LAND SUITABILITY OF COMARNA CATHEMENT BASIN FOR CHERRIES TREES

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Abstract

The land suitability for cherries orchard represent the extent to which soil satisfy requirements of Cherry trees, on the local climatically conditions and within the framework of a management adapted to adapted to this species. Land with optimal suitability for cherry plantations are located in areas with average annual temperatures of 20 years, 8 ÷ 11°C, the average temperature of May are between 14 and 16°C, the absolute minimum annual air temperature does not drop abruptly as -20°C), and if it decreases gradually does not fall below (-28°C). In Romania, cherry trees grow well on a wide range of soil types such as Chromic Luvisols, Phaeozems, Eutric Cambisols, Chernozems and even Kastanozems. The stagnic, gleyic and stagni-gleyic soils are unsuitible for cherry plantations due to poor drainage. Another optimal soil characteristics for cherry orchard are: pH values between 5,5-7,2, aeration porozity of 16-22%, calcium carbonate content lower than 7%. The hyposalic, hyposodic and vertic soils are excluded from the establishment of orchards. We intend to present a case study of Comarna catchment area. The land of this watershed has good suitability for cherries orchard due to local microclimate, good external and internal drainage, ensured by middle slope and middle soil texture. The specific local microclimate is reflected by an earlier ripening cherry, about two weeks compared to neighboring basins located on the same altitude. Some of the lands are degraded by landslides and have severe restrictions for the establishment of orchards. The soil are more colder due to high content of clay, high water capacity and land shaded exhibition.

Key words: microclimate, land suitability, cerry orchrards.

Horticultural sector is of great importance for Romania, as it satisfies the nutritional needs of the country, contribute to the jobs, meet the requirements of industrial raw materials sector.

Fresh fruit cherries are recognized by their nutritional therapeutical and economical value. After Cherry Growers' promotion, consumption of fresh fruits cherry brings many health benefits: reduce the risk of cardiovascular disease, diabetes and cancer; flavonoids and procyanidin can protect neuronal cells; high content of potassium in sweet cherries may reduce risk of hypertension and stroke; anthocyanins promotes heart health by reducing inflammation; have a low glycemic inde; regulates circadian rhythm and encourages restful sleep (Kayla Young, 2014). Cherries are also a source of a number of vitamins and minerals such as Ascorbic acidNiacin, riboflavin vitamin A, thiamin, iron calcium (Richard P. Marini, 2014).

Among major countries producing cherry in the world, Turkey ranks the first both in the northern hemisphere and in the world with 417 thousand tons of production in 2010, corresponding to 20.3%, U.S. with 284.000 tons (13,8%). In the same year (2010) Romania ranks the 9th and produce 70920 tons, 3,4 percent. (Bal and Cercinli, 2013).

Production of sweet cherries has a long tradition Romania. The main grown cherry area are located in the highlands and Subcharpatian region. Orchards recognized for the high quality of cherry fruit are also found in Comarna catchment area.

It is well known that Cherry trees will grow on a wide range of soil types such as Chromic Luvisols, Phaeozems, Eutric Cambisols, Chernozems and even Kastanozems (Hornung St., 1975, Teaci D. şi colab. 1985, Mihăescu Gr., 2006, Voiculescu N., 1999). All of these soils should have good drainage. The soils located on slopes and those with good water and air permeability satisfy these conditions.

Another optimal soil characteristics for cherry orchard are: pH values between 5,5-7,2, aeration porozity of 16-22%, calcium carbonate content lower than 7%.

Investigation concern to the land suitability for cherries orchard evidenced that cherry trees are very susceptible to damage caused by poor

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drainage. The stagnic, gleyic and stagni-gleyic soils are unsuitible for cherry plantations due to poor drainage or due to shallow groundwater, located on the depth lower than1,5-2m.

The rootstock most commonly used in Romania prefers deep soils with medium texture.

Research conducted by Bucur et al. Cherry revealed that the variety Ramona Oliva growing stagnant since a soluble salt content of about 90 mg / 100 g soil. He tree death begin if the saluble salt content reaches a threshold of of 240 mg / 100 g soil (Bucur, 1962).

The ideal climatic conditions for growing cherries are: average annual temperatures of 20 years, 8 ÷ 11°C, the average temperature of May between 14 and 16°C, the absolute minimum annual air temperature does not drop abruptly as -20°C), and if it decreases gradually does not fall below (-28°C).

Cherry trees originate from the hardwood forests of Eurasiaa. They are from temperate zone deciduous and require four distinct seasons in order to thrive and actively produce fruit.

Cherry grows well in areas with annual rainfall of 620-670 mm (Cimpoeş, 2002). One interesting aspect of cherry trees is that the fruit itself has a very short period of time on the tree from flowering to maturity, more shorter than most other fruit crops. The optimal amount of rainfall in June May period is about 200-250 mm (Voiculescu, 2001). Adverse weather conditions dramatically influences the performance of cherries in fruit yields and fruit quality.

The main optimal climatical conditions for growing cherries are: 1) no severe frosts on the winther; 2) daily temperatures values during the blossoming period above 13°C; 3) Low summer rainfall to minimize fruit damage; 4) low humidity throughout the growing season to minimize disease outbreaks; 5) low or moderate winds to minimize physical injury to trees and fruit while providing sufficient aeration to reduce humidity within the crop (James, 2011).

One of the famous cherry plantation areas is the Comarna basin.It is located in the southern part of the Iasi County and in the in central eastern part of North-east development region of Romania.

We present a case study of Comarna catchment area. The land of this watershed has good suitability for cherries orchard due to local microclimate, good external and internal drainage, ensured by middle slope and middle soil texture. The specific local microclimate is reflected by an earlier ripening cherry, about two weeks compared to neighboring basins located on the same altitude (Bucur 1950).

Some of the lands are degraded by landslides and have severe restrictions for the establishment of orchards. The soil are more colder due to high content of clay, high water capacity and land shaded exhibition.

MATERIAL AND METHODS

Our investigation were carried out since 2014 in the Comarna catchment, area renowned for its cherry plantations. Comarna watershed is located in the south east of the Iasi County and in the north-eastern part of the Central Moldova Plateau.

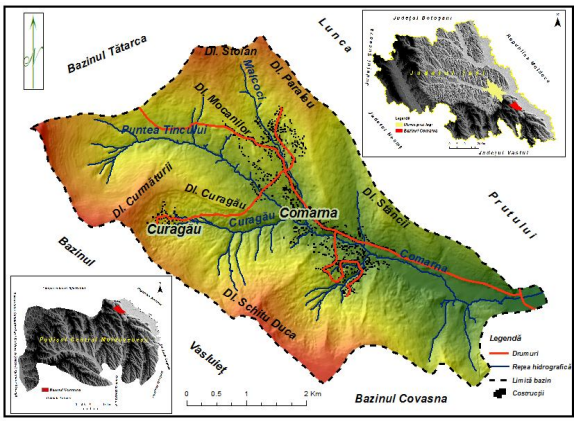

Figure 1 **Comarna catchment localization in the administrative territory of the Iasi County and in the geomorphological unit of Central Moldova Plateau**

In order to highlight some geomorphological characteristics and soil capabilities for cherry orchards, were used both traditional research and modern methods based on GIS soft.

Cartographic materials were obtained by means of the program TNT mips v.6.9., and the statistical processing was realized by Microsoft Office Excel 2007. An important step in the spatial modeling consisted in the achievement of the Didital Elevation Model (DEM), by vectorizing the contours lines and the heights from the topographic plans at scale 1:5,000.

For the characterization of the soils cover, the soil studies released by Office of edological and Agrochemical Studies were also consulted.

The soil units were corrected and completed with new obtained data, in the field and laboratory. It was necessary the equivalence of taxonomic units name, from the Romanian System of Soil Classification (Conea et al. 1980) and the Romanian Systems of Soil Taxonomy published 2003, 2012 and 2014 (Florea et Munteanu 2003 and 2012, Vlad et al. 2014).

Disturbed samples from the soil profiles were used to determine the total soil organic matter by potassium dichromate method (Walkley-Black, method), total nitrogen content by Kjedahl method, the calcium carbonate by Scheibler method. The chemical analyses in three replicates for each depth were independently performed (Stoica et al. 1986, Dumitruet al. 2009, Obrejanuet al. 1964).

The particle size distribution was also determined.The textural classes and subclases were

established after Romanian clasification system (Soil Survey Methology, 1987). The solouble salts have been determined by conductometric methods in water extract (1:5).

RESULTS AND DISCUSSIONS

Typical hilly area of Comarna catchement with an average altitude of 200 m and is closely linked to developments subsequent valley. Lithological structural plates on the right side of the basin must be local by maintaining the highest altitudes as on Curmăturii Hill or on the Schitu Duca Hill. Altitude has a progressive decrease NW-ESE at maximum of 337 m Mustăţii Forest and 319 m in Schitu Duca Hill.

Most of the land, respectively 89% of the study area has lower absolute altitude of 250 m and only 11% of the area is between 250-340 m altitudes

It is noted that about a third of the land in the catchment Comarna have a very good exposition, SE, S and SV, for. cherry plantations (*figure 2*). The good exhibition of the slopes favors earlier cherry fruit ripening.

Shady slopes, whith north, north east and north west faces, have a share of 42.3%. We mention that the lands shady slopes are susceptible to landslides and therefore are avoided for tree plantations.

The subsequent valley of the Comarna, through its almost cross orientation towards the SSE, promotes circulation of air masses, the dominant winds are those from the north west.

Weak winds have a beneficial effect on the trees: spread the frozen air; dried leaves and fruits after rain; reduces the negative effect of hot days, refresh air in the trees crown (Grădinariu 2003).

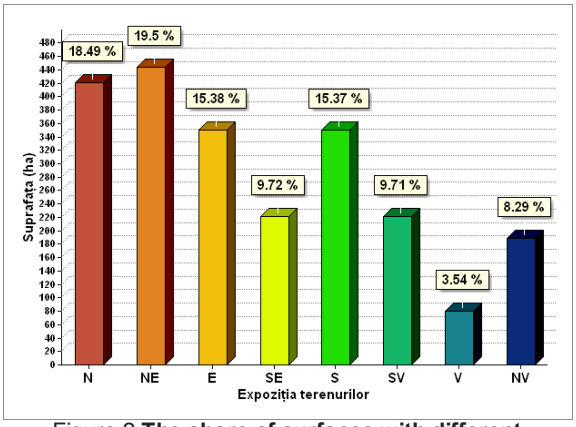

Figure 2 **The share of surfaces with different exhibitions in the Comarna catchment**

The map of slopes reveals of the presence of several categories slope. About 80% of all land less than 15% slope (*figure 3*). Lands with slopes greater than 15% are susceptible to surface erosion, linear erosion and landslides.

Cherry trees, on the sunny land and with slope values between 5 and 15% receive a more favorable thermal regime than those who are on steep slope less than 5%.

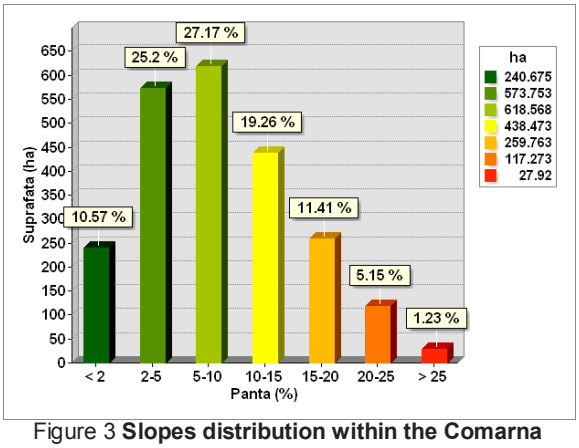

Figure 3 **Slopes distribution within the Comarna catchment**

After Romanian Soil Taxonomy, soils from Comarna catchment belong to 4 classes (*figure 4*): Protisols, Cernisols, Luvisols and Antrisols.

The Cernisols (*table 1*), the most extended class (50,62%), includes the following types of soil Cernoziomuri (Chernozems after WRB-2014) and faeoziomuri (Phaeozems after WRB-2014).

Cambic Chernozem (Haplic Chernoyems after WRB-2014), the most dominant soil type, have slightly acid up to slightly alkaline reaction (pH = 6.3–8.4), loam or loamy clay texture. Although cambic chernozems are widely spread in the cuesta backslope (reverse), is characterized by favorable conditions for cherry trees. The land capability for orchrads is illustreted in figure 5.

Faeoziomuri (Phaeozems after WRB 2014) are much like Chernozems but are leached more intensively, the depth of CaCO3 accumulation is higher than 125 cm. Phaeozems are either free of secondary carbonates or have them only at greater depths. Phaeozems are porous, fertile soils and make excellent farmland. Phaeozems occuppy 61 hectars, almost 4%.

The luvisols class is represented only by preluvosols (Haplic Luvisols, after WRB-2014), occuppy 0,65 % (10 ha) of the pedological surveyed surface.

Luvisols with a high silt content are susceptible to structure deterioration where tilled used for extensive grazing or planted with tree crops.

Soil reaction is slightly and moderatly acid and the organic matter content (1.8–2.1%) is low.

Luvisols occupy land with higher altitudes, is covered by forest and are not used for orchards.

The antrisols class also imposes by soil types such as anthrosol (AT) aric regosols and strong eroded chernozems. The aric subtype of anthrosol occupies 965 ha. The cerno-cambic aric anthrosols occurs in the higher part of the cuesta backslope. Erodic cernic anthrosols have formed on the steep slopes occupies 179 ha (exceeding 10%), especially on the cuesta front.

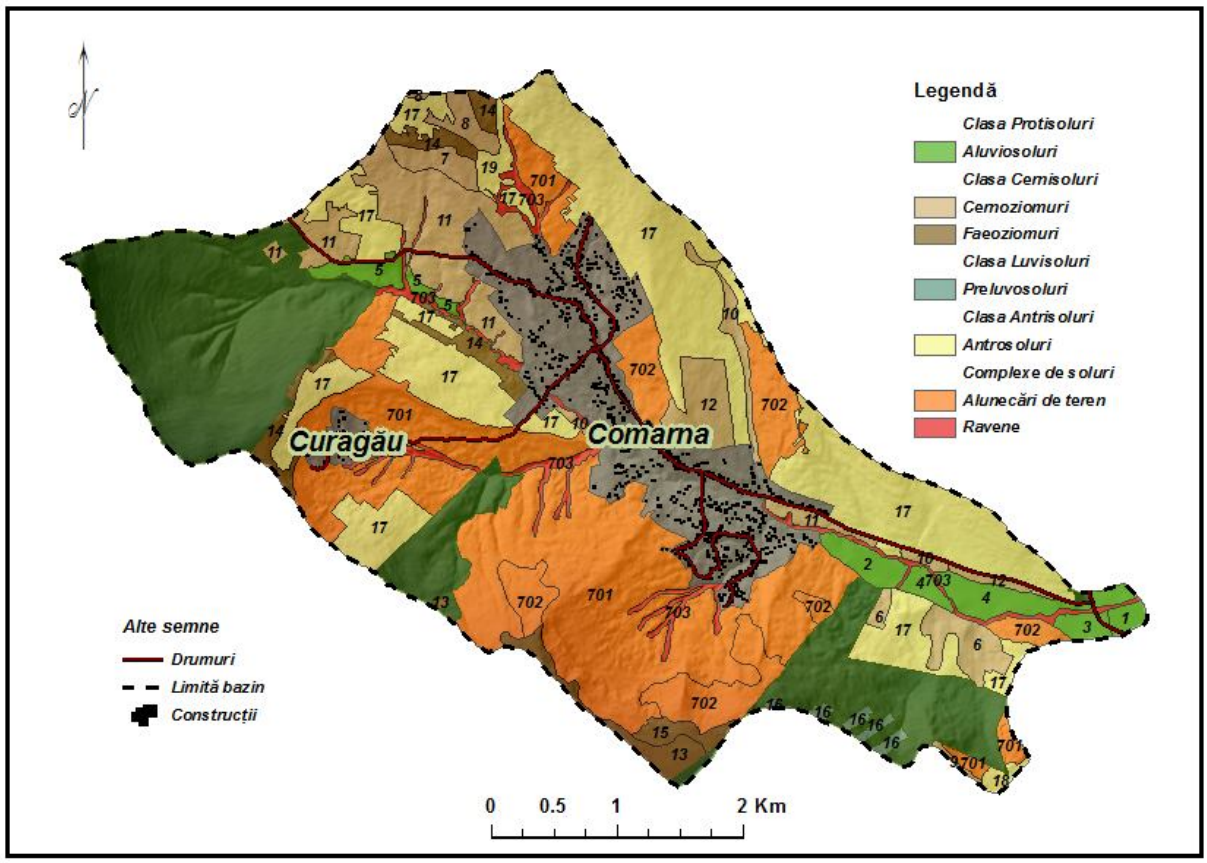

Figure 4 **Soils map of the Comarna watershed**

Table 1

Soil units of Comarna watershed meaning of symbols on the soil map

SOIL CLASS	Soil type	Soil subtype	hectares	%	Soil unit (US)
PROTISOLS			**79**	**5.17**	
	Aluviosol (**AS**)* (Fluvisols)**	calcaric (**ka**)	29	1.9	1,2,3
		calcaric-**mo**lic (**ka-mo**)	33	2.16	4
		molic-**gl**eic (**mo-gc**)	17	1.11	5
		TOATAL AS	**79**	**5.17**	
CERNISOLS			**773**	**50.62**	
	Cernoziom (**CZ**) (Chernozems)	**ca**lcaric **sa**linic (**ka-sc**)	27	1.77	6
		cambic **pa**rarendzinic (**pa-cb**)	14	0.92	7
		cambic (**cb**)	671	43.94	8,9,10,11,12
		TOTAL CZ	**712**	**46.63**	
	Faeoziom (**FZ**) Phaeozems	**ca**mbic **gr**eic (**cb-gr**)	61	3.99	
		TOTAL FZ	**61**	**3.99**	13,14,15
LUVISOLS	**P**reluvosol (**EL**) Haplic Luvisols	**st**agnic (**st**)	10	0.65	
		TOTAL EL	**10**	**0.65**	16
ANTHRISOLS	**An**trosol (**AT**) Aric regosols pp Eroded Chrenozems pp		**665**	**43.55**	
		aric cambic (**ad-cb**)	486	31.83	17,18
		erodic **ce**rnic (**er-ce**)	179	11.72	19
		TOTAL EL	**665**	**43.55**	
Soil complex					**701,702,703**

*After Romanian Soil taxonomy, 2012/2012+; **After World Reference Base for Soil Resources 2014; pp-pro parte.

The protisols class occupies 79 ha (7%of the surveyed area) and includes Aluviosols (Fluvisols after WRB-2014).

The good natural fertility of Aluviosol were recognized in soil science literature (IUSS Working Group, 2014).

Alluvisols are avoided for cherry tree plantations, even with some form of water control, due to unfavorable microclimate registered in the floodplain area.

By analyzing 18 soil, geomorphology and clima indicators involved in establishing the mark of land evaluation a number of six soil quality classes resulted in Comarna catchment for orchrad: first class (1,44%) the second class (16,76%), third class (32,53%9 the fourth class (36.74%). Unsuitable land for fruit trees belong to 5th and 6 th and it represents 35 of the total area occupied by agricultural land represent almost 45% of total agricultural land (*figure 6*).

As to the orchrds, six classes of pretability were identifie). An area of 35,23% of the agricultural total area, offer good conditions for the cherry trees and are included in the third class (*figure 6*).

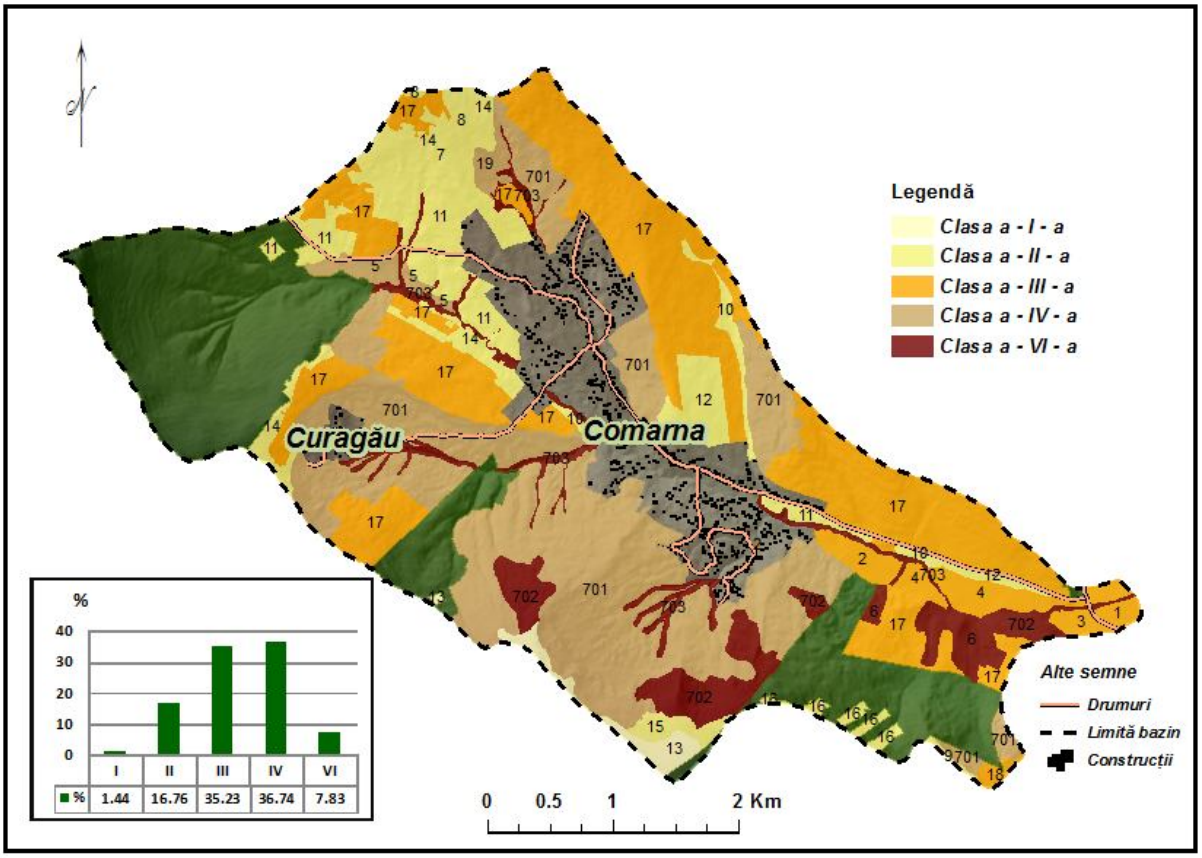

Figure 5 Weight of the pretabilitty class for orchards

CONCLUSIONS

Most of the land, respectively 89% of the study area has lower absolute altitude of 250 m and only 11% of the area is between 250-340 m altitudes. Third of the land in the catchment Comarna have a very good exposition, SE, S and SV, for. cherry plantations. The good exhibition of the slopes favors earlier cherry fruit ripening.

The subsequent valley of the Comarna, through its almost cross orientation towards the SSE, promotes circulation of air masses, the dominant winds are those from the north west. Weak winds have a beneficial effect on the trees: spread the frozen air, dried leaves and fruits after rain; reduces the negative effect of hot days, refresh air in the trees crown.

The map of slopes reveals the presence of several categories slope. About 80% of all land less than 15% slope. Lands with slopes greater than 15% are susceptible to surface erosion, linear erosion and landslides.

After Romanian Soil Taxonomy, soils from Comarna catchment belong to 4 classes: Protisoluri (Protisols)), Cernisoluri (Cernisols), Luvisoluri (Luvisols) and Antrisoluri (Antrisols).

The best soils (situated on the plateau), without any restrictions for cherry trees is cambic

greic faeoziom (grey-luvic Phaeozems).

After analyzing 18 soil, geomorphology and clima indicators involved in establishing the mark of land evaluation, about 54% of land have good capability for cherry trees plantations. Unsuitable represents almost 45% of total agricultural land.

ACKNOWLEDGEMENTS

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