Short communication

Rooting potential of grapevine rootstocks cuttings

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ABSTRACT

The objective of this work was to evaluate the rooting potential and propagation of seventeen grapevinevine rootstocks. The experiment was carried out in the municipality of Canoinhas - Santa Catarina, in 2018 and 2019. Woody canes from the grapevine rootstocks 99R, 110R, 420 A Mgt, 101-14 Mgt, IAC 766, IAC 313, IAC 572, Courdec 3309, Freedom, Gravesac, Harmony, Kober 5BB, Paulsen 1103, Salt Creek, Solferino, SO4 and VR043-43 were collected during dormancy period. After 45 days of the experiment installation, parameters considered as quality indicators were evaluated: percentage of rooting; average number and length of roots, number of leaves and length of branches. The results obtained were subjected to analysis of variance, and the means were grouped using the Scott-Knott test at 5% probability. The rootstocks showed different rooting behaviors, and it is concluded that 101-14 Mgt, IAC 572, Courdec 3309, Freedom, Gravesac, Harmony and Paulsen 1103 have greater rooting and propagation potential. While 110 R, 420 A Mgt and VR 043-43 present difficulties in propagation, due to low rooting, low number of roots and low average length of roots, requiring the use of exogenous auxin, in order to increase rooting rates.

Keywords: viticulture; vegetative propagation; root development.

INTRODUCTION

The choice of grapevine rootstock is based on characteristics such as resistance to pests and diseases, soil characteristics, scion variety and cultivation conditions (Miele *et al*., 2009). Besides these characteristics, rootstocks have different influences on canopy vigor and development, this factor is also determinant for their choice according to the production objective (Santarosa *et al*., 2016).

The formation of grapevine rootstocks is done through cuttings, where canes are used to form the roots. The ability to form roots from cuttings depends on different factors, such genetic, nutritional balance, physiological conditions of the mother plant, multiplication time, endogenous hormonal balance, among others (Kraiem *et al*., 2010; Bettoni *et al.*, 2014).

Although studies have shown that there is no difficulty to produce rootstocks with rooting woody cuttings (Tecchio *et al*., 2007), there are cultivars, like *V. rotundifolia* hybrids, that, when propagated by this method, have low rooting capacity, which can become a barrier for large-scale nurseries (Brend *et al*., 2007).

Seeking to understand the behavior of different rootstocks in relation to cut rooting, the objective of this work was to evaluate the rooting potential in the propagation of seventeen grapevine rootstocks recommended for use in Brazil.

MATERIAIS AND METHODS

The present work was carried out in the municipality of Canoinhas - Santa Catarina, in 2018 and 2019. Woody canes from rootstocks 99R, 110R, 420 A Mgt, 101-14 Mgt, IAC 766, IAC 313, IAC 572, Courdec 3309, Freedom, Gravesac, Harmony, Kober 5BB, Paulsen 1103, Salt Creek, Solferino, SO4 and VR043-43 were collected during the dormancy period (July), from plants kept in the collection of Embrapa Clima Temperado - Canoinhas Experimental Station - Santa Catarina.

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The plant material was prepared according the methodology described by Bettoni *et al*. (2015), in which the canes were segmented on cuttings with approximately 30 cm in length, then those with 8 to 10 mm in diameter were selected. At the base of each cane, a transversal cut was made, 0.5 cm below the last bud, and at the apex of the cane, the cut was made in bevel, 3 cm above the last bud.

The cuttings were then kept in a cooling chamber, with an average temperature of 3 ± 1 ºC, for 20 days. After this period, the vegetative material was prepared in a greenhouse, at the experimental area of Santa Catarina Federal Institute - Campus Canoinhas, in a randomized block design, with four blocks and 50 cuttings of each repetition, totaling 200 cuttings per rootstock.

The cuttings were planted in Styrofoam trays containing substrate and sand, the cuttings were buried below the basal node. After 45 days of experiment installation, parameters considered as propagation quality indicators were evaluated: rooting percentage (cuttings that presented at least one root); root number and average root length (cm). In addition to the rooting-related assessments, number of leaves and shoot length (cm) of woody cuttings from seventeen grapevine rootstocks were evaluated.

The results obtained were subjected to analysis of variance, and the means were grouped using the Scott-Knott test, at 5% probability, using the Sisvar 4.1 (Ferreira, 2011). Data transformation was performed according to $\sqrt{x}/100$ for rooting percentage values.

RESULTS AND DISCUSSION

In Table 1 are found data related to rooting index, root number and average length of roots, statistically significant differences were observed for these variables in relation to the seventeen evaluated rootstocks, in both years. For rooting (%) higher values were found for the rootstocks 101-14 Mgt, IAC 572, Courdec 3309, Freedom, Gravesac, Harmony and Paulsen 1103, with values higher than 85% of rooting, in 2018 and 2019. However, the rootstocks 110 R, 420 A Mgt and VR 043-43 have the lowest rooting values, with values below 30%.

Studies carried out by Regina *et al*. (2012) show that Paulsen 1103 is easily rooted. In general, there is no difficulty in root cuttings for the production of grapevine rootstocks, when propagated by wood cuttings (Tecchio *et al*., 2007). However, rootstocks originated from *V. rotundifolia* hybrids like VR043-43 (*Vitis vinifera x V. rotundifolia*) require the application of 1,000 to 3,000 mg L^{-1} of indole-3-butyric acid (IBA) for rooting and multiplication of cuttings (Salibe *et al*., 2010; Bettoni *et al*., 2015). The IBA is one of the most used growth regulators for rooting, because even in high concentrations it is not toxic, in addition it is effective for several species (Blythe *et al*., 2007). Besides the use of IBA,

Table 1: Rooting index (%), root number (root per cutting) and average root length (cm) of woody cuttings from seventeen grapevine rootstocks. Canoinhas - Santa Catarina, 2018 and 2019

Rootstock	Rooting (%)		Root Number (root per cutting)		Average Root Length (cm)	
	2018	2019	2018	2019	2018	2019
99 R	58.1 d	60.8 c	7.9 f	10.8 e	2.8 e	3.4 e
110 R	30.5 f	12.4 e	1.3 h	0.8 g	1.4 f	0.4 f
420 A Mgt	20.1 g	10.8 e	1.8 h	0.4 g	1.5 f	0.7 f
101-14 Mgt	92.5 a	97.5 a	28.9 a	38.7 a	9.1 a	10.1 a
IAC 766	60.5 d	54.1 d	6.5 f	7.4 e	4.4 d	4.5 d
IAC 313	66.2 d	73.3 c	9.3 e	13.0 d	6.9 c	7.1 b
IAC 572	95.8 a	88.2 b	12.8 d	13.6 d	6.9 c	7.4 b
Courdec 3309	92.5 a	97.5 a	24.3 a	20.9 c	7.9 b	9.1 a
Freedom	85.6 b	94.1 a	17.3 c	22.4 c	8.7 a	9.9 a
Gravesac	98.1 a	94.9 a	22.1 b	30.5 b	10.1 a	9.2 a
Harmony	98.9 a	100.0 a	26.9 a	32.8 b	9.8 a	9.1 a
Kobber 5BB	71.1 c	65.7 c	12.2 d	7.9 e	6.5 c	4.4 d
Paulsen 1103	90.2 a	85.2 b	17.1 c	15.3 d	6.6 c	5.6 c
Salt Creek	52.6 e	49.9 d	4.2 g	5.2 f	2.9 e	3.1 e
Solferino	64.6 d	52.4 d	7.8 f	4.0 f	4.1 d	3.6 e
SO4	65.2 d	62.0 c	13.5 d	12.9 d	7.5 b	7.4 b
VR 043-43	20.2 g	9.1 e	1.8 h	0.1 g	2.2 e	0.2 f
Average	54.1	65.1	12.7	13.3	5.3	5.3
CV (%)	11.6	11.2	23.8	22.1	18.5	15.6

*Averages followed by the same letter, in the column, belong to the same group by Scott Knott test at 5% probability.

Bettoni *et al*. (2014) recommends for woody cuttings, that lesions should bem ade at cuttings base.

For root number, it was observed that rootstocks that provided high rates of rooting also resulted in a greater number of roots per cutting (Table 1). The highest number of roots per cutting was observed in the rootstocks 101-14 Mgt, Couderc 3309, Gravesac and Harmony, with values higher than 20 roots per cutting. The rootstocks 110 R, 420 A Mgt and VR 043-43 have the lowest values for root number, with values from 1.3 to 1.8 roots per cutting in 2018, and values from 0.1 to 0.8 roots per cutting in 2019.

The rootstocks 101-14 Mgt, Couderc 3309, Freedom, Gravesac and Harmony showed higher average root length, with values between 7.9 to 10.1 cm. While the rootstocks 110 R, 420 A Mgt and VR 043-43, presented lower average root length, with values between 1.4 to 2.2 cm and 0.2 to 0.7 cm, in 2018 and 2019 respectively, these three rootstocks also present less rooting percentage, fewer and shorter roots. In a previous work made by Regina *et al*. (2012), they indicate that the rooststock 420 A Mgt was not indicated for the production of grapevine rooted cuttings by the table grafting technique, in addition the authors also indicated low rooting potential of this rootstock.

It is noteworthy that all cuttings of the seventeen rootstocks were kept in cold. Cold conservation of cuttings is considered, according to Pires & Biasi (2003), a process to overcome dormancy and increase the rooting, acting in overcoming inhibitory substances and increasing auxinic activity.

Variables related to vegetative growth were also evaluated, like number of leaves per cutting and shoot length (cm), as shown in Table 2. In both years, the rootstocks 101-14 Mgt, Freedom and Harmony presented the higher number of leaves; it should be noted that these three rootstocks presented, as shown in Table 1, the highest rates of rooting, root number and average length of roots. The rootstocks 420 A Mgt, Solferino and SO4 present the lowest observed values for number of leaves. Of these three rootstocks, only 420 AMgt had low rooting rates, while Solferino and SO4 had a median rooting potential, in this case it wasn't found relation with root number and number of leaves.

Even though graft sprouting is more related to starch reserve in the cuttings (Regina *et al.*, 2012), according to Albuquerque & Dechen (2000), the greater development of root system promotes greater absorption of water and nutrients, as a result, greater growth of aerial part occurs.

For shoot length, higher values were observed for rootstocks 101-14 Mgt, IAC 572 and Freedom, with values ranging from 5.0 to 7.1 cm, in the two evaluated years. While the rootstocks 99R, 110 R, 420 A Mgt, IAC 766, Salt Creek, Solferino and VR 043-43 showed lower values for shoot length, with values ranging from 3.1 to 4.6 cm. It is

Table 2: Number of leaves (leaves per cutting) and shoot length (cm) of woody cuttings from seventeen grapevine rootstocks. Canoinhas - Santa Catarina, 2018 and 2019

Rootstock	Number of leaves (leaves per cutting)		Shoot Length (cm)	
	2018	2019	2018	2019
99 R	5.1 e	4.5 e	3.5 e	3.1 d
110 R	5.3 e	4.2 f	3.6 e	3.2 d
420 A Mgt	3.5 h	3.2 g	3.2 f	3.6 d
101-14 Mgt	9.2 a	8.3 b	5.9 b	6.2 a
IAC 766	4.5 f	4.0 f	3.3 f	3.1 d
IAC 313	6.6 d	5.8 d	4.6 d	4.5 b
IAC 572	6.5 d	5.5 d	6.9 a	6.4 a
Courdec 3309	8.8 b	7.9 b	4.6 d	4.2 c
Freedom	10.1 a	9.5 a	7.1 a	5.0 b
Gravesac	7.5 c	6.9 c	5.3 c	4.7 b
Harmony	10.3 a	9.6 a	5.1 c	4.7 b
Kobber 5BB	4.6 f	3.9 f	4.9 c	4.8 b
Paulsen 1103	6.5 d	5.3 d	4.9 c	4.3 b
Salt Creek	4.4 f	4.7 e	3.8 e	3.5 d
Solferino	3.8 g	3.5 g	4.6 d	4.5 b
SO4	3.9 g	2.7 h	3.5 e	4.0 c
VR 043-43	4.1 g	5.1 d	3.8 e	3.5 d
Average	5.6	5.5	4.6	4.3
CV (%)	9.5	10.6	11.8	11.1

*Averages followed by the same letter, in the column, belong to the same group by Scott Knott test at 5% probability.

important to note that among the variables evaluated, shoot length showed less variation and difference between rootstocks, regardless of the rooting rates observed between them.

In a previous work, Dalbó & Feldberg (2019) found that IAC 572 was the rootstock that induced the highest vigor to the canopy, while 99 R, induced the lowest vigor. Those results corroborate with the data found in the present work, it was observed longer shoot length for IAC 572 and a reduced number of leaves and shoot length for 99 R. The higher canopy vigor induced by IAC rootstocks series, particularly by IAC 572, had already been observed in other studies (Dalbó *et al*., 2011).

Studies related to the rooting potential are essential, according to Broetto *et al*. (2011), one of the primary factors in rootstock indication for a given region is the capacity for root and vegetative development, having a direct influence on canopy vigor and productivity.

CONCLUSIONS

The rootstocks present different rooting behaviors, and it is concluded that 101-14 Mgt, IAC 572, Courdec 3309, Freedom, Gravesac, Harmony and Paulsen 1103 have greater rooting and propagation potential.

110 R, 420 A Mgt and VR 043-43 present difficulties in propagation, due to low rooting, low number of roots and low average length of roots; requiring other techniques, in order to increase rooting rates.

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