

Study of the Soil Quality in Radojinska Valley as a Major Factor in Raspberry Production

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Abstract: Radojinska valley has substantial soil areas which fulfil the conditions for intensive raspberry growing.

Since for this production optimal soil plots are 0.10-0.50 ha per household, it is recommended to set up raspberry plantings on homeyards, which are otherwise the most productive soils in this region.

Limiting factor for intensive raspberry production can be the occurrence of drought in summer months due to which it is important to provide necessary amounts of water for cane irrigation. This can be achieved in two ways: (1) by establishing plantings in the immediate vicinity of waterways and other water sources and (2) supplying the planting with water by some of the possible ways, since the costs in that case would be lower from the value of the increased yields.

Key words: humus, pH value, brown soils, smonitza, raspberry

Introduction

In recent decades of this century, there has been increasing interest of agricultural producers, enterprises and individuals from other fields of raspberry production, mainly due to two main reasons: (1) gaining profit for funds invested into production and (2) provision of currency necessary for the import of equipment, new technologies and reproduction material. Owing to the mentioned reasons, the renowned enterprise 'Zlatar-plast' from Nova Varoš in 1998 entrusted the authors of this paper with drawing up the programme for raspberry production in the Nova Varoš commune.

This paper presents the results of studying soil on selected plots with 36 agricultural producers from Radojinska valley (the villages of Vraneša, Radojina and Rutoši) who grow or plan to grow raspberry, as well as global estimation of other natural conditions relevant to raspberry production. Analyses were made of N, P₂O₅, K₂O and pH value contents of the soil. In addition, a global evaluation of other elements of production soil capacity (type, the depth of the upper layer of the soil profile, etc.). Finally, a comparison was made of the results obtained from the literature data, on the basis of which the evaluation of quality of this factor for raspberry production for each plot studied was given.

Material and methods

Radojinska valley is located in the mountainous part of south-western Serbia, 10-15 km north-west from Nova Varoš, at an altitude of 600-800 m. It is from lake origin and is greatly isolated from climatic-thermic influences of medium high mountains surrounding it (Tornik, Murtenica, Tikva and Crni Vrh). It is only partly open from the north-western side to the Lim river and the influence is of somewhat milder climate. The villages of Vraneša, Radojina and Rutoši, with some 800 agricultural households and about 4,000 ha of agricultural land are situated in the valley and its surroundings. Soil studies and other natural factors were carried out in July-October 1998 and 1999.

Studies of the humus content were carried out by the method of Kotzman, and that of nitrogen by the method of Kjeldahl, that of easily available phosphorus and potassium by the method of Egner-Reihm (P₂O₅ colorimetrically and K₂O by flame photometry), whereas pH soil value (in H₂O and nKCl) was determined by potentiometric method.

The other elements from which soil quality was assessed (the depth of the upper layer of the soil profile, soil type, mechanical composition and structure, water and air regime, etc.) were evaluated visually, i.e. by direct touring and study of each plot. The published literature data, as well as internal information from the enterprise of the Lim hydro-electric station were used for the estimation of climatic properties of the valley.

Results and discussion

The studies have shown the contents of major elements of soil fertility in 36 selected localities of Radojinska valley to be rather heterogenous (Tab.1). Humus content ranged from 3.55 to 5.45 (averaging 4.24%), that of N from 0.160 to 0.272%, P₂O₅ from 1.0 to 4.0, averaging 10.29 mg per 100 g dry soil, and K₂O from 10.0 to 40.0 (average 27.9 mg).

Results from Table 1 revealed great deviation in pH soil values between different localities. The values of pH in nKCl range from 4.2 units (locality 3) to 7.6 units (locality 27). Since it is known that raspberry growing is possible on mildly acid to neutral soil reaction, 9 localities can be singled out with pH in nKCl < 5.0 and 7 localities with pH in nKCl > 7.0, and which at the same time can

be considered unsuitable soils for raspberry. Other soils have appropriate acidity, which is one of main prerequisites for raspberry growing.

Table 1. Contents of major elements of soil fertility in the localities studied

Sample No.	PH		CaCO ₃ qualitative	Humus %	N %	mg/100 g soil	
	H ₂ O	nKCl				P ₂ O ₅	K ₂ O
1.	6.13	5.6	-	3.62	0.181	3.4	35.8
2.	5.93	5.2	-	4.21	0.210	1.0	16.2
3.	5.05	4.2	-	4.04	0.202	2.0	34.6
4.	7.00	6.7	+	5.06	0.253	>40.0	>40.0
5.	5.69	4.8	-	4.69	0.234	3.0	22.5
6.	5.52	4.8	-	4.29	0.214	1.1	27.4
7.	7.68	7.4	++	4.49	0.224	11.0	>40.0
8.	5.90	5.0	-	3.83	0.191	1.2	20.5
9.	5.69	4.7	-	4.07	0.203	0.9	11.0
10.	7.7	6.9	++	4.23	0.205	10.8	30.6
11.	6.5	5.7	-	4.65	0.232	>40.0	30.4
12.	7.57	4.8	-	4.28	0.214	2.0	20.0
13.	5.95	5.2	-	3.97	0.198	7.3	35.0
14.	5.98	4.9	-	3.93	0.196	1.2	18.1
15.	5.57	4.6	-	3.79	0.189	1.5	37.4
16.	6.31	5.4	-	4.04	0.202	2.5	33.6
17.	6.21	5.3	-	3.80	0.190	0.8	20.0
18.	6.62	5.8	-	4.40	0.220	6.0	30.6
19.	6.20	5.5	-	3.62	0.181	0.7	18.4
20.	7.94	7.3	++	4.66	0.233	14.1	>40.0
21.	7.35	6.6	+	3.67	0.183	2.6	18.1
22.	7.55	6.9	++	4.99	0.249	14.0	27.1
23.	6.77	5.6	-	4.44	0.222	1.4	16.4
24.	6.43	5.8	-	5.45	0.272	10.4	>40.0
25.	7.92	7.4	++	3.20	0.160	6.3	24.0
26.	7.91	7.3	++	4.63	0.231	15.0	39.0
27.	8.02	7.6	++	3.55	0.177	8.5	40.0
28.	6.56	6.3	+	4.05	0.202	9.6	>40.0
29.	5.55	4.5	+	4.88	0.244	6.6	>40.0
30.	6.52	5.4	-	3.80	0.190	0.7	22.4
31.	6.07	5.0	-	4.44	0.222	0.8	14.1
32.	7.44	6.4	+	4.11	0.205	14.6	19.6
33.	5.66	4.6	-	4.35	0.217	1.6	10.0
34.	6.07	4.6	-	3.64	0.182	0.9	18.8
35.	8.03	7.2	++	4.84	0.242	22.6	>40.0
36.	7.75	7.0	+	4.92	0.246	2.8	35.4

Humus content in all the plots studied ranged above 3.5% (except for the locality 25, where it amounts to 3.2%). According to classifications of soil supply with humus, this belongs to the group of well supplied ones, and thus this

parameter cannot be considered as limiting for establishing intensive raspberry plantings.

All the localities studied were moderately to well supplied with total nitrogen, which are sufficient amounts of this nutrient for raspberry growing, provided that nitrogenous fertilizers are added in optimal amounts and dates.

The greatest deviations in the contents of nutrients were recorded with easily available phosphorus. The values range from very low (1-3 mg/100g soil in 20 localities) to very high (>40 mg/100g soil, localities 4 and 11). In other localities the assessed content of easily available phosphorus suits raspberry growing and ranges from 6-15 mg/100 g soil.

All the soils are well supplied with easily available potassium (K₂O content is above 10mg/100g soil), which is in accordance with the values necessary for raspberry growing.

It can be concluded, therefore, that providing certain calcification measures on acid soils and increased amounts of phosphorus fertilizers on some localities, and with proper cultural practices, it is possible to grow raspberry in this area.

With regard to the type of major nutrients content¹, the depth of the upper layer of soil profile, as well as other elements of production soil value (mechanical composition, physical properties, water and air regime, etc.) very heterogeneous soils are in question. A whole range of different types, subtypes and other taxonomic soil units can be found in a relatively small area.

In the central parts of the valley, which is otherwise rather flat, the soils are mainly degraded and shallow smonitza (SM), having all the negative characteristics of the soil which are not suitable for intensive raspberry growing (localities: 1, 2, 8, 9, 14, 16, 18, 21, 22, 28, 31, 34). The exception are only homeyards, which are by intensive cultivation and fertilization transformed into the so-called 'cultivated soil'. However, on margins of the valley, i.e. on mild slopes and smaller plateaus, there are substantial areas of relatively deep brown soils (mildly acid to neutral reaction) on different substrates (pure limestone and conglomerated sand, etc.), which are, using proper cultural and pedomeliorative measures, suitable for growing raspberry and other small fruits.

Special attention has been paid to brown soils on marl (localities 7, 20, 25, 35, 36) since due to high pH value, high calcium content and skeleton, as well as adverse water regime, etc., they are not theoretically suitable for raspberry growing. However, in some of these localities for two years on end relatively high yields and good fruit quality have been obtained. As an example, in locality 20 (owned by Đole Stojić from Radojina) in the second year of cropping (year 2000), which was otherwise, due to extreme drought, exceptionally adverse for raspberry, under conditions without irrigation, 1,989 kg of raspberry fruits was produced on the area of 0.10 ha. On the same plot in 1999, i.e. in the first cropping year, only 1,200 kg was produced. This indicates

¹ Soil classification done according to the adopted methodology of JDPZ from 1997 (Antonović G.M. and Protić N, 1997): Proposal for soil classification of Yugoslavia, JDPZ, Novi Sad, pp. 501-508.

that some established parameters concerning individual factors, relevant intensive raspberry production must be scientifically verified.

Main climatic characteristics

Radojinska valley is located at the margin of the hilly-mountainous region of western Serbia, which is affected through the narrow valley of the Uvac river by weakened effect of moderately continental climate. Summers are relatively warm and short, with warm days and cool nights; winters are mostly long and severe, and springs and autumns are short. As a rule, springs are colder than autumns.

Main characteristics of the climate are illustrated in tables 2,3,4,5².

Tab. 2. Mean Montly and Annual Air Temperatures

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	X
Temperatures air	-22.5	-2.0	2.0	7.4	11.1	16.1	17.7	14.9	14.5	9.3	2.7	0.5	7.5

These temperatures are suitable for intensive raspberry growing.

Tab. 3. Absolute Maximum and Absloute Minimum Air Temperatures

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Max	12.4	15.0	25.3	23.6	26.9	31.6	33.9	35.5	33.5	26.7	19.5	16.7
Min	-27.8	-26.7	-21.0	-8.7	-3.9	2.3	4.0	4.0	-1.5	-5.6	-15.6	-23.5

Under the conditions of Radojinska valley, temperature extremes do not often represent a limiting factor for raspberry production. In some years, especially when summers and autumns are rainy in lower parts of the valley, insufficiently matued canes can be damaged by early summer frosts.

Tab. 4. Mean Montly and Annual Sum of Precipitations in mm

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Σ
Precipitations	32	55	40	38	101	73	55	43	56	77	67	63	700

This index indicates that critical months regarding needs for water are July and August. This is a period when canes prepare for the next year. It is important to provide necessary amounts of water for irrigation.

² The data from the following publications were used for composing these tables:

- Nikola Pavićević et al.: Zemljišta Starog Vlaha i Raške (The soils of Stari Vlah and Raška). Institute for soil research, Belgrade, 1968.

- Đorđe Tanasijević et al.: Pedological cover of western and north-western Serbia. Institute for soil research, Topčider, 1966.

Conclusion

Radojinska valley has substantial soil areas which fulfil the conditions for intensive raspberry growing.

Since for this production optimal soil plots are 0.10-0.50 ha per household, it is recommended to set up raspberry plantings on homeyards, which are otherwise the most productive soils in this region.

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ISPITIVANJE KVALITETA ZEMLJIŠTA RADOINSKE KOTLINE KAO OSNOVNOG ČINIoca ZA PROIZVODNJU MALINE

-originalni naučni rad-

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Rezime

U radu su izneti rezultati ispitivanja kvaliteta zemljišta kao osnovnog uslova za ekonomski opravdanu proizvodnju maline u Radoinskoj kotlini (opština Nova Varoš). Rad predstavlja sastavni deo Programa za podizanje zasada maline u opštini Nova Varoš čiji je investitor preduzeće Zlatar-Plast. Saopšteni rezultati ukazuju da se na rubnim delovima kotline kao i blagim padinama iste prema dolinama reka Lim i Uvac nalaze značajne površine zemljišta koja su, uz adekvatne pedomeliorativne i agrotehničke mere pogodna za gajenje maline i drugih vrsta voća.