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STUDIUL REPARTIȚIEI SISTEMULUI RADICULAR LA PATRU PORTALTOI DE PRUN ÎN FUNCȚIE DE DIAMETRUL RĂDĂCINILOR ȘI DISTANȚA DE LA TRUNCHIUL POMULUI

STUDY OF THE DISTRIBUTION OF ROOT SYSTEM AT FOUR PLUM ROOTSTOCKS DEPENDING ON THE ROOT DIAMETER AND DISTANCE FROM THE PLUM TRUNK

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Abstract

This paper presents the distribution of the root system at the 'Tita' plum variety, in the central area of Oltenia, depending on the thickness of the roots and the depth intervals. Thus, in 2018, within a plantation near the city of Craiova, was studied the variety of plum 'Tita', grafted on 4 rootstocks – 'Oteşani 8', 'Pixy', 'Miroval', 'Roşior văratic'. According to the profile method, we followed the distribution method of the root system of the variety studied at the 4 resulted scion/rootstock combinations. Of the 4 rootstocks analyzed, the smallest number of roots recorded at 1 and 2 m from the tree trunk and at a depth of 1 m was found at the 'Oteşani 8' rootstock, which reached 60 (100%), followed by the Pixy rootstocks with 133 roots (155%) and 'Roşior văratic' with 135 roots (157%), and the largest number of 192 roots (223%) was registered at the 'Miroval' rootstock. These different values of the root systems of the 4 rootstocks also require a differentiation of the planting distances of the trees depending on the rootstock used. Of the 4 rootstocks analyzed, a more obvious differentiation of the number of thin roots that were confined on the depth of 0-60 cm was recorded at the 'Miroval' rootstock, especially at a distance of 1 m from the tree trunk.

Cuvinte cheie: soi, altoi, portaltoi, rădăcină.
Key words: variety, scion, rootstock, root.

1. Introduction

Being a more rustic species, with lower claims to environmental conditions, the plum has spread on all meridians; and the constant emergence of new creations requires their study, adaptation of technologies, promotion of the most valuable varieties, keeping pace with the world technical-scientific progress (Cichi M., 2008).

Botu M. et al. (2017), studying the behavior of 5 European varieties of plum, grafted on two rootstocks, during a period of 11 years, found that the grafted varieties on the rootstocks 'Oteşani 8' recorded a lower growth vigour, respectively a volume of the crown smaller, compared to the same varieties grafted on the yellow 'Mirobalan' rootstock.

Following the behavior of the scion/rootstock depending on the soil type, Botu I. and Achim Gh. (2004), found that it has a major influence on the fruit production, their quality, as well as the growth vigor.

Also, the rootstock is of great importance in the development of the phenophases, especially during the flowering, ripening of the fruit, growth and the end of the vegetation period (S. Cosmulescu et al., 2010).

2. Material and methods

In 2018, within a plum plantation established in the year 2000 near the city of Craiova, a study was carried out on the distribution of the root system to the 'Tita' plum variety, depending on the thickness of the roots and the depth intervals.

For a clearer highlighting of the effects of the factors investigated on the distribution of the number of roots, the following experimental scheme was used:

Factor A - type of rootstocks with 4 graduations: a1 – 'Oteşani 8'; a2 – 'Pixy'; a3 – 'Miroval'; a4 – 'Roşior văratic';

Factor B - distance from tree trunk (m), with 2 graduations: b1 - 1 m; b2 - 2 m;

Factor C - diameter of the roots (mm), with 3 graduations: c1 - 0-3 mm; c2 - 3-5 mm; c3 - greater than 5 mm.

The plantation was located on a poorly pseudogleised reddish preluvosol below 50 cm, baticalcaric (strongly decarbonated), generated by cover materials resulting by slope-disaggregation-alteration, having as subjacent rocks clays including loess layers, with weak acid reaction (pH: 5.50-6.64), humus content of 2.35% in the surface horizon, medium-coarse texture in the first two horizons and a medium to fine medium texture in the deep horizons. Increasing the percentage of clay at the B horizons (27.8% in the first horizon, slightly increasing to 34.7% in the Bt2 horizon) results in more intense processes of compaction and waterproofing, and which is why on this soil, seasonally, soil aeration deep works is recommended. The planting distance was 4m/4m, the crown form is constituted by the improved vessel, and the land was maintained in the form of a black field.

By means of the profile method (Oscamp-Dragavşev) the aim was to know the arrangement of the root system at the 'Tita' plum variety, grafted on the four rootstocks, both at a distance of 1 m from the trunk and at 2 m. Consequently, between trees in a row was made at a distance of 1m from the trunk, one slice 1m long, 1m wide and 1m deep (root counting was done on the wall towards the tree, every 10 cm, using a metric frame). The thickness categories that were followed are: 0-3 mm, 3-5 mm and over 5 mm.

3. Results and discussions

Of the four rootstocks analyzed, the smallest number of roots on the surface of $1m^2$ of the wall of the soil profile was registered at the 'Oteşani 8' rootstock, respectively 86 roots (100%). Compared to the values recorded at this rootstock, the number of roots at the 'Pixy' rootstock was 133 (155%), at the 'Roşior văratic' rootstock 135 (157%), and at the 'Miroval' rootstock 192 (223%) (Table 1).

Of the total number of roots recorded at a distance of 1 and 2 m from the tree trunk, the number of roots recorded at a distance of 1 m from the trunk at the 'Oteşani 8' rootstock was 6- (70%), at the 'Pixy' rootstock of 61 (46 %), at the 'Miroval' rootstock of 128 (66%) and at the 'Roşior văratic' rootstock of 77 (57%). The data above shows therefore that the 'Oteşani 8' and 'Miroval' rootstocks had a less extended root system on the lateral side than the 'Pixy' and 'Roşior văratic' rootstocks.

Analyzing the distribution according to the thickness of the roots, as it was natural, the largest number of roots was registered in the category of the thickness of the roots of 0 - 3 mm. Analyzing the share of the thinner roots (0 - 3 mm) recorded at the distance of 1 and 2 m from the trunk of the tree against the total number of roots, it is found that the highest percentages of the thin roots were recorded at the 'Miroval' and 'Roşior văratic' rootstocks. (98%), followed by the 'Pixy' rootstock (93%) and, in last place, with the lowest value, by 87% was the 'Oteşani 8' rootstock.

In the figure 2 and figure 3 are shown the distributions on the 0 - 100 cm depth of the thinner roots (0 - 3 mm) that have registered the largest number and which are also the most valuable in the processes of water absorption and nutrients. At both distances from the tree trunk, the largest number of thinner roots (0 - 3 mm) was recorded at 0 - 60 cm depth. Of the 4 rootstocks analyzed, a more obvious differentiation of the number of thin roots that were confined on the depth of 0-60 cm was recorded at the 'Miroval' rootstock, especially at a distance of 1 m from the tree trunk.

The smaller number of thin roots on the soil layer of 0 - 10 cm in all the 4 rootstocks analyzed could probably be explained, by destroying the roots of this layer by the works carried out to keep the soil clean of weeds.

The data presented above showed that at a distance of 2 m from the tree trunk, at the 4 rootstocks analyzed, over 30% and 54% of the total roots were recorded at a distance of 2 m from the trunk, which represents half the interval between the rows of both trees, as well as between 2 neighboring trees located on the same line. This means those 19 years after planting the trees, all the space allocated to the trees through the planting distances has been occupied with roots in a high proportion. The respective behavior implies that both the distribution of water by irrigation, as well as of the organic and mineral fertilizers in such plantations should be applied on the whole surface of the orchard.

The fact that most roots at all 4 rootstocks analyzed were located at a depth of 0 - 60 cm also shows that on soils similar to those experienced, it is necessary that mineral fertilizers with phosphorus and potassium, which have a very small displacement on the soil profile should be placed, from the beginning, during the preparation of the land, on the greatest possible depth, so that they can be used by the trees as efficiently as possible.

4. Conclusions

Of the 4 rootstocks analyzed, the smallest number of roots recorded at 1 and 2 m from the tree trunk and at a depth of 1 m was found at the 'Oteşani 8' rootstock, which reached 60 (100%), followed by the 'Pixy' rootstocks with 133 roots (155%) and 'Roşior văratic' with 135 roots (157%), and the largest number of 192 roots (223%) was registered at the 'Miroval' rootstock. These different values of the root systems of the 4 rootstocks also require a differentiation of the planting distances of the trees depending on the rootstock used.

The recording at a distance of 2 m (half of the interval between the rows of trees and that of 2 neighboring trees on the same row, a percentage of roots located between 30 and 54% of the total recorded roots at 1 and 2 m of trees, showed that 19 years after the planting of the trees, they were distributed in a large proportion throughout the entire area of the orchard. This distribution justifies the application of water by irrigation and of the organic and mineral fertilizers on the whole surface of the orchard.

The recording at the 4 rootstocks studied, at a distance of 1 and 2 m from the trunk of the tree and on the depth of 0 - 60 cm of a percentage of roots with a diameter of 0 - 3 mm that ranged between 78% ('Miroval') and 92% ('Oteşani 8') from the total number of roots recorded at a depth of 1 m, indicates that on soils similar to those experienced, the application of amendments and organic and mineral fertilizers with phosphorus and potassium, hardly miscible on the soil profile, should be applied on as deep as possible with the preparation of the land for planting trees. Also, when determining the quantities of water that is applied by irrigation, take into account the depth of 60 cm.

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Tables and Figures

Table 1. Influence of the rootstock on the number of roots on the depth of 1m depending on the distance from the tree trunk and the diameter of the roots

No	Rootstock	Distance from the trunk - m								Total no. of roots at 1 and 2 m from the trunk	
		1 m				2 m					
		Roots diameter – mm				Roots diameter – mm					
		0-3	3-5	>5	No. of roots at la 1 m	0-3	3-5	>5	No. of roots at 2 m	Absolute values (%)	Relative values (%)
1	Otești 8	55	2	3	60	24	1	1	26	86	100
2	Pixy	55	3	3	61	69	1	2	72	133	155
3	Miroval	119	1	8	128	59	5	0	64	192	223
4	Roșior văratic	75	0	2	77	57	1	0	58	135	157

Fig. 1. The root system at the 'Tita/Miroval' combination, at a distance of 2 m from the trunk

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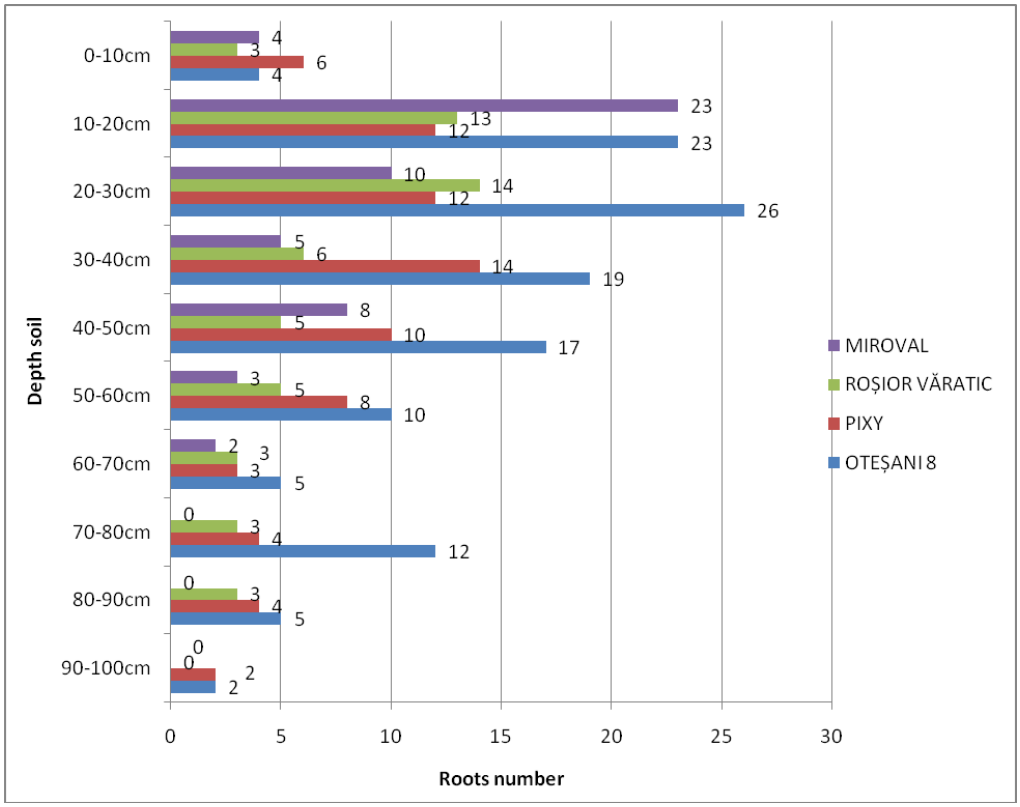

Fig. 2. Distribution on the depth and at a distance of 1 m from the tree trunk of the roots with the diameter between 0-3 mm at the 4 plum rootstocks studied

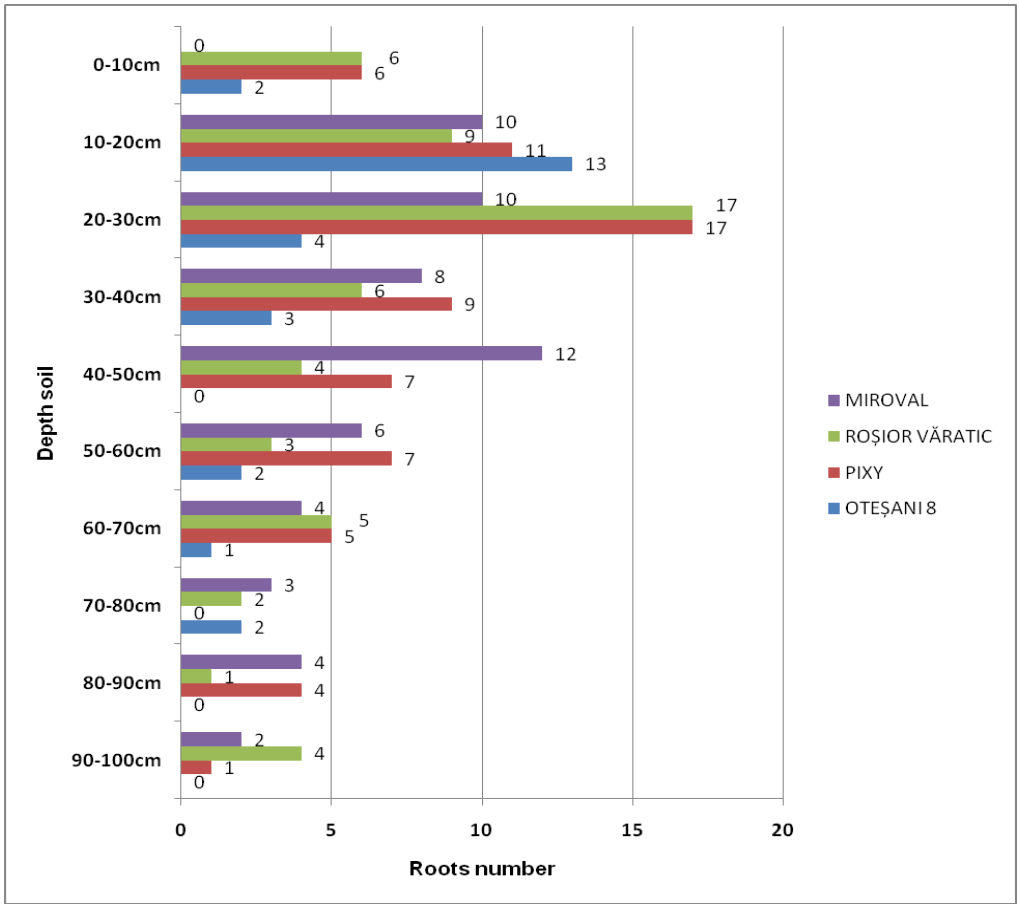

Fig. 3. Distribution on the depth and at a distance of 2 m from the tree trunk of the roots with the diameter between 0-3 mm at the 4 plum rootstocks studied