Journal homepage: www.fia.usv.ro/fiajournal
Journal of Faculty of Food Engineering,
Ştefan cel Mare University of Suceava, Romania
Volume XVIII, Issue 1 -2019 , pag. 44 - 51

FOOD AND ENVIRONMENT SAFETY

THE RELATIONSHIP BETWEEN PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND AND BIOMETRICS ROSEHIP FRUITS

***Sorina ROPCIUC[1], Cristina DAMIAN[1], Ancuța Elena PRISACARU[1]**

[1]*Food Engineering Faculty, Stefan cel Mare University of Suceava, Romania*
sorina.ropciuc@fia.usv.ro
*Corresponding author
Received 17th December 2018, accepted 27th March 2019

Abstract: *Soil analysis was determined in order to identify the type of soil through nutrient analysis and granulometric analysis, features that may occur in the fructification of the species Rosa canina L. The studied area includes the Plateau of Suceava and Obcina Mare, where the lowest elevation is in the floodplain area of Suceava (292 m) and in Dărmănești station and the highest research point is Palma with an altitude of 1080 m. The field gradient is between 0.1 ° and 13.4 °, the dominant slopes have values of 0.8 ° and 2.6 ° and they are characteristic to the plateau of Suceava. The assessment of geodeclivity was obtained based on grid information using GIS software. The obtained results led to the classification of the studied soils based on fertility; statistical interpretation has been made in terms of influence of soil fertility on the fructification of Rosa canina L. By using statistical PCA and MCA programs we were able to classify soils by chemical constituents. The correlation index determined by Pearson matrix showed a significant correlation level between the chemical characteristics of soil and the productivity of rosehip bushes.*

Keywords: *chemical constituents, biometric characters, granulometry, productivity.*

1. Introduction

As environmental factor, soil represents a major importance because it influences directly or indirectly the production potential of the station. Taking into account the soil, rosehip is one of the least demanding species that vegetate even on poor and dry grounds [1, 2]. It achieves good growth on compact, clayey and clay-loamy soils, slightly acidic, neutral to stony, skeletal, eroded or subject to erosion, and even on great slopes exposed to insolation *Rosa canina* L. harnesses well any type of soil from soils which are usually medium textured, with skeletal, reduced content to the alluvial soils from plains, stuffy and humid [3, 4]. In our country *Rosa canina* L. is the most popular of the many species of Rosa. It is common in all parts of the country, from the Black Sea up to an altitude of 1100 – 1200 m. The studied area is represented by the route Suceava–Palma and it includes the following stations: Suceava, Pătrăuţi, Dărmănești, Costîna, Părhăuţi, Todireşti, Cajvana, Arbore, Solca, Clit, Marginea, Rădăuţi, Suceviţa, and Palma. From a geomorphological point of view, the studied territory includes Obcina Mare and Suceava Plateau, the lowest elevation stands in the meadow of Suceava 292 m and in Dărmăneşti station and the highest research point is Palma, with an altitude of 1080 m. The field gradient is between 0.1° and 13.4° and the dominant slopes have values of 0.8° and 2.6° and they are characteristic to the Suceava Plateau. Stations with higher gradients are found in Suceava and in the following stations: Părhăuţi, Arbore and Clit which are located on sloping grounds.

2. Material and methods

For the analysis of the chemical constituents and for the granulometric analysis, soil samples were taken from each studied station and were collected during the vegetative rest period (early March). Thus, average samples were formed from the surface layer (0-20cm).
For the analysis of the biometric characteristics, the rosehip beerries were harvested by hand randomly, from 42 biotypes marked on the field, in rosehip bushes respectively. Of each biotype, there were harvested 10 berries; only the whole, healthy, fully riped berries were harvested. The harvested samples were labeled and analyzed in a laboratory.

2.1. Soil analysis methods

Soil samples were gathered with a probe with a prior dismission of the vegetation layer. From each station there were collected average samples of 1 kg. The soil samples have been processed in the laboratory for pedological analyses. Thus, the samples were dried in the air for 24 hours and then the foreign parts have been removed (roots, other plant remanents, stones). Then the following operations grinding, mixing and screening took place. Chemical constituents foodstuffs in the soil samples were determined by standard analysis methods of soil.

2.2. Fruit analysis methods

The biometric measurements of rosehip fruit were made on freshly picked fruit during the years. Thus, from 3 bushes per station there were harvested randomly 10 berries each, i.e. a total of 30 berries per station. The measurements were made with callipers and the length of each berry was determined and the value was expressed in mm. The weight of the fruits was determined by weighing 100 g of randomly harvested berries from three different bushes.

2.3. Statistical Analysis

Using statistical analysis computer packages Excel and XLSTAT (Version 2017, Addinsoft, U.S.A.), the data were statistically processed via analysis methods of main elements (PCA) and the method of multiple variables analysis (MCA).

3. Results and discussion

The analysis of soil collected from the studied stations was made for the chemical and granulometric analysis of soil, two values that can interfere in the productivity of bushes and in the biometric changes of the pseudofruit of the species *Rosa canina* L. The results of the soil analysis from the point of view of nutrients and of granulometry are shown in table 1 (a, b) and table 2.
From the point of view of the reaction of soil in aqueous solution, Cajvana presents a strongly acid reaction, the soils in Todireşti and Pătrăuţi are strongly acidic, the soils in Pârhăuţi and Clit are moderately acidic, the soils in Costîna, Solca, Arbore, Palma and Rădăuţi are slightly acidic, the soils in Suceava, Dărmăneşti, Marginea and Sucevița present a neutral to a weak alkaline reaction (Figure 3).
The humus content (%) in the 0-20 cm layer ranges between 0.4% (Clit) and 5,94% (Palma) and indicates extremely low values of humus content.
The total nitrogen indicates limits between low and high content (0,019% - Clit and 0,313% Palma).
The granulometric composition was statistically processed by analyzing the main components in order to obtain accurate information on the division of the stations according to this variable. The analysis of the main components divides the analyzed stations into two planes, on the left and on the right of the F1 axis, Figure 4. On the right of the F1 axis there are grouped the stations that significantly correlated with coarse sand, fine sand and pH. The best correlation with coarse sand takes place at Dărmăneşti station and in the same plane can be found Pătrăuţi, Sucevița, Rădăuți and Marginea. Rădăuți station correlates with fine sand. On the left of the F1 vertical axis, Arbore station significantly correlates with clay whereas Palma and

Costîna significantly correlate with physical clay.
Dărmăneşti station is distinguished by its high content in coarse sand (43.13%) while Marginea presents the highest values of fine sand content (76.47%). Soil classification according to the fertility.

Table 1.

The analysis results of nutrients in soil (a,b) and granulometric analysis

Stations	Carbonates%	Humus%	Nt(s.u.) %	P-Al ppm	K-Al ppm	SB me/100g	Soil acidity/alcalinity
Suceava	3.41	3.49	0.166	45.3	250	0	7.48
Patrauti	0	3.87	0.193	11.7	80	6.83	4.99
Darmanesti	0	4.77	0.227	17.8	96	0	7.12
Costina	0	4.16	0.218	64.9	134	29.98	6.15
Parhauti	0	1.96	0.109	13.2	105	17.1	5.4
Todiresti	0	2.6	0.140	30.1	74	11.47	5.38
Cajvana	0	2.78	0.138	39.7	53	5.63	4.34
Arbore	0	3.26	0.163	10.7	161	21.33	6.38
Solca	0	3.11	0.153	6.7	117	19.32	6.04
Clit	0	0.4	0.019	10	51	7.44	5.17
Marginea	0.21	0.87	0.039	32.6	46	0	7.29
Radauti	0	2.91	0.132	7.8	166	17.1	6.56
Sucevita	2.98	3.84	0.175	37	265	0	7.31
Palma	0	5.94	0.313	17.3	238	31.99	6.33

Stations	SH me/100g	Ah me/100g	V-Ah %	Al me/100g	C.E Simens/cm	CTSS mg/100g	U %	I.N
Suceava	0	0	0	0	174.71	111.81	3.11	0
Patrauti	8.57	7.31	48.3	3.11	102.3	65.47	3.96	1.87
Darmanesti	0	0	0	0	108.32	69.32	3.07	0
Costina	7.73	6.01	83.3	0	90.85	58.14	3.08	3.46
Parhauti	16.97	15.21	52.92	0.21	37.56	24.04	3.11	1.04
Todiresti	11.03	9.98	53.47	0.17	55.91	35.78	3.21	1.39
Cajvana	10.98	8.97	38.56	8.2	40.18	25.72	3.17	1.07
Arbore	6.16	5.2	77.59	0	78.62	50.32	3.08	2.62
Solca	12.41	9.5	67.04	0	61.15	39.13	3.02	2.08
Clit	8.56	7.69	49.17	0.63	25.32	16.21	3.17	1.02
Marginea	0	0	0	0	141.52	90.57	3.2	0
Radauti	5.01	3.99	77.34	0	45.42	29.07	3.12	2.36
Sucevita	0	0	0	0	203.07	129.96	3.1	0
Palma	8.9	6.88	78.23	0	115.54	73.95	3.14	4.89

Nt (total nitrogen); P-Al (mobile phosphorus); K-Al (mobile potassium); SB (sum of basic cations); SH (total exchange acidity); Ah_{me} (hydrolytic acidity); SH (total exchange acidity); Ah (hidrolitic acidity); Al (changeable aluminium according); CTSS (total mineral content); CE (electrical conductivity); U (umidity); I.N. (nitrogen index).

The infield bonitation is a complex action of research and quantitative estimation of the main conditions that determine growth and fruit-bearing, of establishing the favourability of these conditions for each use and culture (as a field may be unfavourable to certain uses and cultures but favourable to other ones). Since soil bonitation and the determination of their suitability for the studied species is more laborious and more difficult, soil assessment was carried out in the 14 stations based on the results obtained from analyses. The optimal level of the analysed results received the mark 3, the average level 2, the satisfactory level 1 and the unsatisfactory level 0, according to the data in Table 3.

The analysis results may highlight the following: the soil in Palma has a very good fertility. A satisfactory fertility can be found in Suceava, Dărmăneşti, Costîna, Todireşti, Arbore, Solca, Marginea, Rădăuţi and Suceviţa.

Table 2.

The results of the granulometric analysis

Stations	Granulometric analysis				
	NG	NF	P	A	AF
Suceava	4.26	44.1	20.67	30.97	39.12
Patrauti	10.08	42.62	25.57	21.73	33.65
Darmanesti/ Lunca Sucevei	43.13	39.55	8.51	8.81	12.96
Costina	7.43	44.12	28.76	19.69	32.09
Parhauti	2.28	46.12	27.99	23.61	36.21
Todiresti	3.28	50.53	27.27	18.92	30.9
Cajvana	5.11	48.96	25.57	20.36	32.71
Arbore	4.57	37.75	30.93	26.75	42.07
Solca	2.57	41.55	29.33	26.55	40.03
Clit	1.76	41.74	33.77	22.73	37.21
Marginea	10.61	76.47	6.15	6.77	8.96
Radauti	8.28	49.86	20.47	21.39	30.41
Sucevita	7.63	48.11	19.84	24.42	33.2
Palma	3.9	31.3	32.53	32.27	49.71

NG (coarse sand); NF (fine sand); P (dust), A (clay), AF (phisical clay)

Table 3.

The relative fertility potential of soils

Specification	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Ph	3	0	3	2	1	1	0	3	2	1	3	3	3	3
Humus	1	1	2	1	0	1	1	1	1	0	0	1	1	3
Nitrogen IN	0	0	0	1	0	0	0	1	1	0	0	1	0	2
Phosphorus	2	1	1	3	1	2	2	1	0	1	2	0	2	1
Potassium	3	1	1	2	1	1	0	2	1	0	0	2	3	3
Average	1.8	0.6	1.4	1.8	0.6	1.0	0.6	1.6	1.0	0.4	1,0	1,4	1,8	2,4

S1- Suceava; S2- Patrauti ; S3- Darmanesti; S4- Costina; S5- Parhauti; S6- Todiresti; S7- Cajvana; S8- Arbore; S9- Solca; S10- Clit; S11- Marginea; S12- Radauti; S13- Sucevita; S14- Palma

Given that the studied species are not part of cultivated plants, and they are rather spontaneous species that can be located on different categories of land, we must emphasize the fact that we are dealing with a natural fertility of soils with a satisfactory level and less demanding species in terms of soil fertility of soils with a satisfactory level and less demanding species in terms of soil fertility. As an environmental factor, soil has a major importance directly or indirectly influencing the productive potential of the station. Regarding the soil, rosehip is one of the least demanding species that vegetate even on poor, dry soil.

According to the studies in the field, rosehip achieved good growth in compact, loamy or clay-loamy soils, slightly acidic to neutral and even in stony, skeletal, eroded or subject to erosion soils. On the other hand, rosehip does not resist in wetlands, alluvial soils in meadows and mires [5-7].

The granulometric analysis offers the possibility of determining soil texture. For example, this analysis shows the fact that in Suceava station, the soil texture comprises: coarse sand - 4.26%, fine sand - 44.10%, dust - 20.67%, clay - 30.97%. Comparing these values to the chart for textural classes, it results the fact that the soil belongs to the structural clay class with a medium clay type.

Soil acidity is emphasized by the results of the analysis of exchangeable aluminium in soil. From this point of view, the situation is critical in Cajvana (8.2 me/100g) and Pătrăuţi (3.11 me/100g). In this situation it is recommended immediate action in order to correct soil reaction by applying amendments and avoiding administration of nitrogenous fertilizers, which increase the acidity of soil [8, 12]. Overall, from the point of view of soil reaction (pH), the studied soils can be regarded as good ones.

Determining humus content is of great importance because it helps to identify the presence of nitrogen in soil.

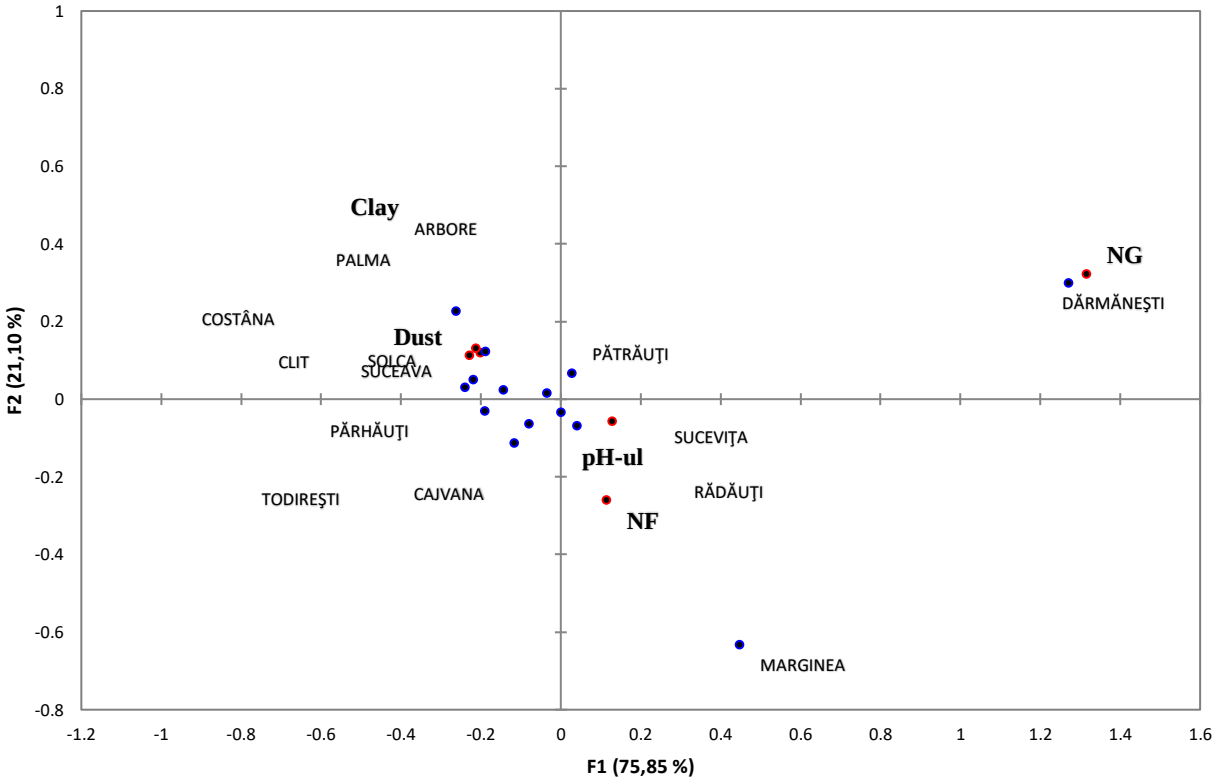

Fig. 1. The relationship between soil granulometric features within the stations Suceava-Palma

This is explained by the organic matter which contains more than 90% of the soil nitrogen. Moreover, based on the content of humus and the degree of base saturation, the value of the nitrogen index (IN) was calculated. The results of the biometric data show that the length of beans on the Suceava - Palma route records a higher

amplitude of variation within the same station and a narrower amplitude at the inter population level.

Thus, the average length of the bush is between 17.1 mm (minimum) in the resort of Clit and 31.3 mm (maximum) in the Todiresti resort (measured in 2010, the results of the measurements are not shown). Biotopes from Arbore, Clit, Marginea and Palma resorts have shorter grain lengths, averaging between 17.1 mm (minimum) and 2.0 mm (maximum) [10,11]. Within the analysed populations, a mass of 100 grains was determined in terms of quantity, which contributes to the appreciation of fruit quality and the productivity of bushes. Biotopes do not differ significantly in the length of the grain. We noted the small value of grain weights in stations 4 and 8 (Fig. 2).

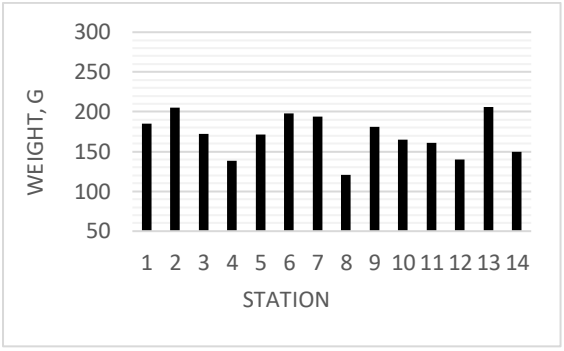

Fig. 2. The weight of 100 grains

In terms of the influence of soil composition on biometric features, it is estimated that phosphorus is a stimulating factor for grain growth and pulp ratio in the fruit [12, 13, 15]. Acidic soils and those with high nitrogen index do not positively influence the length of the fruit and, implicitly, low weight.

Table 3.

The correlation matrix between the soil features and the biometric features at rosehip fruits

Variabile	P-Al ppm	NF	SB me/100g	SH me/100g	Ah me/100g	V-Ah	U %	I.N
NF	0.264							
SB	-0.082	-0.472*						
SH	-0.291	-0.288	0.545*					
Ah	-0.297	-0.260	0.493*	0.994***				
V-Ah	-0.258	-0.445	0.907***	0.662**	0.620*			
U	-0.175	0.028	-0.195	0.092	0.109	-0.008		
I.N	-0.113	-0.515*	0.936	0.432	0.372	0.877***	0.022	
Avg L, 2009	0.344	0.156	-0.295	0.138	0.140	-0.297	0.218	-0.332
Avg L, 2010	0.323	0.219	-0.248	0.388	0.410	-0.170	0.152	-0.360
Avg, g 2009	0.111	0.125	-0.620**	0.033	0.057	-0.543	0.412	-0.540*
Avg, g 2010	0.340	0.106	-0.223	0.403	0.435	-0.167	0.212	-0.327

Studies on *Rosa canina* L. harvested at altitudes of 1800 m in New Zeeland present length values ranging between 17, 29 and 19.68 mm [14]. The results obtained by weighing 100 freshly harvested beans range in the interval confirmed by other studies as well. The indicated weight was of 1.88- 4.95 g/fruit [12]. The Pearson correlation matrix between the soil composition and the medium length of the fruit, the weight of 100 berries and the percentage of pulp in fruit, indicates positive correlations

between mobile phosphorus in soil and fruit length in 2007, r = 0,558* according to the detailed data in table 4.
Phosphorus correlates significantly positively with the fruit weight, r = 0.698** and correlates significantly with the percentage of pulp in fruit r = 0.489*.
The soil fine sand content correlates with the content of pulp in fruit in 2007 and 2008. The basic cations correlate significantly negatively with the berries weight r = -0.620* and with the percentage of pulp in fruit r = -0.443*.
Hydrolytic soil acidity correlates significantly negatively with the average weight of 100 berries r = -0.543*. The nitrogen index correlates significantly negatively with the fruit weight r = -0.540* in 2008. The physiology research is confirmed by the fact that nitrogen and its components increase vegetative organs, while phosphorus affects the growth of the reproductive organs.

4. Conclusions

Under the influence of soil composition on biometric features, it is estimated that phosphorus is a stimulating factor for grain growth and pulp ratio in the fruit. The acidic and high nitrogen index does not positively influence the development of fruit and, implicitly, low weight and poor fruit pulp. Rosehip is ruderal species, ecological role, being included in restoring forest ecosystems, wildlife conservation, the development of ecotourism, planning and the gaps in hardwood stands. Depending on the resistance to anthropogenic factors, *species Rosa canina L.* urbanofobic moderate in nature with a tendency towards non-urban areas was recovered well irrespective of soil type oil, with sandy loam soil preferences. Under the aspect of soil composition, the influence on biometric features it is estimated that phosphorus is a grain growth stimulating factor. Acid soils and high nitrogen index positively influence hawthorn fruit length and thus lead to lower values and relative weight of the fruit pulp decrease. Hilly area stations provide fruits with higher values of biometric features in the sub-mountainous.

5. References

[1]. CELIK, F., KAZANKAYA, A. and ERCISLI S., 2009. Fruit characteristics of some selected promising rose hip (Rosa spp.) genotypes from Van region of Turkey. African Journal of Agricultural Research 4 (3), 236-240
[2] CELIK F, KAZANKAYA A, ERCISLI S., 2009. Fruit characteristics of some selected promising rose hip (Rosa spp.) genotypes from Van region of Turkey. Afr J Agric Res;4(3):236–240
[3]. AHMED, J., GÜVENC, A., 2009. Morfological and anatomical investigation on the rose hips sold in some herbalists in Ankara. Turkish Journal of Pharmaceutical Sciences, vol 6/2: 135-146.
[4]. CVETKOVIC, B., FILIPČEV, B.V., BODROZA-SOLAROV, M., BARDIC, Ž.M., SAKAČ, M.B, 2009. Chemical composition of dried fruits as a value added ingredient in bakery product. Food &Feed Research, 36 (1-2):15-20.
[5]. GÜNER, Ş. T. , ÖZKAN, K., ÇÖMEZ, A., 2011. Key factors in the site selection of Rosa canina (L.)- Applying generalized additive model. Polish Journal of Ecology 599(3), 475-482
[6]. DAMIAN C., 2013. A study on biodiversity in agriculture, International scientific symposium „Modern agriculture – Achievements and Prospects", 80th Anniversary of State Agrarian University of Moldova,Chişinău, October 09-11
[7]. Ercişli S, Güleryüz M (2006) Fruit properties of promising Rose hips (Rosa spp.) from the north-eastern Anatolia region of Turkey. Asian J Chem 18(1):239–242
[8]. GÜNER, Ş. T. , ÖZKAN, K., ÇÖMEZ, A. , 2011. Key factors in the site selection of Rosa canina (L.)- Applying generalized additive model. Polish Journal of Ecology 599(3), 475-482.
[9]. ŠINDRAK, Z., JEMRIĆ, T., BARIČEVIĆ, L., HAN DOVEDAN, I, FRUK, G., 2012. Fruit quality of dog rose seedlings (Rosa canina L).

Journal of Central European Agriculture 13(2), 321- 330
[10]. SOARE R., BONEA D., IANCU P., NICULESCU M., 2015. Biochemical and Technological Properties of Rosa Canina L. Fruits from Spontaneous Flora of Oltenia, Romania. BulletinUASVM Horticulture 72(1) / 2015
[11]. SOARE R, IANCU P, SOARE M, BONEA D, MANILA G, PANITA O, 2014. Morfological and biochemical issues to some Rosa canina L. populations from the spontaneous flora from SoutWest Romania. Micro and Nano Tehnologies advances in biotechnology 1:432-442
[12]. DINCU, I., LĂCĂTUȘU, GH., 2002. Technological bases of agricultural crops (*in romanian)*, Editura Ceres
[13]. ERCIŞLI S., EŞITKEN A., 2010. Fruit characteristics of native rose hip (Rosa spp.) selections from the Erzurum province of Turkey. New Zealand Journal of Crop and Horticultural Science.
[14]. MABELLINI A & al., 2011. Chemical and Physical Characteristics of Several Wild Rose Species Used as Food or Food Ingredient, International Journal of Industrial Chemistry, 2(3), 158-171
[15]. LEAHU, A., GUTT, S., GUTT, G., HRETCANU, C., 2011. The impact of fertiliser types on soil's macronutrients and microlements content, Environmental engineering, vols 1-3,Pages: 182-187, 8th International Conference Environmental Engineering, Vilnius, Lithuania, MAY 19.5-20.5/ 2011.