RESEARCH ON THE ROOT SYSTEM OF RED WINE VARIETIES GRAFTED ON VARIOUS ROOTSTOCKS IN COZMEŞTI VITICULTURAL CENTER OF HUŞI VINEYARD

CERCETĂRI ASUPRA SISTEMUL RADICULAR LA SOIURILE PENTRU VINURI ROŞII ALTOITE PE DIFERIŢI PORTALTOI, ÎN CENTRUL VITICOL COZMEŞTI - PODGORIA HUŞI

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Abstract. *Our research focuses on the Cabernet Sauvignon, Merlot and Fetească Neagră varieties grafted on 7 root stocks and selections of root stocks. We used the method of soil samples drawn from every 20 cm in depth, down to a total depth of 100 cm, of which we removed and weighed the roots. According to the data gathered, we proceeded to the graphical representation of the development of the root system.*
Key words: root system, root stocks, vineyard, Cozmeşti, Huşi

Rezumat. *Cercetările se referă la soiurile Cabernet Sauvignon, Merlot şi Fetească neagră, altoite pe 7 portaltoi şi selecţii de portaltoi. S-a folosit metoda de prelevare a straturilor de sol din 20 în 20 cm adâncime până la adâncimea totală de 100 cm, din care au fost separate şi cântărite rădăcinile. Pe baza datelor obţinute s-a procedat la reprezentarea grafică a dezvoltării sistemului radicular.*

The promotion of the red wine production directorate of Cozmeşti viticultural center of Huşi vineyard by SC Vinia SA Iaşi also had from the very beginning an experimental nature, namely that of determining the most adequate range of varieties and root stocks for that viticultural area, able to ensure good grapes production for high quality red wines. The first experiment results were published in 2004 and 2006 (D. Mursa et all.).

This paper shows the results of the research on the development of the root system of the Cabernet Sauvignon, Merlot and Fetească Neagră red wine varieties grafted on various root stocks, in the first 6 years after their plantation.

MATERIAL AND METHOD

The experimental plantations date back from 2000 and they are located in the Cozmeşti Farm of S.C. VINIA. Experimental varieties:

A. FETEASCĂ NEAGRĂ
- grafted on Berlandieri x Riparia, selection: Crăciunel – 26 (C 26);
- grafted on Berlandieri x Riparia, selection: Crăciunel – 71 (C 71);
- grafted on Berlandieri x Riparia, selection: Oppenheim – 4 (SO 4);
- grafted on Berlandieri x Rupestris, selection: Ruggeri – 140 (Ru 140);

B. CABERNET SAUVIGNON
- clone USA/grafted on Berlandieri x Riparia, selection: Crăciunel – 71 (C-71);
- clone USA/grafted on Berlandieri x Rupestris, selection: Paulssen 1103;
- clone 4 Iaşi/grafted on Berlandieri x Riparia, selection: Oppenheim 4 (SO_4);

- clone 4 Iaşi/grafted on Berlandieri x Rupestris, selection: Ruggeri – 140 (Ru 140);
- clone 7 Drăgăşani/grafted on Berlandieri x Riparia, selection: Crăciunel – 71 (C – 71)
- clone 7 Drăgăşani /grafted on Berlandieri x Riparia, selection: Oppenheim – 4
- clone 4 Valea Călugărească (SO_{4-4});

C. MERLOT
- clone Valea Călugărească / grafted on Berlandieri x Riparia, selection: Kober 5 BB;
- clone 8 Valea Călugărească / grafted on Berlandieri x Rupestris, selection: Ruggeri 140 (Ru 140);

The planting stock came from the experimental stations network. The land configuration is a gentle 6-7% slope, the soil is a fairly leached black earth turned before plantation at a depth of 60 cm. The vine rows are oriented on the direction of the level curves at a distance of 2,20 / 1.20 m.

Work method. We chose a medium-development vine of each variety and delineated the reserved nutrition area by the plantation distances: 2,20 x 1,20 m = 2.64 m^2.

Of the delineated nutrition area we dug out the soil layers together with the vine roots, every 20 cm, down to a total depth of 100 cm. We separated and weighed (table 1) the roots from every soil layer (horizon). Based on the weight of the roots from every soil layer, we proceeded to the graphical representation of the development architecture of the root system (charts 1,2,3).

Finally, the total weight of the roots was compared to the soil volume exploited by the vine root system, down to the depth of 1 m (2,640 m2 x 1 m = 2.640 m3) and we were thus able to determine the development of the root system.

RESULTS AND INTERPRETATION

Grafted vine is a new biological entity resulting from the association of the *Vinifera* grape-bearing vine variety with the root stock (American vine species), meant to fight indirectly phylloxera attacks. The two symbiosis products keep their biological characteristics, as the root system of the root stock is under the influence of the grape-bearing vine variety. This influence does not alter the architecture of the root system, however it influences the development of the roots. Hence, the root mass exploring the soil horizons is different, depending on the association by grafting of the grape-bearing vine variety with the root stock vines (table 1).

Table no. 1

Root weights on soil horizons

Variety / root stock	Soil horizon depths:										Total root weight (g)
	0 – 20 cm		20 – 40 cm		40 – 60 cm		60 – 80 cm		80 100 cm		
	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	
Fetească neagră / SO4	155	11	650	43	365	26	180	13	100	7	1405
Fetească neagră / Ru 140	85	7	420	33	425	34	195	15	135	11	1260
Fetească neagră / C26	150	8	400	22	985	54	220	12	70	4	1825

Fetească neagră / C71	160	11	470	32	675	46	110	8	35	3	1430
Cabernet Sauvignon clone USA / Paulsen 1103	60	6	265	25	545	52	120	12	55	5	1045
Cabernet Sauvignon clone USA / C71	70	11	145	23	295	47	85	14	30	5	625
Cabernet Sauvignon clone 4-ls / Ru 140	40	7	215	37	195	34	85	15	45	7	580
Cabernet Sauvignon clone 4-ls / SO4	75	11	285	42	190	26	95	13	55	8	680
Cabernet Sauvignon clone 7-Dg / SO 4-4	65	5	250	23	530	51	195	17	45	4	1025
Cabernet Sauvignon clone 7-Dg / C71	135	14	315	34	345	37	110	12	30	3	935
Merlot clone 8-VI / K5BB	55	7	450	53	200	24	85	10	50	6	840
Merlot clone 8-VI / Ru 140	50	4	300	26	580	51	140	13	65	6	1135

Fetească neagră grafted on various root stocks (chart no. 1). Researches pointed out the following:

- the most powerful root system is developed by the Fetească neagră variety grafted on the Berlandieri x Riparia Crăciunel 26 and 71 root stock sections. The total weight of the roots, in the first 6 years after plantation, on a depth of 1 m, is 1825 g on the C-26 root stock and 1430 g on the C-71 root stock;
- a less extended, yet deeper root system is developed on the Berlandieri x Riparia Oppenheim 4 selection root stock. The total weight of the roots is 1405 g and it explores the soil on a much higher depth than the C-26 and C-71 selections;
- the least extended root system is developed by the Berlandieri x Rupestris Ruggeri 140 selection root stock. The total weight of the roots is only 1260 g, however the root system is the deepest;
- the soil horizon where most of the roots grow is 40 to 60 cm deep. The exception is Fetească neagră grafted on the Oppenheim – 4 selection root stock, which also grows a large mass of roots in the soil horizon of 20 to 40 cm deep.

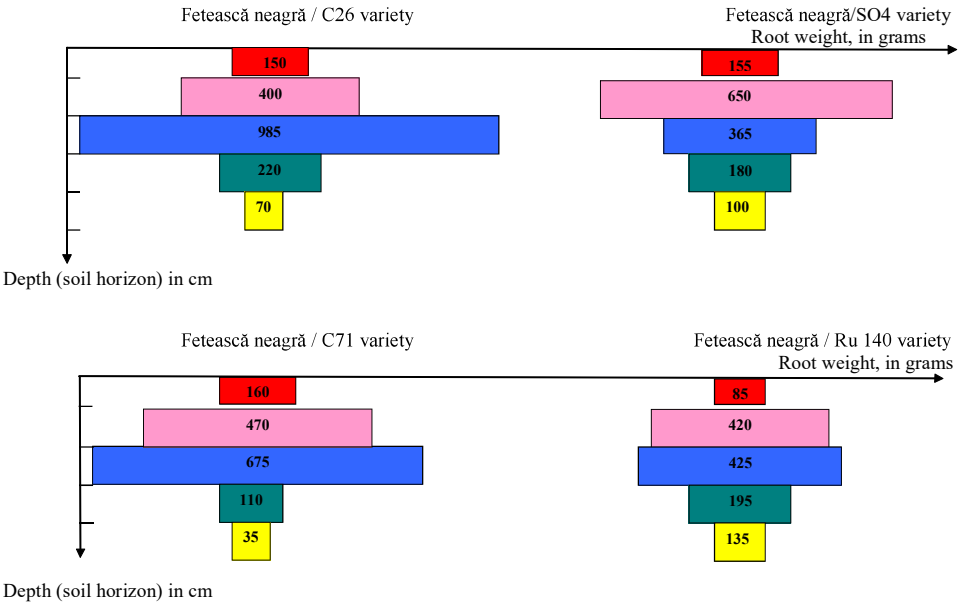

Chart no. 1 – Architecture of the root system of the Fetească neagră variety grafted on various root stocks

Cabernet Sauvignon grafted on various root stocks (chart no. 2). The study performed on the Cabernet Sauvignon clones grafted on a number of 6 root stocks showed the following:

- generally, the Cabernet Sauvignon variety, with less strength than the Fetească neagră variety, has a moderate induced influence on the development of the root system. The largest weight of the roots in the first 6 years after plantation, down to a depth of 1 m, is 1040 g on the Berlandieri x Rupestris Paulssen 1103 selection root stock and 1025 g on the Berlandieri x Riparia Oppenheim – 4 selection, clone 4 (SO_{4-4});

- the smallest root system is developed by the Cabernet Sauvignon 4 – Is clone variety, grafted on Berlandieri x Rupestris Ruggeri – 140 selection, in which the total root weight is only 500 g. In this root stock, root development on the whole is weaker in all the soil horizons;

- a deep root system is achieved in the Oppenheim – 4 and Paulssen – 1103 root stock selections, in which the root weight is large also at 100 cm deep;

- as regards the soil layers (horizons) where most roots grow, this is at 40 to 60 cm deep. The exception is the Oppenheim – 4 selection, which preserves the same superficial root system, at 20 to 40 cm deep, and has a large root weight;

- a strong root system with good representation in all the soil horizons is specific to the Cabernet Sauvignon variety grafted on Berlandieri x Rupestris, Paulssen – 1103 selection.

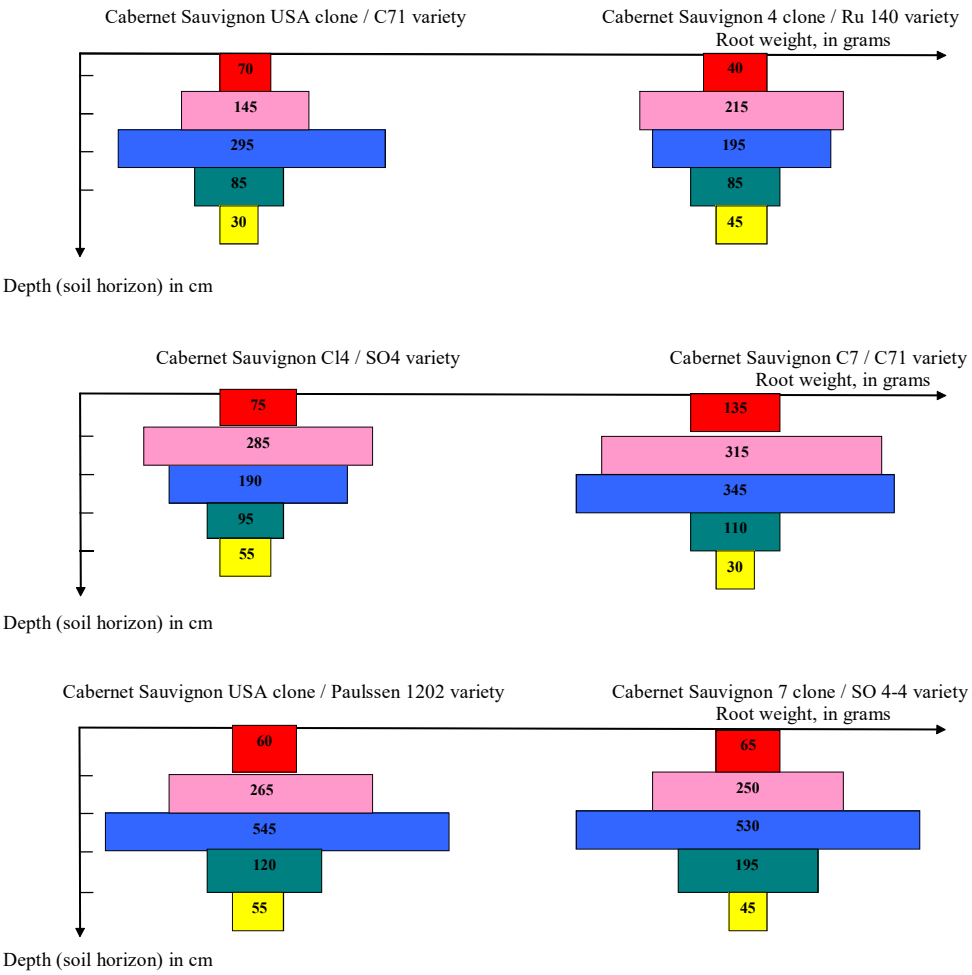

Chart no. 2 – Architecture of the root system of the Cabernet Sauvignon variety grafted on various root stocks

Merlot grafted on various root stocks (chart no. 3). We analyzed the development of the root system in the Merlot 8 – VI clone variety grafted on the Kober 5 BB and Ruggeri-140 root stocks. The findings were the following:

- the most powerful root system, in the first 6 years after plantation, is developed by the Merlot variety grafted on the Berlandieri x Rupestris, Ruggeri – 140 selection root stock, in which the total root weight is 1135 g. A deep root system with good representation in all the soil horizons, down to 100 cm, is developed;

- the Merlot variety grafted on Kober 5 BB grows a weak root system, as the total weight of the roots is only 840 g. Moreover, the root system is superficial, as it grows mainly in the 20 to 40 cm deep soil horizon;

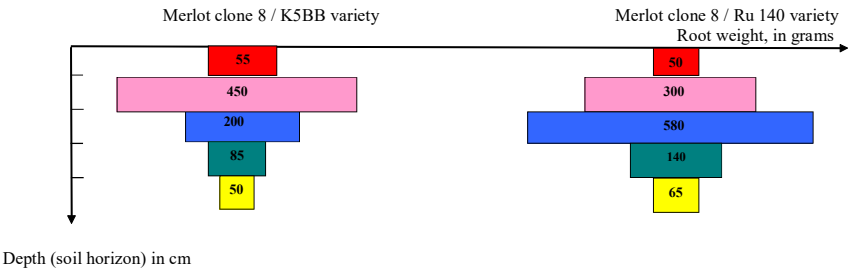

Chart no. 3 – Architecture of the root system of the Merlot variety grafted on various root stocks

OVERALL CONCLUSIONS

The following overall conclusions may be drawn of the experimental results obtained:

1. The root system of grafted vines preserve the biological characteristics of the root stocks, as the grape-bearing vine variety has an induced influence on root development.

2. Given the pedo-climate conditions of Cozmeşti viticultural center, Huşi vineyard, where pedological drought is frequent, grafted vines should grow a larger mass of roots, especially in the deeper (40 to 80 cm deep) soil horizons/layers.

3. The study performed showed that the red wine varieties grafted on Berlandieri x Rupestris root stock selections develop in the soil the most powerful and the deepest root system in the first 6 years after plantation. The Feteasc㠠neagră and Cabernet Sauvignon varieties grow a strong root system on the Berlandieri x Rupestris, Paulssen – 1103 selection root stock, and the Merlot variety on Berlandieri x Rupestris, Ruggeri – 140 selection.

REFERENCES

1. **Calistru Gh.,** 1978 – *Caracteristicile sistemului radicular al soiurilor vinifera din podgoriile vestice ale României*. Analele ICVV, vol.8.
2. **Climatico P., Carneiro C.L., Castro R., 1999** – *Influence du cepage et du porte-greffe sur les rendement et la qualite du mout.* Bull. OIV vol. 72/823-824, pp. 631-641.
3. **Mursa D.,** 2004 **–** *Comportarea soiurilor de viță de vie pentru vinuri roăii de calitate în centrul viticol Cozmeşti – podgoria Huşi.* Lucr. Şt. USAMV Iaşi, seria Horticultură, vol. 47, pp. 1399-1404.
4. **Mursa D**., **Țârdea C.,** 2006 – *Maturarea fenolică a strugurilor la soiurile pentru vinuri roşii altoite pe diferiți portaltoi, în centrul viticol Cozmeşti – podgoria Huşi*. Lucr. Şt. USAMV Iaşi, seria Horticultură, vol. 49, pp. 577-582.
5. **Perraud A.,** 1991 – *Essais de porte-greffes dans le vignoble champenois Epernay*. Rev. Vitis, vol. 3,
6. **Profir C.,** 1997 – *Studiul optimizării combinațiilor portaltoi – soi vinifera în podgoria Iaşi.* Teză de doctorat, USAMV Iaşi.
7. **Southye J.M., Archer E.,** 1988 – *The effect of rootstock cultivar on grapevine root distribution and density*. Rev. The Grapevine root and it's enviromend, 57-73, South Africa.
8. **Țârdea C., Rotaru Liliana,** 2003 – *Ampelografie vol. I (Ampelografia generală şi viețele portaltoi)*. Ed. Ion Ionescu de la Brad, Iaşi.