



Lunar influence on *Brunfelsia uniflora* (Pohl.) D. Don (Manacá-de-cheiro) rooting¹

*Influência das fases da lua no enraizamento de *Brunfelsia uniflora* (Pohl.) D. Don
(Manacá-de-cheiro)*

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Abstract -This study aimed to determinate the moon phase's influence on *Brunfelsia uniflora* (Pohl.) D. Don. In January 2008, semi woody cuttings were collected in Curitiba, Brazil. The experiment was conducted in a randomly design with four treatments that represent the moon phases (new; full; waning and waxing). The cuttings were maintained inside a greenhouse. After 90 days the followings were analyzed: rooting percentage, number of roots, length of the three longer roots, un-rooted living cuttings, dead cuttings and cuttings with sprouts. It was also evaluated the amount of reducing sugar and total sugar. From the results obtained it was not possible conclude that the moon phases had any influence on the rooting of *Brunfelsia uniflora*.

Key-words - Native ornamental specie. Organic ornamental crop. Reducing sugar and total sugar analyses.

Resumo - O objetivo neste estudo foi avaliar a influência das fases lunares no enraizamento da planta ornamental *Brunfelsia uniflora* (Pohl.) D. Don. (Manacá-de-cheiro). Em janeiro de 2008, foram coletadas estacas caulinares semi-lenhosas oriundas de brotações do ano anterior de uma planta matriz, em Curitiba - PR. O experimento foi conduzido em delineamento inteiramente casualizado, com quatro tratamentos (lua nova, lua crescente, lua cheia e lua minguante, respectivamente), quatro repetições e 20 estacas por parcela, sendo mantido em casa-de-vegetação. Após 90 dias foram avaliadas: porcentagem de estacas enraizadas, número de raízes formadas por estaca, comprimento das três maiores raízes formadas por estaca, porcentagem de estacas vivas não enraizadas e porcentagem de estacas mortas. Também foram avaliados os teores de açúcares redutores (Método do Dinitrosalicilato) e açúcares totais (Método Fenol Sulfúrico). Pelos resultados obtidos não se pode concluir que as fases da lua influenciam o enraizamento de estacas de *Brunfelsia uniflora*.

Palavras-chave - Espécie ornamental nativa. Produção orgânica de mudas. Análise de açúcares totais e redutores.

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Introduction

According to Ehlers (1999) in the XIX century, the *modern agriculture* started with a lot of technological and scientific advances, as the chemical fertilizer molecules, plants genetic improvement and internal combustion engine, which made possible the intensive animal production and vegetal crop. This productive model has been consolidated and applied in the last decades, based on the massive use of industrial supplies (EHLERS, 1999).

This system is very efficient from the economic viewpoint, but from the social and ecological viewpoint doesn't look the same. The ecological problems were first presented by the biologist Rachel Carson, who reported some of the consequences of the massive use of chemical substances in agriculture, among them, as soil depletion, food chain poisoning, and among human health, problems such cancer and depression (CARSON, 1962).

Meanwhile, the movement for less damaging agriculture practice grew up in many world societies, as well as the consumption of food without pesticides, increasing biodynamic agriculture, organic agriculture and other alternative models. All these different movements pursuing more natural practices follow one of the oldest agricultural techniques: the moon influence on living beings.

The moon influence on the living beings has been focus of observation for a long time by the peasants, animal stockers and fishermen. Nonetheless, this empirical knowledge is placed on the border of scientific surroundings, and only few researchers share it. Fisher and Roumbouts (1986) *apud* Pfitscher (2001)⁷, in a study about the farmers from Joinville, SC, Brazil, state that the moon influence on plants and animals, associated to the weather, propitiates a great difference on the harvest and productivity. Their study, during 90 days, demonstrated that vegetables which produce roots and tubers should be planted in the wane moon phase and the vegetables that produce seeds and fruit, like rice, beans and corn, should be planted in the waxing moon phase. In addition to the production increasing, a greater resistance of the vegetables for pests was perceived (Fisher and Roumbouts, 1986 *apud* Pfitscher, 2001).

Glugoski (1997), observed a lot of peasants that were guided by the moon phases in the vegetables cultivation and bamboo cultivation, so he decided to analyze that influence. For many years, he planted the same bamboos and vegetables on different moon phases and compared the results, but he concluded that they didn't show any difference.

⁷FISCHER, Gert Roland; ROMBOUTS, Piet. **Biodinâmica e o Pequeno Agricultor da Região de Joinville**. Joinville: Aprema- Associação de Preservação e Equilíbrio do Meio Ambiente de Santa Catarina, 1986.

Additionally, another problematic to be inserted in this work is about the lack of native ornamental species in the Brazilian market, exactly because of insufficient research about propagation and cultivation of these native species. *Brunfelsia uniflora* (Pohl.) D. Don. (Manacá-de-cheiro) native from Brazil is a shrub with simple leaves and flowers in clusters or alones (GRIFFITHS, 1994). Its flowers have a purple color, which may turn white color after flower opening (JOLY, 2002). Because of its outstanding ornamental characteristic, it is considered the symbol flower of Curitiba, PR, Brazil, according to the Municipal Law n° 6324 from 12th of July of 1982 (CURITIBA, 1982).

There are some reports in Horto Municipal of Barreirinha, Curitiba, regarding *Brunfelsia uniflora* unsuccessful erratic sexual propagation, where it is produce for the public landscaping, because of insect attacks. Also Ottmann *et al.* (2006) observed that the *Manacá-de-cheiro* has a short rooting percentage, rather in the stem cutting, as in the air-layering technique, so it can be considered a difficult specie to propagate.

The vegetative propagation is one of the most important techniques of plant propagation and the root formation is the main purpose to rich the success to produce plant clones. However, many species doesn't have the capacity of rooting, which can limit its plant production (HARTMANN *et al.*, 2011).

The usage of vegetative propagation can lead to a high quality and healthy plant material production. This can be a good alternative to plants that produce short amount of seeds, or for those, which the seeds germinate poorly or also for those which the seedling has a high cost. In addition, it allows the multiplication of plants that are stronger and more resistant to diseases; maintain the genotypic and phenotypic characteristics that can be selected from an ideal stock plant (EDMOND *et al.*, 1957).

Within these two problematics, the scope of this work was to study the moon phases' influence on vegetative propagation of *Brunfelsia uniflora* (Pohl.) D. Don. (Manacá-de-cheiro) - Solanaceae.

Material and methods

In January 2008, semi woody stems cuttings of *Brunfelsia uniflora* (Pohl.) D. Don. (Solanaceae) were collected from a stock plant – using previous year branches - located in a private garden, Curitiba, PR, Brazil. The plant material was collected at the same day that the

experiments were installed, and it had been kept hydrated in water containers, until the cuttings preparation.

The cuttings were set up in a shape of 10.0 cm long by 0.20 cm of diameter containing two leaves in the apex. The base was cut in angle and the apex was cut straight. After the preparation, the cuttings were immersed in a sanitary treatment with sodium hypochlorite 0.5% for 10 minutes, and then they were washed in current water for 5 minutes. The studied treatments were the four moon phases: T1. 08th of January of 2008 – New Moon; T2. 15th of January of 2008 – Waxing Moon; T3. 22nd of January of 2008 – Full Moon; T4. 30rd of January of 2008 – Waning Moon.

The experiment was conducted in a randomly design, with the 4 treatments, 4 replicates and 20 cuttings for each plot, totaling 320 cuttings.

The cuttings were planted in polypropylene cylindrical containers with 53 cm³, using the Plantmax HA[®] soil amendment, composition: pine bark, turf, expanded vermiculite and mashed coal, in unknown proportions; with pH among 5.5 - 6.2; water-holding capacity of 150% and conductivity of 1 – 1.5 μScm^{-1} .

After 90 days maintained inside a greenhouse (24° ± 2°C e 90% HR, with intermittent irrigation, 15 minutes every 30 minutes), the cuttings were submitted to analysis, which scoped: rooting percentage (RC), number of roots per cuttings (NRC), length of the three longer roots formed per cuttings (LRC), percentage of unrooted living cuttings (LC), percentage of dead cuttings (DC), and percentage of cuttings with sprout (SC).

The results were statistically analyzed. The treatments variance homogeneity was evaluated by the Bartlett Test. The samples were verified by F Test which showed significant differences between each other. Afterwards they were compared by the Tukey Test on 5% of significance.

Three rooted cuttings from each four different treatments were selected at the end of the experiment to analyze the amounts of reducing sugar – RS (Dinitrosalicilato Method) (MULLER, 1959) and total sugar – TS (Phenol Sulfuric Method) (DUBOIS *et al.*, 1956). These variables did not receive any statistical treatment.

Results and discussion

The percentage of RC was short in all 4 treatments, and did not show a significant statistical difference between them (Table 1). Although the treatment T1 had shown 6.25% of RC, the cuttings that were collected and

set to root during new moon phase were the ones which showed the lowest percentage of rooting. The treatment T2 had 16.25% of RC, the cuttings that were collected and set to root during waxing moon phase, were the ones who showed the highest percentage of rooting.

The NRC, LRC and LC, also didn't show a significant statistical difference between the 4 treatments, demonstrating a low or nonexistent influence of moon phases for these variables under the studied conditions. Nevertheless the variables DC and SC, showed a significant statistical difference between the 4 treatments. For the SC, the treatment T2 (32.50% of SC), cuttings collected and put to root in the waxing moon phase, again were the ones who revealed the highest percentage of SC, but without significant statistical difference for the treatments T1 (26,25% of SC) and T3 (22.50% of SC), respectively new moon and full moon phases.

Ottmann *et al.* (2006) had observed in a study about vegetative propagation of *B. uniflora* high percentages of cuttings with sprouts (52.5% to 77.5% - 60 days after the cuttings had been put to root, and 36.39% to 61.46% -120 days after) shown in the different treatments tested and in the two periods of evaluation (60 and 120 days). The authors discussed about many roots, which were coming out directly from the sprouts, and as time went by, the percentage of cuttings with sprouts decreased, while the percentage of rooted cuttings had increased. But, they didn't surmise that in *B. uniflora* the rooting is entirely connected to the sprouts formation. Perhaps the same situation could happen in this study, if the cuttings were maintained for longer period in the rooting bed, although it was not noticed roots coming out from the sprouts in this study.

The percentage of dead cuttings showed a statistically significant difference between treatment T1 and treatments T2 and T3, but with no variance from treatment T4. Treatment T1 displayed the highest percentage (33.75%) of DC and the shortest percentage of RC (Table 1). This could have happened because the cuttings were been collected and brought to root during new moon phase, period in which the sugar from the stock plant phloem is transported downward and the collected stems were with short concentration of it (RIVERA, 2004).

Rivera (2004) mentions that the ideal time for the vegetative propagation would be three days after waxing moon phase or three days after full moon phase, period in which the plants have an intensive photosynthetic activity. For the vegetative stems spread is recommended the waning moon phase to avoid stressing the plants, once the sugar transport is downward. The rooting of the bamboo cuttings, for example, must be accomplished from the

Table 1 – Analyzed variables randoms comparison of *Brunfelsia uniflora* (Pohl.) D. Don on the different moon phases

TREAT	RC (%)	NRC	LRC (cm)	LC (%)	SC (%)	DC (%)	Concentration of RS (μ moles/g tec.)	Concentration of TS (mg eq. glu/g tec.)
T1	6.25 a	1.0 a	0.65 a	33.75 a	26.25 ab	33.75 b	231.33	271.67
T2	16.25 a	1.7 a	1.06 a	42.50 a	32.50 a	8.75 a	35.56	263.50
T3	13.75 a	1.6 a	0.78 a	53.75 a	22.50 ab	10.00 a	245.92	751.17
T4	15.00 a	2.1 a	0.62 a	53.75 a	12.50 b	18.75 ab	200.00	216.33

Randoms followed for the same letter don't differ between each other, for a 5% of significance, by the Tukey's Test. TREAT = treatments; T1 = new moon; T2 = waxing moon; T3 = full moon; T4 = waning moon; RC = rooted cuttings; NRC = number of roots per cuttings; LRC = length of the three longer roots formed per cuttings; LC = unrooted living cuttings; SC = cuttings with sprouts; DC = dead cuttings; RS = reducing sugar; TS = total sugar.

first day of the waxing moon phase, period in which the sugar transport in the plants is upward. This can be one of the answers for the greatest percentage of rooted cuttings observed in the treatment T2 (Table 1).

The few works that discuss about the lunar influence on plants have used the Maria Thun Lunar Calendar. One of the basic principles of this calendar is being associated to the moon orientation around Earth in its cycle of 27.3 days and about its passage through the twelve regions of the Zodiac (Sideral Lunar Rhythm). The Zodiac is the association of constellations which the Moon and every planet lie within under their orbits. In each day, the plants should receive different inducements, that would act on their different organs (roots, stems, lives, flowers, fruits, seeds) and these should be a benefit for them (KEPPEL, 2005; JOVCHELEVICH, 2007).

According to this calendar, the plant transplant is better when it coincides with the period of the "downward moon" (when sugar descends favoring activities related to plant's formation or transport, since they can root better – longer and more numerous). Also it is an appropriate period for pruning stems and to cut wood (JOVCHELEVICH, 2007).

For this work we didn't use this Calendar, but we used the regular 2008 Lunar Calendar, with its monthly 4 moon phases.

Jovchelevich (2008) using the M. Thun Calendar to study the lunar rhythms influence on the carrots (*Daucus carota*), seeded in different times, under the same conditions, during May/June of 2005 and April/May of 2006, with the harvest after 82 days from the seedling. The author found that the roots dry matter was the only variable showing a statistical significant difference in the traditional sinodical rhythms and peasant sinodical rhythm.

The same author also concluded that the two years of lunar rhythms influence evaluation in the carrots crop

can not be a determinant result, and they are not conclusive about the use of M. Thun Calendar. More experimental data would be necessary (JOVCHELEVICH, 2007).

Keppel (2005) also has studied the moon phase's influence in efficiency increase of apple crops. And for that he has used the concept of "lunar impulse" from M. Thun Calendar. This impulse acts in the "flower day", in "fruit day" and in "root day", which were identified as the best days for the plants parts to grow. This means that every 9 days the moon lies in front of a force trigon⁸, on this way making different crop practices with the rhythms of these trigons would grant a new impulse to the plant day (THUN, 2008). So Keppel (2005) on his study made different combinations between the trigons (leaves, flowers, fruits and roots days, combined between each other) and surmised that to improve apple crop output, the best trigon combinations are: flower day- fruit day and fruit day-flower day. For the seedlings transplant, the best trigon combinations are: fruit day-flower day and leaf day-flower day.

Regarding the sugar analysis, the greater concentrations of RS and TS in the selected cuttings were found in treatment T3 (Table 1), which corresponded to the full moon phase. According to Rivera (2004), during this moon phase the sugar is moving upward, so it is more concentrated in the new buds, stems, flowers and fruits.

According to Taiz and Zeiger (2004), the reducing sugar constituents are fructose and glucose, which are not normally translocated in the phloem, because they are more reactive. These components are obtained by the saccharose breakdown; the non reducing sugar is the most common sugar transported in the phloem.

Ono *et al.* (2005), studying the kiwi (*Actinidia chinensis* Planch cv. Abbott), noticed the existence of a possible relation between the reducing sugar quantity and the rooting percentage of the cuttings. The highest averages for rooting percentage, quantity of reducing

⁸Maria Thun calls the trigons positions angled at 120°. Every 9 days the moon moves into a new force trigon.

sugar and total sugar were found on the same treatments, probably due to others carbohydrate transformations into sugars and their translocations from the leaves to the cuttings. Nevertheless, Bortolini (2006) observed in the *Tibouchina sellowiana* (Cham.) Cogn. the highest rooting percentage during the spring and summer, in synch with the lowest level of total sugar.

These correlations were not verified in this study, once the highest concentrations of sugars (RS and TS) were found in treatment T3 and the highest percentage of rooting cuttings was found in treatment T2 (Table 1).

One possible explanation to this short concentration of RS found in the waxing moon phase (T2), the treatment with the highest percentage of rooting cuttings, may be that glucose and fructose from RS provide substrate to the compounds synthesis reactions during the roots formation.

Conclusions

From the results obtained in this study, it can not be concluded that the moon phases have any influence on the rooting of *Brunfelsia uniflora*.

Further research becomes necessary to compare the sugar grades (RS and TS) in the experiment setup and evaluation, to analyze the sugar role in the rooting and its relation to the moon phases.

It is also recommended to better understand the lunar influence in the rooting of *Brunfelsia uniflora*, repeating this experiment during other seasons.

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