.441±2.2 a	3.027±1.3 b	1.791±0.4 b	2.139±0.7 a	1.536±0.5 a

The averages (at the column) followed by the same letter do not differ significantly among themselves, according to the Scott-Knott test at 5% probability.

The stem fresh and dry mass did not statistically differ in response to the substrate used. Cuttings propagated in soil + sand + manure and commercial substrate (Bioplant®) had a higher performance of dry and fresh mass compared to

those propagated in soil and soil + sand. The best results observed in leaves fresh mass in saplings produced in the soil + sand + manure and commercial (Bioplant®) substrates are due to physicochemical properties, such as lower density

and chemical composition (Table 1, 2, 3 and 4). Soil + sand + manure substrate allowed higher performance of leaves dry mass, which represents an accumulation of 12.8% compared to those saplings propagated in commercial substrate (Bioplant[®]) and three times higher than those cultivated in soil and soil + sand.

The best ratio of leaves dry mass for soil + sand + manure substrate is due to pH ideal values, good base saturation and cation-exchange capacity, and absence of aluminum in its composition, which makes the provision of nutrients for the plant easier.

The substrate soil+sand+manure cattle provided greater accumulation of fresh root and leaf mass in comparison to other substrates. This same substrate for the dry leaf mass obtained the highest average, not differing for the dry root mass with the Bioplant[®] substrate. These substrates according to the chemical analysis (Table 4) have the highest values of base saturation and CTC, indicating the good fertility, and that the plant is responsive to the availability of nutrients, since the soil substrates and soil plus sand are limiting in fertility. Sales et al. (2016) in the production of passion fruit seedlings

verified that these were affected positively by the addition of organic matter in the substrate. According to Costa et al. (2011) cattle manure increased cation exchange capacity (CTC), being an important component of substrates.

CONCLUSIONS

The physiological maturity of the stem and the type of substrate tested highlighted the differences in the *Pereskia aculeata* sapling quality.

The cutting originated from the basal and medium part harvested from the branch of the year and the substrate soil + sand + manure allowed the best growth and development of the ora-pro-nóbis seedlings.

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RESUMO: *Pereskia aculeata* Miller, comumente chamada de ora-pro-nóbis em algumas regiões do Brasil, é uma planta que se destaca pelo seu alto teor de proteínas, com grande potencial de uso. Observa-se o crescente interesse pelo uso de ora-pro-nóbis como matéria-prima pela indústria alimentícia na forma de concentrado (desidratado e moído), e da popularização do consumo direto como hortaliça folhosa pela população, diante disto é importante conhecer a melhor forma de propagação da espécie. Objetivou-se com este estudo analisar a influência da posição da estaca retirada do ramo, e o tipo de substrato, sobre o crescimento e desenvolvimento de ora-pro-nóbis durante a fase de produção de mudas. Com necessidade de um aumento de produção de mudas para atender a demanda, e na ausência de trabalhos científicos sobre este assunto, e considerando a necessidade de informações na literatura, torna-se necessário o desenvolvimento de pesquisas direcionadas para a propagação vegetativa e substrato para mudas de ora-pro-nóbis. Para a propagação vegetativa foram utilizadas três tipos de estacas: apicais, medianas e da parte basal do ramo. O plantio das estacas foi realizado em quatro tipos de substratos: S₁= solo; S₂= solo+areia lavada (1:1); S₃= solo+areia lavada+esterco bovino curtido (2:1:1) e S₄= substrato comercial Bioplant[®]. Após 60 dias a instalação do experimento, as mudas foram analisadas quanto ao: índice *Soil Plant Analysis Development* (SPAD), número de folhas, número de brotações, comprimento de raiz e massa da matéria fresca e seca da parte aérea e raiz. A maturação fisiológica do ramo e o tipo de substrato testado evidenciaram diferenças na qualidade de mudas de ora-pro-nóbis. A estaca oriunda da parte basal e mediana do ramo cultivada em solo+areia+esterco proporcionou melhor qualidade nas mudas de ora-pro-nóbis.

PALAVRAS-CHAVE: Ora-pro-nóbis. Propagação vegetativa. Estaquia. SPAD. Planta alimentícia não convencional.

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