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Propagation of rose varieties by cuttings under the effect of different rooting hormones

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Abstract: Roses are one of the oldest and perhaps most noble and beautiful plants in the world. The propagation of roses by stem cutting is the simplest and a largely used method to multiply them. For the present experiment, seven varieties of roses were selected as follows: 'Monika', 'Mr. Lincoln', 'Queen Elisabeth', 'The Fairy', 'Peace', 'King's Ransom', and 'Don Juan'. To assess the differences between the varieties, growth, root length, root number, and frost damage were determined. The aim of the experiment is to determine which rose varieties are better suited to propagation by cuttings, which varieties have a higher rooting tendency, and to what extent the rooting could be influenced by rooting hormones [Incit-8 (0.8% of 1-Naphthaleneacetic acid) and Radi-Stim®]. From our results, it could be determined that the Incit-8 positively influenced the number of roots of all varieties. In conclusion, our research suggests that the rooting hormones increase the rooting of the rose varieties; moreover, that proper rooting could also be depending on the appropriate conditions.

Keywords: cuttings, rooting hormones, rose, varieties, vegetative propagation

1. Introduction

Roses have been known worldwide for centuries for their beautiful blooms, are commercially important shrubs [1], and can also have many landscaping uses: they can be placed as accent plants or used to form hedges or ground covers. Roses offer a rainbow of colours and a variety of forms and fragrances, and their sizes range from miniatures to tall climbing plants. Roses may be grown under many climatic and soil conditions, and, with care, they thrive and produce flowers for many years. Roses are one of the most admired ornamental plants worldwide, and, with the growing demand

for ornamental plants, prompt innovations are needed [2]. The nurseries need newer and quicker methods to obtain high-quality plants. Of course, tissue culture could be a successful propagation method; however, when acclimatizing them, only 50% of the seedlings survive [3]. Therefore, most of the nurseries are opting for vegetative propagation, and in order to promote root initiation, rooting hormones are used [4].

Root growth and differentiation in plants are closely related to plant hormones [5]. Furthermore, root formation can also be influenced by environmental factors, nutritional levels of the mother plant, rooting medium, cutting type, and the treatment [6]. Hormones used in the propagation stage could reduce propagation time and improve the percentage of rooting [7]. Plant hormones are substances naturally processed by plants, which can control root growth, plant growth, and even fruit maturation [8, 9]. Adventitious root formation is a crucial process for the successful vegetative propagation of many species [10, 11]. According to [12], adventitious root formation in cuttings is a multiphase development process, as because of the wounding at the cutting site, that part of the plant is isolated from the resources and the signal is transmitted to the whole plant. Furthermore, it is also mentioned that adventitious root formation is a multifactorial response guiding the plant to produce new roots at the base of the cutting, and then a new autonomous plant is developed [13]. In previous studies, it has been mentioned that rooting hormones can be used to increase the rooting capacity of different varieties in a positive way and even to obtain a higher number of rooted cuttings in a shorter period of time [14–17].

The aim of the present study was to test the effect of two different rooting hormones (Incit–8 and Radi-Stim®) on seven rose varieties often used and much liked in Romania to determine which varieties are better suited to propagation by cuttings, which varieties have a higher rooting tendency, and whether the rooting could be influenced by rooting hormones.

2. Materials and methods

The experiment was conducted at Sapientia Hungarian University of Transylvania, Târgu-Mureş (46°31'17" N 24°35'54" E). The cuttings were collected with secateurs from the nursery of the local rose farm on 4 July. The cuttings were immediately transported to the experimental site to prevent desiccation. For each variety, 10 cuttings per replication were used, with three replications. Disease and pest-free propagation material was applied between 9 and 11 cm in length. The leaves from the lower part of the stem were removed. Two types of rooting hormones were used: Incit-8 contains 0.8% of 1-Naphthaleneacetic acid (AMVAC Chemical UK Ltd., Surrey, UK) and Radi-Stim®; unfortunately the product content of the latter is not revealed to the users (CCDB Bios, Cluj, Romania). The cuttings were constantly kept wet with an automatic humidifier in order to provide the 80–90% humidity. After the treatments were applied, the rose cuttings were placed into plastic trays filled

with perlite (granulation: 1–3 mm, density: 0.05 kg/L, and pH: 7–7.5) with a depth of 20 cm; to assess the differences between the varieties' cuttings, length (cm), cutting width (cm), root length (cm), and root number were determined on 22 August, after seven weeks. For each variety, 30 cuttings/treatment were immersed in Incit-8 and Radi-Stim®, and the stem cuttings without any treatment were considered the control.

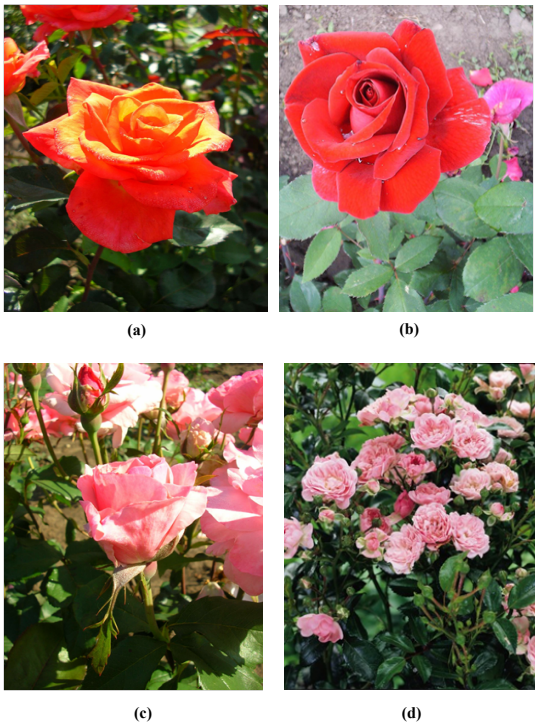


Figure 1. Selected rose varieties: 'Monika' (a), 'Mr. Lincoln' (b), 'Queen Elisabeth' (c), 'The Fairy' (d)

As plant material, the following seven varieties of roses were selected:

The 'Monika' (*Fig. 1a*) variety is characterized by a strong habit, the reddish branches break upwards. It can reach a height of 90 cm; on average, the shrubs have 40 cm in diameter. The branches are covered with a few thorns; the leaves are large, shiny, and dark green.

'Mr. Lincoln' (*Fig. 1b*) has a medium growth rate; the branches are straight and break upwards. It can reach a height of 80 cm. The shrub diameter is 45 cm on average, and the stem has many thorns. The leaves are matte dark green, and the flowers are dark red.

'Queen Elisabeth' (*Fig. 1c*) is a powerful, upright shrub, and the flowers grow high on long stems. It can reach a height of 140–180 cm; the flowers are full pink throughout the summer and the autumn.

'The Fairy' (*Fig. 1d*) is a densely branched variety with semi-double pale pink flowers. The flowers are rosette-shaped, with 25 petals.

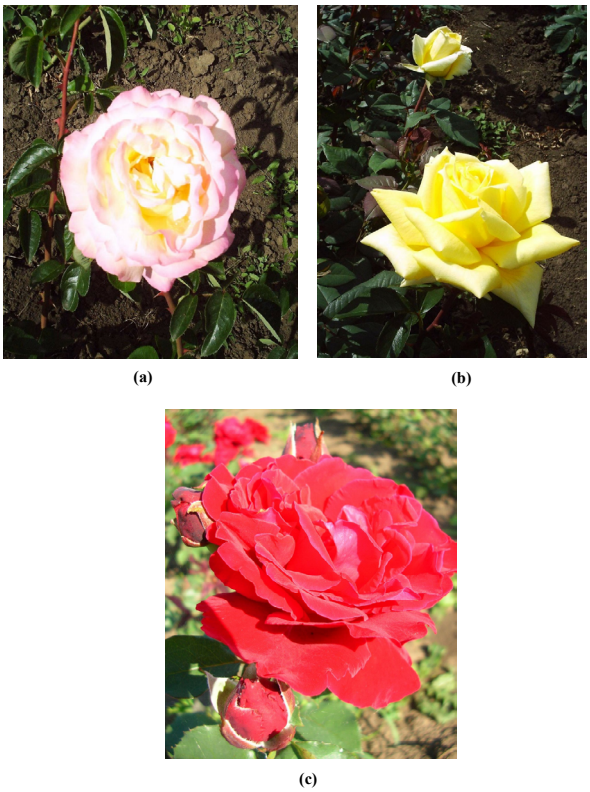


Figure 2. Selected rose varieties: 'Peace' (a), 'King's Ransom' (b), and 'Don Juan' (c)

The 'Peace' (*Fig. 2a*) variety can reach up to a height of 120 cm, with a flower diameter of 14 cm; its colour is a light, bright yellow with a reddish pink petal edge, and it is moderately fragrant. It has brownish-green, large, plate-like thorns and bright green, leathery foliage. It has a good resistance to frost and diseases.

The 'King's Ransom' (*Fig. 2b*) flower's diameter is approximately 13 cm, has a golden yellow colour with a pale-yellow streak, and is moderately fragrant. It blooms from mid-spring to mid-autumn. It has brownish-green, dense, recurved plate thorns. The leaves have a dark green shade, are leathery, oval, with a slightly serrated edge. Most specimens form their flowers on long shoots. It can reach a height of 80–90 cm.

The 'Don Juan' (*Fig. 2c*) variety can reach a height of 250 cm and has large thorns. It is characterized by a strong growth force, develops flowers on long shoots. The flowers' diameter is 10 cm, their colour is velvety, dark red, and it blooms from May until the frosts. The leaves are matte green.

The significance of the differences between the cuttings were tested by applying one-way ANOVA. When the ANOVA null hypothesis was rejected, Tukey's post-hoc test was carried out to establish the statistically significant differences at $p < 0.05$.

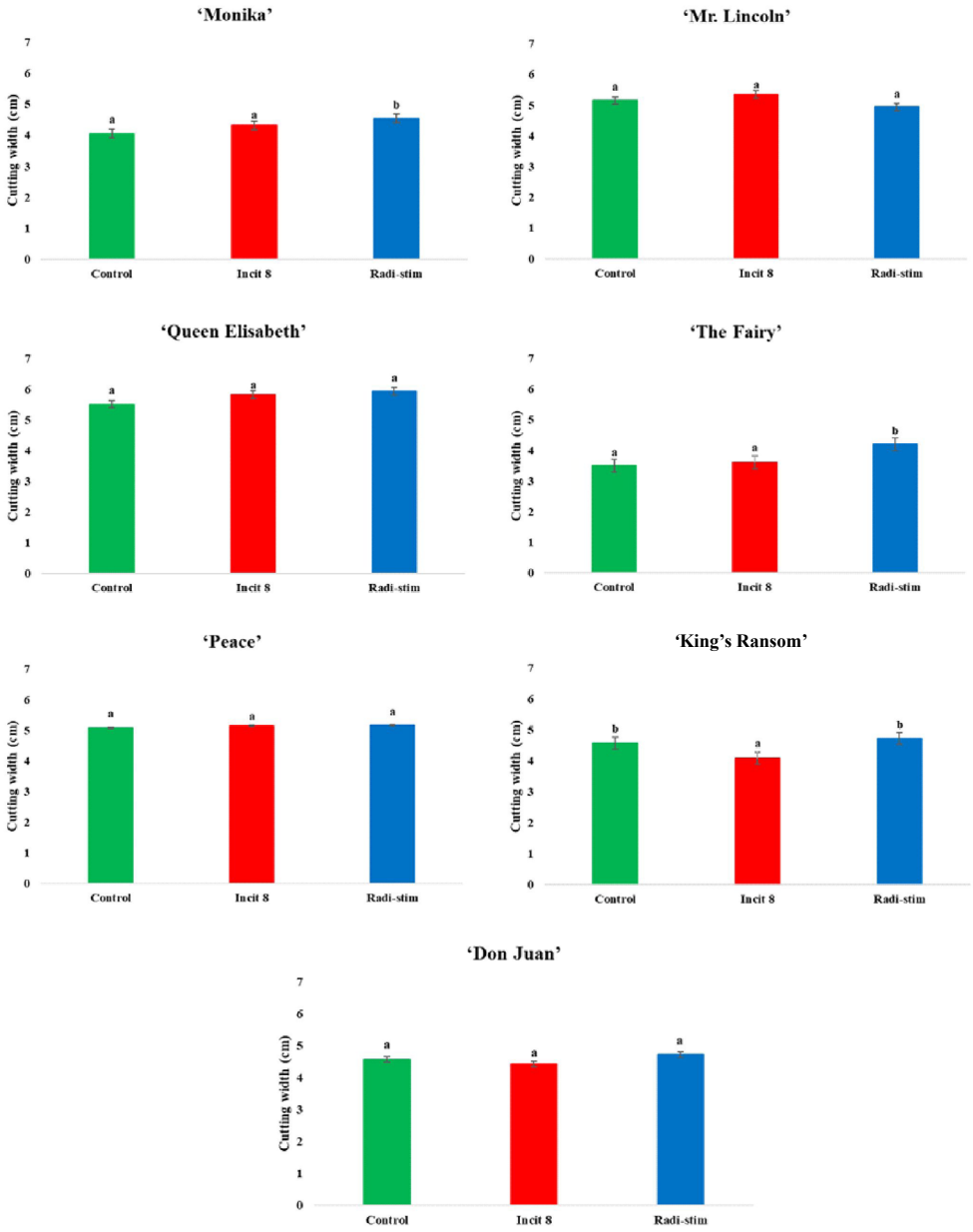
3. Results and discussions

Considering cutting width, the rooting hormone treatments influenced in different ways (*Fig. 3*). For the 'Monika' variety, a significant increase was determined at the cuttings treated with Radi-Stim® compared to the other two. Furthermore, with 'The Fairy' and 'King's Ransom', the same rooting hormone (Radi-Stim®) significantly influenced the cutting width; however, with the second variety mentioned above, the control and Radi-Stim® cutting width were similar, in this case decrease being reported at Incit-8 compared to the other two treatments. Regarding the other rose varieties ('Mr. Lincoln', 'Queen Elisabeth', 'Peace', and 'Don Juan'), the rooting hormones did not influence statistically the cutting width.

Under our experimental conditions, the cutting length was statistically significantly influenced in almost all cases (*Fig. 4*). In the case of 'Monika' Radi-Stim®, cutting length significantly increased. No significant differences were observed on 'Mr. Lincoln'. For 'Queen Elisabeth' and 'The Fairy', Incit-8 significantly increased cutting length. Further, for the 'Peace' variety, cutting length was increased under the Incit-8 treatment, however, not significantly compared to control, and a significant decrease was observed upon the Radi-Stim® treatment. Regarding 'King's Ransom' and 'Don Juan', a significant decrease was recorded on the cuttings treated with Incit-8.

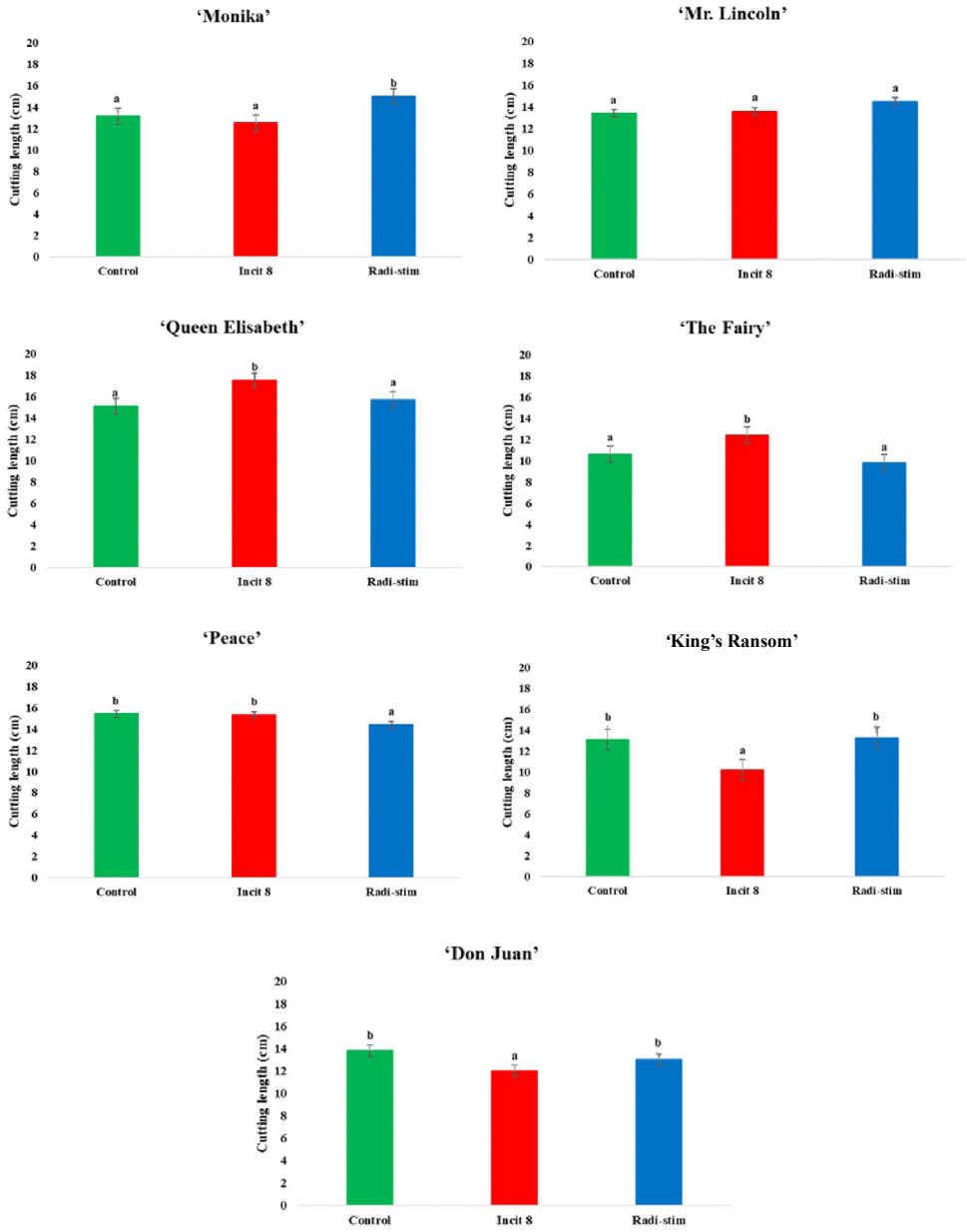
From our results, it could be clearly observed that the rooting hormones have had different effects on the rose varieties' root length (*Fig. 5*). No statistically significant differences were observed between 'Monika' and 'Don Juan'. A significant decrease was reported on the 'Mr. Lincoln' variety when the cuttings were treated with Radi-Stim®. In the case of 'Queen Elisabeth', 'The Fairy', and 'King's Ransom', Incit-8 positively influenced the root length, yielding statistically significant differences compared to the other two treatments. Furthermore, for the 'Peace' variety, both rooting hormones significantly increased the root length of the rose cuttings.

As expected from the previous results, the rooting hormones resulted in different influences on the rose varieties' root number (*Fig. 6*). In the case of 'Monika', 'Queen Elisabeth', and 'Don Juan', no statistically significant differences were determined when comparing the treatments. Additionally, for the 'Mr. Lincoln' variety, a significant increase was observed with Incit-8 compared to the other two treatments and a significant decrease when cuttings were treated with Radi-Stim®. In the case of the 'The Fairy', 'King's Ransom', and 'Peace', Incit-8 significantly increased the root number; moreover, for the 'Peace' variety, a significant increase was achieved with the Radi-Stim® treatment.



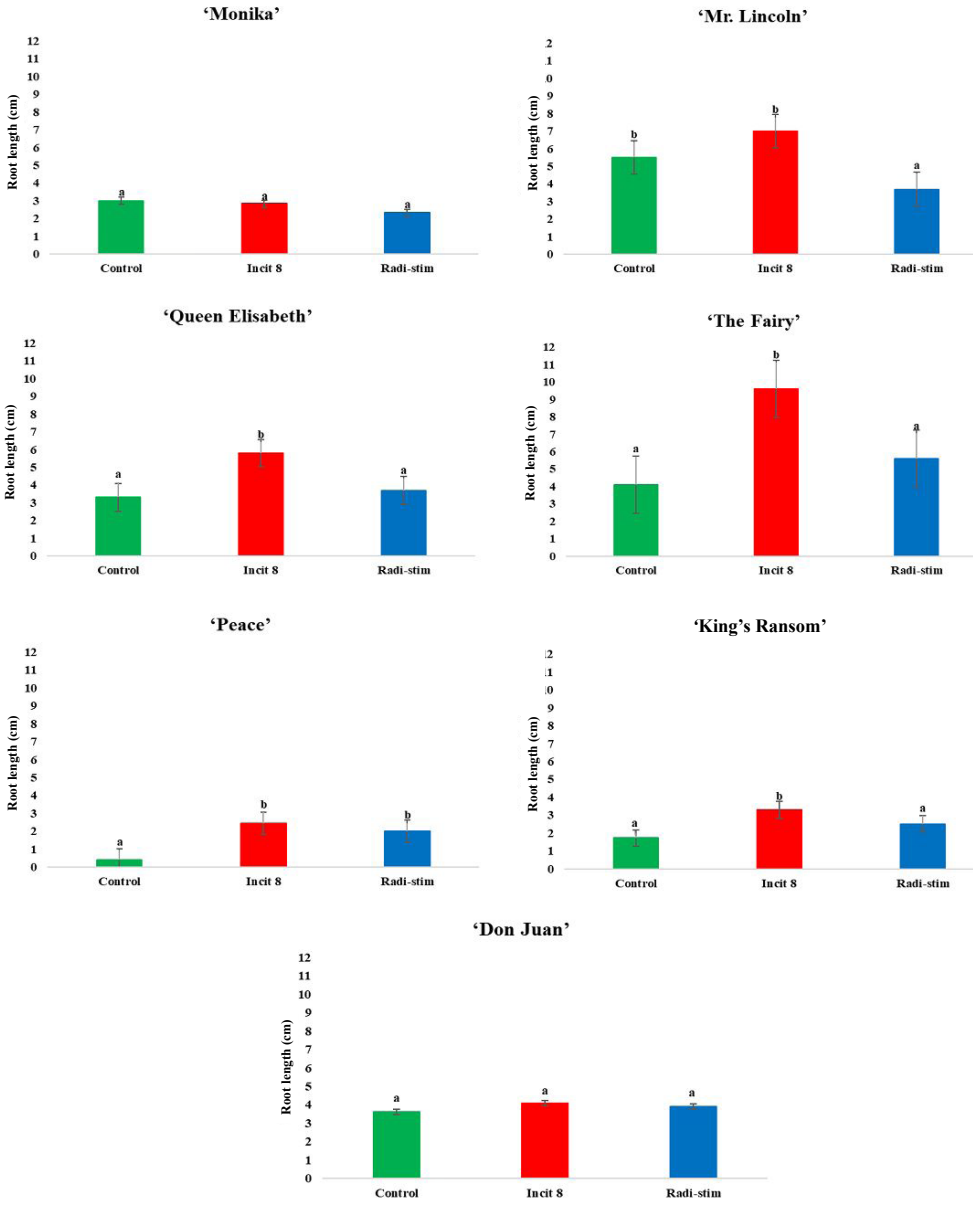
Note: Different letters above the bars indicate significant differences between the treatments.

Figure 3. The effect of the rooting hormones (Incit-8 and Radi-Stim®) on the selected rose varieties' cutting width (cm)



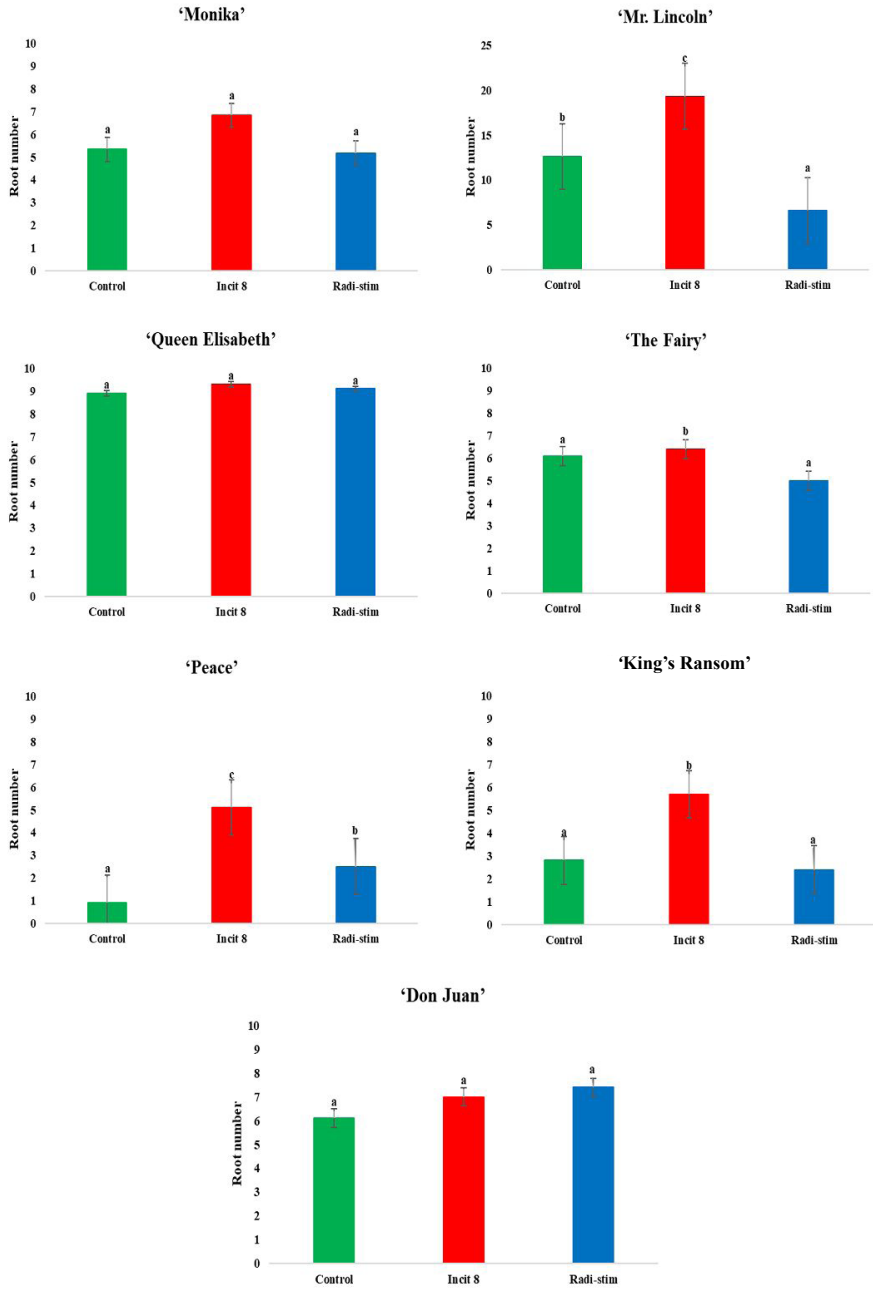
Note: Different letters above the bars indicate significant differences between the treatments.

Figure 4. The effect of the rooting hormones (Incit-8 and Radi-Stim®) on the selected rose varieties' cutting length (cm)



Note: Different letters above the bars indicate significant differences between the treatments.

Figure 5. The effect of the rooting hormones (Incit-8 and Radi-Stim®) on the selected rose varieties' root length (cm)



Note: Different letters above the bars indicate significant differences between the treatments.

Figure 6. The effect of the rooting hormones (Incit-8 and Radi-Stim®) on the selected rose varieties' root number

In a study, it was found that 75 ppm of indole-3-butyric acid recorded the greatest results in the number of leaves, shoot fresh weight, root length, and number of roots in the case of rose cuttings compared to the naphthaleneacetic acid [18]; however, the concentrations of the naphthaleneacetic acid used are lower than in our experiment. In another study, the highest percentage of rooted cuttings were reported upon propagating *Nerium odorum* with indole-3-butyric acid rooting hormone. [19] reported that when combining blue light with naphthaleneacetic acid treatment, rooting percentage was higher for *Chrysanthemum* cuttings. The highest rooting percentage of *Jasminum parkeri* was obtained at a concentration of 0.3% of naphthaleneacetic acid [17]. However, when *Hydrangea* 0.01% was combined with 0.01% of GA_3 [20] and in the case of *Ficus benjamina*, only 0.001% of naphthaleneacetic acid [21] improved rooting percentage.

4. Conclusions

From the present study, it could be concluded that rooting hormones can have a positive effect on the rooting of rose cuttings. However, it is important to mention that root formation can also be influenced by climatic conditions and can act as a variety-dependent factor. As a conclusion, the Incit-8 rooting hormone yielded better results than the Radi-Stim®.

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