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SOIL EXAMINATION AND RECOMMENDATIONS FOR CREATING BETTER CONDITIONS FOR RASPBERRY PLANTING

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Abstract: *When choosing land for raising a new planting of vegetables or fruit crops, the composition of the soil plays an important role; therefore, the composition of soil is examined, and chemical analysis of soil is made. The culture that we examine is a raspberry planting. Raspberry is a multi-annual plant in the form of a bush or semi-shrub, with more annual roots and with one-year or two-year-old offshoots belonging to the Rosaceae family. Raspberries are irrigated by a drop-by-drop system, because through that system, remediation of soil can be carried out by adding appropriate crystalline fertilizers. Nitrogen (N) is the element with the greatest movement in the soil itself and its content is from 0.05 - 0.14 %. The pH value affects the calcium content in soil. Calcium plays an important role in the hardness of fruit and the sensitivity of physiological disturbance amounts to 1-2.1 %. Phosphorus is important for the fruit properties during storage and amounts to 14.7 - 40 kg / da. Potassium is a major element and plays a major role in producing good yields in fruit trees and amounts to about 14-50 kg / da. When mentioning magnesium, its role is not the most important and amounts to 74.5-221 ppm. The main role of magnesium lies within the ratio of potassium (K / Mg), which should range from 2: 1 to 3: 1. With the obtained soil analysis data, in addition to the climatic conditions, type and structure, which are equally important for raising a raspberry plant, we have a full understanding of the soil processes and guidelines for suitable conditions for growing raspberries.*

Key words: *soil, raspberry, planting, chemical elements, soil acidity.*

1. Introduction

Raspberry is a multi-annual plant in the form of a bush or semi-bush with perennial roots and with one-year or two-year-old growths from the roots belonging to the *Rosaceae* family. Raspberries enter the order of the most important varieties of berries in the world, even in the Balkans. The biological properties, the technological and nutritional value of the fruit make this culture quite significant and fairly cost-effective [1]. Raspberry is well adapted to various climatic and production conditions; it can be grown in hilly-mountainous areas at an altitude of up to 800 meters. Proper selection and preparation of soil will greatly influence the development of the bushes - raspberries, the growth of swords (growths on the surface), the yield and the quality of the product itself. Therefore, it is necessary to select the area for raising raspberry plantations, and to begin with timely and proper preparation of the soil [2]. When choosing a soil for raising a new planting of vegetable or fruit crops, the composition of the soil is important. Depending on the needs of each plant, appropriate soil is selected, which will meet the requirements and needs of the plant. For this to be done

correctly, it is best to carry out field analysis and therefore chemical analysis of the soil. Soil analysis should be carried out a few months before the planting begins, by taking samples from several places in that area from a depth of 30-60 cm. In larger plots, sampling from only a few parts can lead to incorrect results, and thus to improper solutions when intervention on the same surface is involved [3]. The best is to take 4-5 specimens of a 1 hectare area to get the best and most relevant results. The application and accumulation of different elements are always different in the various phases of plant development. Values that the soil should contain for raising a raspberry plant are: pH from 5,5 – 6,5; K_2O (light soils) 20 – 25 mg / 100g; K_2O (heavy soils) 25 – 30 mg / 100g; P_2O_5 > 12 – 15 mg; MgO > 10 mg (best ratio K/Mg from 2:1 to 3:1).

It is necessary to be careful about the content of Mg, the lack of which can prevent photosynthesis and lead to colorful leaves. Soil in nature appears as a product of pedogenic factors (creation factors of soil), which should be especially emphasized: soil, climate, relief, vegetation and human influence [4].

When water in the soil reacts with the elements, a solution (soil solution) is obtained, which represents the ratio of the hydrogen (H^+) and hydroxyl (OH^-) ions. Soil response influences: the availability of nutrients and the efficiency of fertilization, nutrient mobility and soil pollution, stability of structural aggregates of the soil, soil, water mobility and its aeration, plant growth, pesticide and environmental performance [5]. When analyzing soil, soil samples are extracted with certain solvents. In addition, the content of the nutrients determined in the extract of soils shows the level (content) of the nutrients in the soil. Today there are many soil solvents used to extract nutrients. For example, today the double lactate method is used, which uses a lactic acid content as a solvent for the extract, as well as the calcium acetate method, used to determine the content of the available K and P in the soils [6].

2. Materials and methods

The culture being examined is a raspberry plant. For that purpose, 4 soil samples were taken to make initial examination of the soil composition of that land. Samples were taken at a depth of 30 to 60 cm at different places in that plot in order to get a better image of that land. The plant, in the case of raspberries, is irrigated by a drop-by-drop system. The samples were taken, packed in black plastic bags and with individually transported to an accredited laboratory. First, the laboratory gave directions about the proper way of taking samples, and how far the distance between the sampling points should be. Thus, over a period of 2 hours, the samples were transferred to the appropriate laboratory and left for further examination.

The samples were taken at a length of about 100m in a diagonal direction in order to cover as much as possible from the target surface and to obtain more relevant results. There were 4 soil samples from the entire area of their own choice of location, but certainly the determined distance between all samples was taken into account.

It was also pointed out that the samples were not taken from a water surface or a covered mud. No earlier processing was performed on the soil in order to prevent layering. Examination of the samples is done on a sample of 1 kg of soil in a period of 15 days from the end of November and the beginning of December.

Appropriate accredited methods were used for each examined element by the respective laboratory. For pH analysis, the TS ISO 10390 method was used with a pH-meter with potentiometer, Sature

ortamda (H_2O). To obtain the percentage of $CaCO_3$, the method TS 8335 ISO 10693 was used with an instrument called Kalsimetrik. In order to obtain the electrical conductivity, the TS ISO 11265 method was used with the same instrument as when determining the pH. To apply the saturation, the texture in percent was used with the aid of TS 8333, by the use of the Saturasyon instrument. For the study percent of organic matter in the soil, the method TS 8336 - the Walkley Black instrument - was used. The TS 8337 ISO 11261 method, i.e. the Kjeldahl method, was applied to obtain the percentage representation of total nitrogen in the soil. The absorbed phosphorus (P) was tested by the use of the TS 834 method and the spectrophotometer type Spektrofotometrik - Olsen. The method TS 8341 / N Amo was used for the examination content of the potassium (K), calcium (Ca) and magnesium (Mg) at Ase / ICP. The presence of other elements in the soil such as iron (Fe), manganese (Mn), zinc (Zn), and copper (Cu) is examined with the aid of the TS ISO 14870 DTPA / ICP method. All methods used for examining soil samples for raspberry plantations are accredited methods by the Institute for Accreditation of the Republic of North Macedonia (IARSM).

3. Results and discussion

The chemical analysis of soil was made with regard to each sample and repeated three times, then the results obtained were statistically calculated and their average value is shown in Table 1.

Table 1.

Basic parameters of soil for a raspberry plant

Basic analysis of soil for raspberries planting						
No. of samples	**pH**	**Lime-Calcium carbonate (%$CaCO_3$)**	**Electro-conductivity EC / (ds/m) t (^{0}C)**	**Salty NaCl / %**	**Saturation – texture / %**	**Organic matter / %**
1	7.7	1.0	0.287 / (21.7^{0}C)	0.01	71.51	2.05
2	6.28	1.3	0.237 / (20.7^{0}C)	0.07	51.04	2.8
3	6.35	1.6	0.215 / (21.16^{0}C)	0.06	53.09	1.64
4	6.11	2.1	0.225 / (21.1^{0}C)	0.009	55.44	1.24

Acidification of the soil: According to the obtained soil acidity results, it is necessary to implement measures only to the surface from which the sample number 1 is taken, where the pH is 7.7 (weak alkaline), because when the pH is above 7.0 it can come to the lack of some elements such as Fe and Zn. In this case, acidification of the soil can be done with sawdust or with a comminute (which is obtained after digestion of brandy). Other samples produce pH (weakly acidic) results provided by the planting, raspberry requirements.

Chemical elements in soil: The results of the analysis show presence of several chemical elements in soil that are presented in Table 2.

Table 2.

Analysis of chemical elements in soil for planting a raspberry plant

Chemical analysis of soil for raspberries planting					
Chemical elements	**Simples**				**Method of analyzes / Instrument**
	1	**2**	**3**	**4**	
Total Nitrogen (N) / %	0.10	0.14	0.08	0.06	TS 8337 ISO 11261/ Kjeldahl
Absorbed Phosphorus (P) P_2O_5 kg/da	16.03	40.36	24.7	14.77	TS 834 Olsen /Spektrofotometrik
Absorbed Kalium (K) K_2O kg/da	17.1	49.7	23.6	14.0	TS 8341 / 1N Amo. Ase / 1CP – 0ES
Absorbed Calcium (Ca) / ppm	3745.0	1235.0	2170.0	1113.0	TS 8341 / N Amo. Ase / ICP
Absorbed Magnesium (Mg) / ppm	74.58	138.7	220.9	184.7	TS 8341 / N Amo. Ase / ICP
Absorbed Iron (Fe) /ppm	1.163	81.92	157.8	76.20	TS ISO 14870 DTPA / ICP – 0ES
Absorbed Manganese (Mn) /ppm	1.283	21.00	24.25	12.12	TS ISO 14870 DTPA / ICP
Absorbed Zink (Zn) /ppm	1.031	5.473	2.570	1.848	TS ISO 14870 DTPA / ICP
Absorbed Copper (Cu) /ppm	3.309	4.655	4.322	2.822	TS ISO 14870 DTPA / ICP

Fertility: Raspberries work hard all summer to produce large leaves and berries, so they need increased fertility than other shrubs and perennial plants. Spread commercial fertilizer -- such as a 20-20-20 formula at a rate of 6 pounds per 100 feet of raspberry plants -- in the spring as new growth emerges [7]. Give fall-bearing raspberries an additional 1 to 2 pounds of fertilizer as the canes start to bloom. If you prefer, spread manure or compost in the fall after you harvest the raspberries [8].

Calcification: The pH value also shows the calcium content in the soil. In soil with a pH higher than 7.0, blocking certain microelements like Fe and Zn may occur [9]. Calcium, important for the soil, is also important for the availability of other elements in the soil. Calcium has an important role for the hardness of the fruit and for the sensitivity of physiological disorders [10]. The adequate presence of calcium in the soil, as can be seen from the obtained results (lime soils), facilitates absorption of other elements and increases the activity in the soil itself. In this case, it is recommended to minimize the addition of calcium on this surface in order to bring calcium into the ideal content required by the raspberry planting. Further calcification can be performed every 3 years to replenish the evaporated or

extracted carbonate from the soil by natural processes [11].

Electroconductivity of the soil: The conductivity results / (ds / m) of the ions from the present sample elements, which have an appropriate temperature of 20.70C - 21.70C and no salt (NaCl), are in the normal range, which is the result of the absence or minimum presence of salt in the soil. The percentage of NaCl is from 0.009 to 0.07% and corresponds to the requirements for the raspberry planting. Plants require nutrients to grow, and, if we fail to supply the proper nutrients in the proper concentrations, plant function is affected [12].

Saturation - texture of the soil: From the results it can be seen that only in the first sample a higher value of 71.51% was obtained, compared to other samples whose value ranges from 51.04% to 55.44%. From the values we conclude that the first sample is a surface with sand deposits or sandy soil, while as far as the other three samples are concerned, we are dealing with clayey rocky soil.

4. Conclusion

The results show that this soil is good for growing the desired crop plantations of raspberries. With small interventions and addition of certain fertilizers in soil the optimal soil quality is achieved. Due to the fact that the elements which are most necessary for the quality production of raspberries are in good proportion and well contained in soil, it can be freely stated that this country is good for raising a new raspberry plantation. From the results one can also get recommendations that actually represent the conclusions of this research:

- The land that is chosen for raising long-term plantations of raspberries is mostly used, i.e. deep land, because the native raspberries system reaches up to about 50 cm, has good permeability, the humus content is 3-5%, the pH value is to move within the limits of 5.5 - 6.5 (weakly acidic) and medium heavy soil (about 50% clay).
- The irrigation method in this case is important, because through that system the land can be renovated by adding appropriate crystalline enzymes, in order to achieve a better quality of the composition of the soil and, if possible, to reach the requirements of the raspberries for the composition of the soil for raising an appropriate plantation [13].
- Nitrogen (N) is the element with the greatest mobility in the soil, which from an ecological point of view can be a significant problem [14].uy The content and the representation of nitrogen in the soil can most easily be determined by the percentage of plant growth and the development of the flower itself. Uncontrolled application of fertilizers can lead to a series of unwanted consequences that are manifested through various forms of disadvantages, accumulation of varied foods, unevenness of the elements in the soil, but also in the plant itself.
- The most important elements that should be included in soil for raspberry cultivation are: phosphorus (P_2O_5) in amounts of 10mg and potassium (K_2O) in the amount of 40mg per 100g soil [15].

In addition to climatic conditions, the type and structure of the soil, the results of the chemical soil structure tests will give a complete image of the best conditions for raising the plant sediment.

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