Rooting of herbaceous minicuttings of different cultivars of peach rootstocks under the effect of IBA

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ABSTRACT

The use of sexually propagated rootstocks is a major problem for peach crops in Brazil due to lack of plant homogeneity, which affects orchard production and longevity. To tackle the heterogeneity problem, clonal propagation is a promising alternative for the production of quality seedlings. There are few rootstocks options available in Brazil for stone fruit, and research work in this area is relatively recent. Therefore, this study aimed at assessing the technical feasibility of the propagation of some peach cultivars such as Capdeboscq, Aldrighi, Nemared, Nemaguard and Flordaguard, through herbaceous minicuttings. In addition, different concentrations of IBA (0, 1.000, 2.000 and 3.000 mg L^{-1}) were tested. The minicuttings were immersed in a solution for five seconds and, then, placed in a SANPACK® hinged clear plastic package for food, with 10x13x20cmof height, width and length, respectively, containing medium vermiculite. The experiment was conducted with four replications of 20 minicuttings, and kept in a greenhouse. At day 60, the rooting percentage, number and average length of the three longest roots, number and length of the longest rooting, and number and length of the longest shoot were evaluated. After the rooting period, the greatest rooting percentage for Capdeboscq cultivar was observed, with 74 %, using IBA concentrations of 2.000 and 3.000 mgL^{-1}.

Key words: Propagation, minicuttings, phytohormone, homogeneity.

INTRODUCTION

One of the main problems that peach crop presents in Brazil is the lack of plants homogeneity, resulting from sexual propagation of rootstocks. In other countries, the reality is different, since, in the main producing areas of the world, seedlings obtainment is done with clones and/or selections of genetically stable cultivars that guarantee orchards uniformity, longevity and productivity (Loreti 2008).

Despite the remarkable advances obtained with the breeding of crown-cultivars, there are few researches on rootstocks due to the absence of a clonal cultivar for recommendation (Mayer et al., 2007). This situation is aggravated in the southern region of the country, where stones from different late maturing crown-cultivars, obtained from industries that process peach, are used, thus increasing rootstock genetic variability and vigor (Pereira and Mayer 2005).

In this context, vegetative propagation is very important to maintain the uniformity of the genetic material, ensuring plants uniformity. Among the methods of vegetative propagation, minicutting is an innovation of the conventional cutting that, in certain species, has enabled to increase productivity, uniformity and rooting percentage when specific nutritional and phytosanitary conditions are met (Titon et al., 2003). The low cost and the demand for small spaces are among its main advantages; in addition, it does not require an intermittent mist chamber, and, due to the small size of the minicuttings provides high yield per matrix plant.

Type of cutting is a factor that influences the rooting process directly, and for the vast majority of plants, herbaceous cuttings root easier than hardwood cuttings of the same species (Aguiar et al., 2005). Some techniques are necessary to try maximizing the rooting percentage of the herbaceous cutting, and the exogenous application of growth regulators is the most recommended (Tofanelli et al., 2002). Among them, an important role is assigned to auxin in the root formation process (Stefancic et al., 2005). The use of auxin to stimulate adventitious rooting of cuttings is a powerful tool for propagation of some species. When these compounds are used correctly, they tend to increase the percentage of cuttings that form roots, accelerate root initiation, increase the number and quality of roots produced per cutting, and increase the uniformity of rooting (Blazich 2001).

The indole butyric acid (IBA) is the most widely used and most efficient synthetic auxin in promoting rooting, and it is effective for a large number of plants. Since it is stable to photobleaching, immune to biological actions and has good capacity to promote rooting cuttings, the IBA has been used in several species, mainly with those with difficulty in emitting roots, thereby promoting cell differentiation to emit roots (Dutra et al., 2002).

In this context, the objective of this study was to determine the appropriate concentration of IBA for the rooting of herbaceous cuttings from different peach rootstocks, to enable the propagation of clonal peach rootstocks.

MATERIALS AND METHODS

The study was conducted in a greenhouse in the Department of Plant Science, (Eliseu Maciel Faculty of Agronomy / Federal University of Pelotas / Rio Grande do Sul). Herbaceous shoots of Capdeboscq, Aldrighi, Nemared, Nemaguard and Flordaguard peach cultivars rootstocks were collected from a matrix located in the Frutplan Mudas Ltda nursery seedlings, in Pelotas/RS, packed in Styrofoam boxes, moistened with water and transported to the experiment location.

Herbaceous cuttings, containing two yolks and a half leaf, were prepared by making a diagonal cut at the apex and a cross one at the base. With the aid of a utility knife, a superficial lesion was made on the base of the cuttings that, subsequently, were dipped for five seconds in an IBA solution (0, 1,000, 2,000 or 3,000mg.L^{-1}). Then, they were placed in transparent, hinged, SANPACK® food plastic packages with 10x13x20cmof height, width and length, respectively, containing expanded medium vermiculite, previously moistened with water. Three holes were made at the bottom of the package with a utility knife for excess water drainage. The procedure of water spray was done whenever necessary, leaving the boxes closed to prevent dehydration. Dead minicuttings were often taken out from the boxes to prevent contamination from the rest. Captan fungicide (3 g.$L^{-1}$of commercial product in water) was applied.

After 60 days from the installation, the percentage of rooting minicuttings, the number of roots per minicutting, the average length of the three longest roots, the number of shoots and the length of the largest shoot were evaluated.

A completely randomized, factorial 5x4 (cultivars x IBA concentrations) design, with four replications of 20 minicuttings, totaling 20 treatments, was adopted.

Data were submitted to an analysis of variance by the F test, and averages were compared through the Tukey test, at 5% probability level. Averages were subjected toa polynomial regression analysis and Pearson correlations between variables of interest, using the WINSTAT statistical program (Machado and Conceição 2007). Minicuttings percentage variables were transformed into an arcsin root (X/100).

RESULTS AND DISCUSSION

In the Capdeboscq cultivar, the percentage of rooting minicuttings increased up to a concentration of 2.500 mg.L^{-1} of IBA, while in the Nemared cultivar, maximum effciency point occurred at 2.200 mg.L^{-1} of IBA. Timm et al. (2015a; 2015b) evaluated three peach rootstocks, including the Nemared and the Flordaguard, and found different results with the point of maximum effciency at concentrations of 1.590 and 1.660mg L^{-1} of IBA, respectively. By propagating Flordaguard and Nemared peach rootstocks using 2000 mg L^{-1} of IBA and vermiculite, the same authors found 63% and 58% of rooting, respectively. Okinawa evaluated semi-hardwood cuttings, Camolesi et al. (2007), and found that the point of maximum efficiency for rooting was at the concentration of 1.427mg.L^{-1}. However, Cardoso et al. (2011) found that the application of IBA at 2000 mg.L^{-1} was more efficient in 68% of the Okinawa peach cuttings rooting. After the maximum point of rooting, a reduction in the percentage of rooting minicuttings occurred, in both cultivars, probably due to the hytotoxic effect caused by the high concentration of IBA.

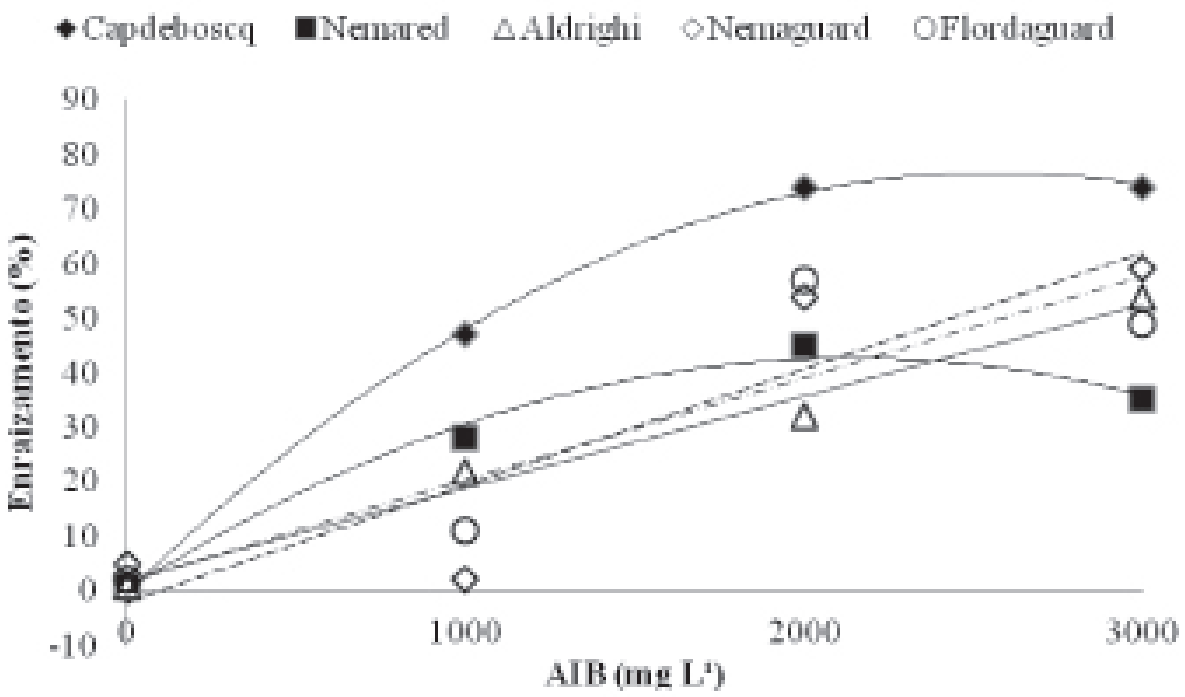
For the Aldrighi, Nemaguard and Flordaguard cultivars, there was an increased linear behavior, indicating that when the IBA concentration increases, there is an increment in rooting percentage. The rooting percentage among cultivars was different, showing that genetic characteristics affect minicuttings rooting capacity, as observed by Trevisan et al. (2000) and Oliveira et al. (2003).

For all tested cultivars, the percentages of rooting were very low when IBA was not used. With these results, it is clear that the levels of endogenous auxin present in the minicuttings of all cultivars were insufficient to promote rooting and the herbaceous type of material minicuttings (Figure 1).

An important aspect in studies of rooting refers to the joint analysis of number and length of roots variables since a cutting that produces a single long root or several roots of short length is not of practical interest. Therefore, a particular condition or treatment that results in a balance between these variables must be sought; in other words, a condition and treatment that result in a cutting that produces multiple roots with good growth, in a short period of time, to increase survival capacity and plant development after the period of root formation. These variables are parameters that indicate seedlings vigor and quality, as other authors have already observed, including Campos et al. (2005).

Pearson correlation coefficients between the average number and length of roots, and the number and length of shoots are shown in Table 1. Significant correlations were observed between number and length of roots variables; in other words, the more roots in the minicuttings, the greater their length. There was also a correlation between number and length of shoots.

Several studies have demonstrated the need for exogenous auxin application in peach cuttings to increase the percentage of rooting. The indole butyric acid (IBA) is a substance of synthetic origin, which was more efficient in promoting rooting (Fachinello et al., 2005). However, concentrations vary for each species or cultivar and for each type of cutting. While conducting a research on various peach, it has not yet been well defined the ideal concentration to increase rooting percentage.



Capdeboscqy= -0,12x² + 0,60x – 0,002 /R²=99,97
Aldrighiy= 0,17x + 0,02 /R²=98,23
Nemaredy = 0,09x² + 0,40x + 0,05 /R²=98,93
Nemaguardy = 0,21x – 0,02 /R²=81,45
Flordaguard y = 0,18x + 0,02 /R²=77, 24

Figure 1. Percentage of herbaceous minicuttings rooting of five peach rootstocks, treated with different concentrations of IBA, Pelotas, RS, 2010.

Table 1. Pearson correlation among root number and average length; number and length of shoots of five peach rootstocks, for different concentrations of IBA.

Correlation	Roots Number	Average Length	Shoots Number	Shoot Length
Roots Number	1	0.803054	0.29638	0.2387933
Average Length		1	0.0046819	0.1464282
Shoots Number			1	0.7995889
Shoot Length				1

CONCLUSIONS

The propagation of Capdeboscq, Aldrighi, Nemared, Nemaguard and Flordaguard cultivars by herbaceous minicuttings is technically possible.

The application of IBA is critical to obtain peach rootstocks. The concentrations of 2.000 and 3.000 mg.L^{-1} of IBA provided the best results in herbaceous minicuttings rooting.

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Figure 2. Minicuttings placed to take root in plastic packaging.

Figure 3. Minicuttings Flordaguard.

Figure 4. Minicuttings Nemarguard.

Figure 5. Minicuttings Capdeboscq.

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