ANNALS OF THE
UNIVERSITY OF CRAIOVA

Series: ✓ *Biology*
✓ *Horticulture*
✓ *Food products processing technology*
✓ *Environmental engineering*

Vol. XXX (LXVI) - 2025

THE INFLUENCE OF CULTIVAR AND POTTING MIXTURES ON ROOTING ABILITY OF FIG CUTTINGS AND SEEDLING GROWTH

Borsai Orsolya[1], Gáll Alexandra[1], Negrușier Cornel[1], Poșta Daniela Sabina[3], Mihai Cosmin-Alexandru[4], Moldovan Ioana[2]*
[1]University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca
[2]Horticultural Research Station, Cluj-Napoca
[3]University of Life Science "King Mihai I" from Timișoara, Timișoara
[4]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Bucharest
* *Correspondence author. E-mail*: ioana.moldovan@usamvcluj.ro

Keywords*: Ficus carica L., propagation medium, rooting percentage, shoot*

ABSTRACT

This research aimed to assess the rooting ability and early growth of five fig cultivars ('Brogiotto Bianco', 'Matalone', 'Verdino', 'Turca', and 'Lungo del Portogallo') using three media: peat + perlite (2:1; M1), peat + coconut fiber (2:1; M2), and perlite (M3, control). A total of 450 stem cuttings were rooted under cold greenhouse conditions. Rooting percentage and seedling performance differed significantly ($p < 0.05$) among treatments. Perlite (M3) achieved the highest rooting rates, up to 88.9 %, while peat peat-based media supporting subsequent seedling growth. M1 improved root length and promoted greater shoot elongation in some cultivars. 'Lungo del Portogallo' showed superior vigor, reaching 49.7 cm in M1. Results indicate strong genotype and substrate interactions, highlighting perlite as most reliable for rooting as compared to other mixtures.

INTRODUCTION

The common fig (*Ficus carica* L.) is a species known since ancient times being one of the oldest cultivated fruit trees, highly appreciated for its nutritional, medicinal, and economic importance across Mediterranean and subtropical regions (Flaishman et al., 2008). First was mentioned by Theophrastus and Dioscorides, and its scientific name derives from the historical geographical name of Caria region (Turkey) where it was identified in the wild flora (Cowart & Graham, 1999). Its adaptability to diverse climatic and soil conditions has contributed to its spread worldwide, becoming an important species for both commercial orchards and small-scale farming systems (Stover et al., 2007).

In Romania, the cultivation of fig trees has a long tradition, especially in the southern and viticultural regions, and is expanding into hilly and submontane areas as global warming makes winters less severe (Stănică et al., 2017). Local farmers prefer cultivars that produce red, yellow, and green fruits, which are able to reach fruit maturity during Romania's relatively short growing season (Giancarla et al., 2017; Odagiu, 2021). Although fig trees are often grown in private gardens, with southern exposures, or sheltered locations to protect them from frost, there is an increasing interest against semi-commercial plantations (Bona et al., 2022). Winter protection measures, such as covering with anti-frost shields or using walls and fences as windbreaks, are commonly used for young plants. Recent assessments of Romanian fig populations have begun to characterize the local genotypes in terms of leaf, fruit, and adaptation traits, with the purpose of identifying selections more resilient to low temperatures and with better fruit quality (Stănică et al., 2017; Asănică et al., 2019).

However, propagation of fig trees remains a critical step in establishing orchards, as the success of vegetative multiplication directly affects orchard uniformity, productivity, and long-term sustainability (Hartmann et al., 2011). Vegetative propagation by cuttings is the most common method for fig cultivation due to its simplicity, low cost, and ability to maintain clonal fidelity (Ahmed et al., 2013). Despite this, rooting success is strongly influenced by factors such as cultivar, environmental conditions, and the physical and chemical characteristics of the potting media (Abdel-Mohsen et al., 2010). Certain cultivars demonstrate inherently higher rooting potential, while others are more recalcitrant, requiring optimization of propagation practices (Khorshidi et al., 2016). The composition of the potting mix is a decisive factor in cutting propagation, as it regulates water availability, aeration, and nutrient supply to developing roots (Hartmann et al., 2011). Mixtures incorporating perlite, peat moss, sand, or organic composts have been shown to significantly affect rooting percentages, root length, and shoot development in a variety of fruit tree species (Leakey, 2014). For figs, studies indicate that potting media with good aeration, moderate water-holding capacity and the use of rooting hormones tend to promote higher rooting rates (Khorshidi et al., 2016; Poșta 2012a). Another report suggest that fig seedlings were successfully rooted in a substrate consisted of decomposed palm stems from *Mauritia flexuosa* L. (buriti palm), which is naturally rich in calcium, magnesium, iron, and zinc (Nunes et al., 2024).

Given the importance of both genetic background and propagation substrates, investigating the interaction between cultivar and potting mix is essential for developing reliable and efficient propagation protocols. Therefore, the main aim of this research was to determine the effect of different planting medium and cultivar on an early shoot and root development of *Ficus carica*.

MATERIAL AND METHODS

The stem cuttings were obtained from five, two-years-old *F. carica* cvs. (mother plants), purchased from a local garden center but originated in Italy (Table 1).

Table 1

Fruit and leaf shapes of the *F. carica* cvs. under study

Cv. name	'Brogiotto Bianco'	'Matalone'	'Verdino'	'Turca'	'Lungo Del Portogallo'
Fruit					
Leaf					

The current research has been carried out in the greenhouse (cold greenhouse) of the University of Agricultural Sciences and Veterinary Medicine from Cluj-Napoca (46°46′0″N; 23°35′0″E), Romania.

A total of 450 stem cuttings were used as propagation materials. The stem cuttings had an average length ranging between 18.74 ± 1.01 cm and 21.89 ± 1.13 cm among cultivars (Table 2) with variable number of internodes (from 4.46 ± 0.90 to 7.73 ± 0.73) which were rooted in 11 cm x 12 cm square plant pots filled with three types of potting mixtures (peat and perlite at 2:1 ratio [M1]; peat and coconut fiber at 2:1 ratio [M2] and perlite [M3] considered as control).

Table 2

Average length of cuttings and internodes' number of *F. carica* cvs.

Cv. name/ Parameter	'Brogiotto Bianco'	'Matalone'	'Verdino'	'Turca'	'Lungo Del Portogallo'
Length of cuttings	18.74±1.01^{a}	20.16±1.00^{ab}	19.83±1.95^{ab}	21.89±1.64^{c}	21.00±1.13^{bc}
No. of internodes/ cutting	7.73±0.76^{b}	4.87±0.91^{a}	4.54±0.86^{a}	4.47±0.90^{a}	5.63±0.56^{a}

Note: Data are means±st. error. Different lowercase letters indicate significant differences between cultivars within the same parameter according to Tukey's HSD test.

Razormin was applied once a week with a concentration of 0.1% as a double acting biostimulant (root and leaf) to all media excepting the control (perlite). After rooting (after 150 days), the fig seedlings were transferred into pots in peat medium with Osmocote added and grown for further analyses under cold greenhouse conditions (Figure 1). The seedlings were watered on a weekly basis. The parameters taken into account were rooting success (expressed as rooting percentage), root length, seedling height, number of newly emerged shoots/seedling and growth rate. Data were analysed by applying the analysis of variance (ANOVA) to identify statistical significances among treatments. Further multiple comparisons of means were assessed employing Tukey's HSD test using SPSS V.19 (IBM).

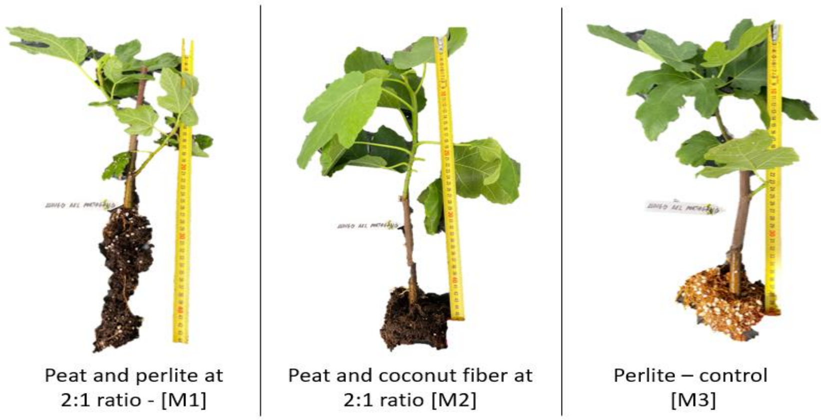

Figure 1. *F. carica cv*. 'Lungo del Portagallo' samples rooted after 150 days

RESULTS AND DISCUSSIONS

The results of this research showed that the rooting ability of fig cuttings was significantly affected by both cultivar and potting mixture. The stem cuttings ranged in length from 18.74 ± 1.01 cm to 21.89 ± 1.13 cm, with the number of internodes varying between 4.46 ± 0.90 and 7.73 ± 0.73, depending on the cultivar (Table 2). These characteristics played an important role in rooting success: longer cuttings with a higher number of internodes tended to root more effectively, likely due to a larger surface area for adventitious root formation and a greater reserve of resources for shoot development. Regarding the substrates used, the results revealed that perlite (M3) consistently promoted the highest rooting percentages, with values ranging from 44.44% in 'Verdino' to 88.89% in 'Brogiotto Bianco' and 'Matalone'. In contrast, peat-based mixtures (M1, M2) showed low and irregular rooting success, with some cultivars failing to root (Table 3). These findings confirm that substrates with high aeration and moderate water-holding capacity are critical for adventitious root initiation (Hartmann et al., 2011). Similar results were reported by Khorshidi et al. (2016), who found that perlite promoted faster root induction in figs compared with organic mixtures. The poor rooting performance in peat-based substrates may be attributed to reduced aeration and waterlogging effects, which impair oxygen diffusion to basal cut surfaces (Caron and Michel, 2015).

Table 3

Rooting percentage (%) and root length of fig cuttings in the three potting mixtures

Cv. name/ Treatment	'Brogiotto Bianco'	'Matalone'	'Verdino'	'Turca'	'Lungo Del Portogallo'
Rooting percentage					
M1	n.d.^{a}	11.11^{aA}	11.11^{aA}	44.44^{cA}	22.22^{bB}
M2	11.11^{aA}	n.d.^{a}	11.11^{aA}	n.d.^{a}	11.11^{aA}
M3	88.89^{dB}	88.89^{dB}	44.44^{aB}	77.78^{cB}	66.67^{bC}
Root length					
M1	n.d.^{a}	15.33^{aA}	25.33^{bC}	15.31^{aA}	21.4^{bB}
M2	6.33^{aA}	n.d.^{a}	6.51^{aA}	n.d.^{a}	7.33^{aA}
M3	9.71^{abB}	10.87^{bB}	11.43^{bB}	10.55^{bA}	5.41^{aA}

Note: Data are means±st. error. Different lowercase letters indicate significant differences between cultivars within the same parameter, while capital letters between treatments according to Tukey's HSD test.

With regard to root development, the results revealed that perlite favored rooting initiation but root elongation was superior in the peat-perlite mixture (M1) for some cultivars, especially 'Verdino' (25.33 cm) and 'Lungo del Portogallo' (21.4 cm). However, in M3, despite higher rooting percentages, root elongation remained moderate, confirming that aeration supports root initiation but nutrient-rich substrates favor root extension. This suggests that once roots are formed, the higher nutrient content of peat can stimulate elongation and lateral development. Rajan and Singh (2021) also observed that organic components in propagation media improve root biomass after initiation. By contrast, in pure perlite, root systems remained shorter (average 5–11 cm), likely reflecting the low nutrient content of the medium (Poșta, 2012b). Therefore, while perlite is optimal for initial rooting, complementary nutrient-rich substrates may be beneficial in later stages to encourage root expansion.

Seedling growth was strongly genotype-dependent (Table 4). 'Lungo del Portogallo' showed the greatest vigor across treatments, reaching 49.7 cm in M1 and recording the highest growth rate (36.7 %). 'Turca' also performed well (29.5 % growth rate), while 'Matalone' and 'Verdino' were less vigorous. These results support earlier observations that cultivar genetics play a decisive role in propagation success (Ahmed et al., 2013; Bona et al., 2022). Interestingly, shoot number per seedling did not vary significantly among cultivars, averaging 1–2 shoots, which may indicate that early growth is more dependent on height and root performance than on branching.

Overall, the results suggest a strong interaction between genetic background and rooting substrate. While perlite (M3) ensured high and consistent rooting percentages, peat–perlite mixtures (M1) favored longer root systems and taller seedlings in some cultivars. Similar genotype-specific responses were reported by Nunes et al. (2024), who demonstrated that organic substrates rich in minerals enhanced growth of fig cuttings. This dual effect suggests that propagation protocols could be optimized by combining the initial use of perlite for rooting, followed by transfer to peat-based mixtures to stimulate further development. Such an approach would ensure both high propagation success and vigorous seedling establishment, which are essential for uniform orchard establishment under temperate conditions.

Table 4

Seedling height (cm), growth rate (%) and shoot number of the fig cvs.

Cv. name/ Treatment	'Brogiotto Bianco'	'Matalone'	'Verdino'	'Turca'	'Lungo Del Portogallo'
M1	n.d.^{aA}	31.8±3.63^{bB}	31.5±4.21^{bB}	35.9±4.73^{bB}	49.7±3.89^{cB}
M2	26.1±4.01^{bcB}	n.d.^{aA}	19.0±2.77^{bA}	n.d.^{aA}	32.7±3.89^{cA}
M3	26.4±5.40^{aB}	25.4±4.81^{aB}	25.7±4.24^{aAB}	36.5±5.93^{bB}	37.7±2.34^{bAB}
Growth rate (%)	0.56^{a}	22.90^{b}	22.91^{b}	29.47^{b}	36.66^{b}
No. of shoots/ seedling	1.57±0.79^{a}	1.57±0.79^{a}	2.00±0.63^{b}	1.50±0.53^{a}	1.44±0.53^{a}

Note: Data are means±st. error. Different lowercase letters indicate significant differences between cultivars within the same parameter, while capital letters between treatments according to Tukey's HSD test.

CONCLUSIONS

Rooting ability and seedling growth of fig cuttings were strongly influenced by cultivar, cutting characteristics and potting substrate. Perlite proved to be the most effective medium for ensuring high rooting percentages across cultivars, while peat-based mixtures supported better shoot elongation in some cases. Among the tested genotypes, 'Lungo del Portogallo' showed the highest vigor and growth potential. These findings emphasize the importance of selecting suitable cultivar–substrate combinations to improve propagation efficiency and establish uniform fig orchards.

ACKNOWLEDGMENT

This research work was carried out with the support of the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Faculty of Horticultural and Business in Rural Development and AgroTransilvania Cluster, through the project "AgroTransilvania Cluster-Cluster specialized in bioeconomy" (Competitiveness Operational Program Axis 1. Program cofinanced by the European Regional Development Fund "Investing for your future", Section BCompetition code POCA1-A1.1.1-B-2015- Project Type-Innovation clusters. P_35_476, co-funded by European Regional Development Fund) and through the project "AgroTransilvania Cluster".

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