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Soil Fertility in Raspberry Planting-collection Orchards of the Zlatar region

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Abstract: The paper presents the content of some most important soil nutrients necessary to plants and their changes depending on soil pH, the mode of fertilization as well as on the previously sown crop in the Zlatar region.

It was noticed that most soils might favour raspberry growth with timely application of tillage, fertilization, good quality planting material and calcification to acid soils.

Key words: raspberry, soil acidity, humus, nitrogen, phosphorus, potassium, calcification

Introduction

Rubus idaeus L. (red wild raspberry) grows in the highlands of the mountain Zlatar on the relatively large areas. In the second half of the current century, it was higher demand on the world market and the possibility of gaining high profit per unit of invested capital that intensified raspberry production. These were major factors that prompted growers of the Zlatar region to start producing raspberry. However, due to a lack of the capacities for deep freezing and unorganized purchase, no remarkable results have been achieved in raspberry production so far, thus, its natural character in the main.

Reconstructed company "Zlatar plast" from Nova Varos adopted the Programme of raspberry production, processing and export from Zlatar region in 1997. In addition to primary production, the construction of freezing unit, as a necessary pre-requisite of an organized raspberry commodity production, was

also initiated.

In 1999, the symptoms of cane blight were noticed in some of the raspberry orchards, which necessitated analyzing all the relevant factors of an efficient intensive raspberry production in this region. Therefore, pH of humus and content of the basic assimilates were analyzed (total nitrogen, readily available phosphorus and potassium) on the plots selected. Quality assessment of this factor lies in the assumption that raspberry is an important fruit with high and specific requirements in respect of soil. Thus, deep, arable (5% humus), loose, sufficiently permeable and mildly acid soils with pH 6, 8-10 mg P₂O₅ and 18-20 mg K₂O per 100 g of dry matter excellently suit raspberry (Nenadic and Radojevic, 1986; Shoshkic, 1989; Petrovic and Milosevic, 1995; Petrovic and Milosevic, 1998; Masic, 1997).

Material and Method

The studies proceeded on the soils within producing-collection orchards of raspberry and other fruit crops (the villages Drazevici and Bistrica at the altitude from 600-900 m and Drmanovici 1200-1300 m) on the area of Zlatar, where the symptoms of blight on the cultivated plants, had already been observed.

Soil samples were taken from the depth 0-20 cm from several points and different expositions on the plots planted with various agricultural crops, in August, when the soil is free and raspberry not planted yet. Chemical analysis of soil including pH, the content of humus, total nitrogen and readily available phosphorus and potassium, followed.

- pH value was determined potentiometrically in nKCl and H₂O;

- Content of humus was determined, employing the method after

Kotzman

- Content of total nitrogen was determined using micro-method after Kjeldahl;

- Content of readily available P and K was established through Al-method after Egner-Richm (P₂O₅ colorimetrically and K₂O flame-photometrically).

Sampling plots were chosen by the authors of the present study and by representatives of the company "Zlatar plast" from Nova Varos.

Results and Discussion

The results of chemical analyses made in the village Drazevici show some deviations depending on the plot from which samples were taken (Tab.1). The soils of this village mainly show mildly acid to neutral reaction, since pH in nKCl ranged from 6-7, with exceptions of the plot on which raspberry patch had already been desert (pH + 4.75) and that on which raspberry and maize were simultaneously grown (pH around 5.1). On the soils with pH being 7, CaCO₃ was also present.

Tab.1. Chemical properties of the soil of the village Drazevici

Number of samples	pH in		CaCO ₃ qualit.	Humus %	N %	mg/100 gr soil	
	H ₂ O	NKCl				P ₂ O ₅	K ₂ O
1	8.2	6.99	++	3.95	0.190	12.5	40.0
2	8.2	7.05	++	3.90	0.195	6.0	40.0
3	8.2	7.00	+	4.47	0.223	30.0	32.0
4	7.8	6.53	-	4.96	0.248	<1.0	35.0
5	7.8	6.63	-	4.86	0.241	<1.0	32.0
6	8.1	7.04	++	5.61	0.280	<1.0	26.5
7	7.6	6.33	-	5.78	0.289	<1.0	22.5
8	7.6	6.36	-	5.96	0.298	<1.0	23.5
9	7.9	6.65	+	5.09	0.250	5.0	35.0
10	7.9	6.60	-	5.01	0.250	<1.0	29.0
11	5.96	4.75	-	5.40	0.270	<1.0	37.2
12	8.0	7.00	++	5.32	0.262	<1.0	30.4
13	7.7	6.45	-	5.43	0.271	<1.0	30.2
14	7.2	6.17	-	5.58	0.229	2.0	45.0
15	7.52	6.42	-	4.09	0.206	8.5	>50.0
16	7.8	6.85	+	4.01	0.200	35.0	21.0
17	6.12	5.00	-	3.38	0.170	9.5	29.0
18	6.26	5.18	-	3.56	0.178	12.5	37.0
19	7.8	6.60	-	4.23	0.215	3.0	>40.0
20	7.95	6.72	-	4.40	0.220	3.5	40.0
21	8.0	7.01	++	4.59	0.229	3.2	23.0
22	7.97	7.10	++	4.20	0.210	3.1	16.0

All the plots surveyed seemed to be well supplied with the total N (above 0.2%), which is directly linked with high content of organic matter in the soil (humus). This may as well have been expected, since the parts of the plant mass have remained in this soil which has not undergone mineralization processes yet. Thus, the soils mainly lack readily available P (below 10 mg/100 of soil) whose content needs to be increased by an application of fertilizers with higher percentage of this element. Soil availability with K is exceptionally good for being above 20 mg/100 g of soil in all the plots under way.

From all the data obtained, one can see that the plots of the village Drazevici show the optimal values for raspberry cultivation.

In the village Bistrica, high discrepancies exist in the content of nutrients and pH value, depending on the locality of sampling (Tab.2). Thus, in one part of the locality (northern slopes of Zlatař), the soil is extremely acid (pH below 4) so that calcification seems unavoidable in order to raise pH and thus improve the uptake of the nutrients from these soils. On the other hand, on the southern slopes of the hill Tikva located in the same village, the soils are fairly calcareous (pH > 7.5) and full of scales of calcareous origin and, as such, may be considered unsuitable for raspberry production. On the remaining localities, the soils are of mildly up to neutral reaction (pH > 6.5) with no CaCO₃ found.

Tab.2. Chemical Properties of the Soil of the village Bistrica

Number of samples	PH		CaCO ₃ qualitat	Humus %	N %	mg/100 gr soil	
	H ₂ O	nKCl				P ₂ O ₅	K ₂ O
1	8.0	7.00	-	5.25	0.261	>40.0	>50.0
2	7.9	6.87	-	5.57	0.268	38.0	>50.0
3	7.8	6.85	-	5.60	0.280	>40.0	>50.0
4	7.8	6.65	-	4.50	0.225	3.0	>45.0
5	7.9	6.96	+	4.45	0.222	>40.0	>50.0
6	7.8	6.80	-	4.42	0.221	5.0	29.0
7	7.31	6.00	-	5.16	0.258	3.0	34.0
8	6.00	4.98	-	5.70	0.285	<1.0	23.0
9	5.32	3.91	-	5.01	0.250	<1.0	15.0
10	5.60	3.91	-	4.67	0.233	<1.0	17.0
11	5.04	3.47	-	4.92	0.246	<1.0	13.0
12	7.30	6.47	-	4.79	0.192	31.0	36.0
13	7.53	6.61	-	4.75	0.238	33.0	>45.0
14	4.70	3.55	-	4.90	0.246	<1.0	11.0
15	4.86	3.43	-	4.86	0.243	<1.0	10.0
16	7.85	7.60	++	6.26	0.313	>40.0	38.0

Similar to the village Drazevici, the high content of humus and total nitrogen was obtained for Bistrica. On the part of soil with extremely acid reaction, the content of readily available phosphorus is rather low, whereas on the part of soil with mildly acid reaction, the content of phosphorus is rather high being above 30 mg/100 g soil. The content of readily available potassium is medium in soil with pH below 4, but high in the soil with pH above 6.5.

For a successful raspberry production in the village Bistrica, it is necessary to apply calcification to acid soils, but bearing in mind fertilization with manure which will make it possible that calcification reach the highest efficiency.

In the village Drmanovici, three plots were studied (Tab.3), each consisting of calcareous scales in high percentages, above 15%, and clay in low percentages. These plots cannot be recommended for an intensive raspberry production, since its root and green part are constrained to develop sufficiently, which will decrease yield, too. These soils are also unable to retain moisture and nutrients so that both, water and nutrient deficit may be expected. Besides, such soils have an extremely acid reaction (pH is around and below 4), thus, soil calcification seems inevitable. The content of humus is high and total nitrogen available enough. Readily available phosphorus is highly present only on the plot that was previously fertilized with manure, whereas its presence is rather low on the remaining plots. As regards potassium, all the plots indicated its high content.

Tab.3. Chemical Properties of Soil of the Village Drmanovici

Number of sample	pH in		CaCO ₃ qualit.	Humus %	N %	mg/100 gr soil	
	H ₂ O	nKCl				P ₂ O ₅	K ₂ O
1	4.9	3.59	-	6.34	0.317	10.0	36.0
2	4.72	3.80	-	6.34	0.317	26.0	31.0
3	5.45	4.22	-	5.11	0.255	7.5	>40.0
4	5.60	4.28	-	4.82	0.241	12.5	>40.0
5	5.03	3.66	-	3.18	0.159	5.0	>40.0

From the data obtained, it may be concluded that the plots of the village Drmanovici cannot be recommended for an intensive raspberry production due to a high content of calcerous scales, whereas their content of nutrients and soil acidity may be improved by means of calcification and appropriate fertilizers. Lastly, a relatively high altitude of the village also represents a serious limiting factor of an intensive raspberry production.

Conclusion

On the area of Zlatar, intensive raspberry producing-collection orchards area of Zlatar can be recommended in the villages Drazevici and Bistrica, while it cannot be recommended in Drmanovici due to a high presence of calcerous particles.

- all the soils were found to have a high content of humus, total nitrogen and potassium, which may be considered suitable for raspberry growth. However, the content of readily available phosphorus is differing, ranging from entirely absent P in the soil, where fertilizers with a higher rate of P are desirable, up to its fairly high presence in the soil.

- soil acidity has shown high discrepancies, from extremely acid (pH below 4) to entirely neutral (pH around 7) and to limy soils (pH > 7). Thus, calcification should inevitably be applied to acid soils, with simultaneously used fertilization with manure, which will help calcification achieve the best possible efficiency. In contrast, on extremely calcerous soils, intensive raspberry production should be avoided.

- on the soils with pH varying from 6.5-7.5, KAN should be replaced with appropriate rates of urea and antihorozin NPK 8:8:24 +2% Fe 2% and Zn 6%. Foliar nutrition of raspberry canes with the most frequently used foliar nutrients Vuksal, Fertigal S-2, SAL 12, SAL 5 at rates 0.2-0.3% and 5-6 treatments to be performed annually at different plant developmental stages is also highly recommended on these soils.

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STANJE PLODNOSTI ZEMLJIŠTA U ZASADIMA MALINE ZLATARSKOG KRAJA

- originalni naučni rad -

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Rezime

U radu je prikazan sadržaj najvažnijih hraniva u zemljestu neophodnih za biljku kao i njihove promene zavisno od vrednosti pH zemljišta, načina djobrenja i prethodno zasejane kulture u Zlatarskom kraju.

Uoceno je da većina zemljišta odgovara za uspesno gajenje maline uz blagovremenu obradu, djobrenje i kvalitetan sadni materijal, kao i primenu kalcifikacije na kiselim zemljestima.