CZU 634.23:631.4

THE ASSESSMENT OF THE IMPACT OF THE ECO-PEDOLOGICAL CONDITIONS ON CHERRY TREES IN RUDI VILLAGE, SOROCA DISTRICT

Emilian MOCANU, Rodica MELNIC, Ion BACEAN
Agrarian State University of Moldova,
Chisinau, Republic of Moldova

***Abstract**:* One of the main conditions of programming and conducting in the territory of different economic activities of the sustainable development of human settlements is food production, ensuring the population with wide diversity of food products, including fruits of superior food value, including cherry. The purpose of the research was to give the physical and chemical characteristics of the investigated soils, which are located on slopes with different inclination. Also was the evaluation of the cherries productivity on these soils. Cherry tree has high demands on soil structure and drainage. The best for this species are medium and light soils, permeable, depending on the humidity, which are easily heated and contain up to 4 - 6% active calcium. When planted in clay, heavy and cold soils, the cherry grows weak, suffers from frost, has glue leaks and lives little. It is one of the fruit species most sensitive to root suffocation, does not withstand stagnant water and flooding, even for short periods. Also, the cherry tolerates the insufficient water in the soil. On soils with advanced erosion, the cherry vegetates greedy and lowers fruit. The cherry gives good results on soils with a pH value of 5.2 - 7. The most favorable location for the cherry is in the middle third of the slope.

Key words: ecopedological conditions, cherry plantations, productivity.

EVALUAREA IMPACTULUI CONDIȚIILOR ECO-PEDOLOGICE ASUPRA ARBORILOR DE CIREŞ DIN SATUL RUDI, RAIONUL SOROCA

Emilian MOCANU, Rodica MELNIC, Ion BACEAN
Universitatea Agrară de Stat din Moldova,
Chișinău, Republica Moldova

Rezumat: Una dintre principalele condiții de planificare și desfășurare, pe teritoriul țării, a diferitelor activități economice pentru dezvoltarea durabilă a localităților este producția de alimente, asigurând populației o mare diversitate de produse alimentare, inclusiv fructe cu valoare alimentară superioară, printre care sunt și cireșele. Scopul cercetărilor a fost de a determina caracteristicile fizice și chimice ale solurilor din zona studiată, care sunt situate pe pante cu înclinație diferită, precum și evaluarea productivității arborilor de cireș ce cresc pe aceste soluri. Cireșul are cerințe mari în ceea ce privește structura și drenajul solului. Cele mai bune pentru această specie sunt solurile medii și ușoare, permeabile, în funcție de umiditate, care se încălzesc ușor și conțin până la 4-6% calciu activ. Când este plantat în soluri argiloase, grele și reci, cireșul crește slab, este sensibil la îngheț, suferă de scurgeri de clei și are o durată de viață scurtă. Cireșul este una dintre speciile de pomi fructiferi cele mai sensibile la sufocarea rădăcinilor, nu rezistă la apă stagnantă și inundații, chiar și pentru perioade scurte. În schimb, cireșul tolerează umiditatea insuficientă din sol. Pe solurile cu eroziune avansată, cireșul vegetează slab și fructifică puțin. Cireșul dă rezultate bune pe solurile cu valoarea pH-ului de 5,2 - 7. Locația cea mai favorabilă pentru cireș se află în treimea mijlocie a pantei.

Cuvinte-cheie: condiții ecopedologice, plantații de cireș, productivitate.

INTRODUCTION

The age in the cherry culture can be seen as very high, a testimony in this regard, considering the seeds found in the Neolithic lacustrine dwellings in western Europe. The first written information was kept by the Greek philosopher Xenophon from 536 BC, because, later, Theophrastus (374-278 BC) in his treatise on botany [4]. Currently, the intensive cherry cultivation is practiced in decreasing areas of cherry plantations: in Turkey, USA (California, Waingtonington etc), Iran, China, Italy, Spain, Uzbekistan, Romania, Russia, Ukraine, Chile, Syria, Australia , France, Greece, Poland, Germany, Serbia, Lebanon, Japan etc.

The total production of cherries in the world is about 2.50 mln. tones and this quantity does not ensure the physiological requirements of man (200g / day / man) and the world market (3-5 ml. tones). The high dietary value of cherry is conditioned by the increased sugar content (7.7 - 16.8%), represented mainly by glucose and fructose, by the content of different acids, pectins, vitamins, potassium salts, calcium, iron and other nutrients easily assimilated by the human body, ensuring its healthy development. Cherries exceed all fruit species in terms of average sugar content, and after acidity (expressed in malic acid) occupy an intermediate position, being superior to apples, pears and peaches. Thus, the cherry is a fruit species with special and important valences from an economic and economic point of view. The fruits of these species are much in demand for consumption as they reach maturity in a period when there are no other fruits on the market. They are used not only for fresh consumption in a period of 35-45 days, cherries being a valuable raw material for obtaining a wide range of processed products [5, 6].

MATERIAL AND METHOD

As research objects, the climatic, geomorphological, pedological and agroecosystems of cherry orchards from Rudi Soroca district served. The purpose of the research was to study the ecopedological conditions and their suitability for cherry culture in the area of the natural area of Northern Moldova, Soroca rayon, Rudi locality.

The work program included collecting soil samples in the field and analyzing them in the laboratory, according to the known methods: hygroscopic water - the method of drying the soil sample in the oven at temperature-105 ^{o}C for 5-6 hours; humus- I. Turin method modifying Simacov; carbonates-the gas-volume method; the cations absorbed Ca, Mg - the trilonometric method; pH-potentiometric method [2]. In assessing the ecological status of the locality, the land cadastre materials and the "Pedogeographic districts and the regional particularities of land use and protection" were used [13]. To characterize the climatic indices, the published martial materials of the State Hydrometeo Service from the Republic of Moldova were used [8]. The relief elements were established as a result of field observations, and some of their characteristics were extracted from the pedological research materials elaborated for Rudi locality by the Research Institute in the field of Technologies for the Organization of the Territory of the Republic of Moldova [11]. The morphology of some soils has been studied in the field under the cherry tree plantations according to certain indices: the composition of

the profile, the thickness of the genetic horizons, the color, the settlement, the structure, the neoformations, the texture, etc. The data regarding the characteristic of the physical and physico-chemical properties were collected from the memory of the pedological researches in the Rudi locality annexed to the cartographic materials: the pedological plan, the plan of distribution of the agricultural lands to the owners, cartograms for the soil texture, the degree of erosion [11].

The harvest of cherry orchards was extracted from the registers of the land holders and from the annual reports of the town hall the agricultural section.

RESULTS AND DISCUSSIONS

The fruit-growing ecological system comprises fruit-growing and fruit-bearing plants closely related to the ecological conditions, which must ensure the harmonious unfolding of the biological cycle and the balance of metabolic processes. Because, the ecological relationships that are established between the requirements of the plants, on the one hand, and the life support, on the other, are normal as long as the relationships of natural reciprocity are maintained. Any fruit crop represents an open bio system to other biological communities. The cherry-fruit ecosystem is specialized. According to some authors in the scientific organization of fruit production, the priority is to know the bio systems and to establish the most accurate ecological-geographic relationships between the plant and the environment, especially between the variety and the biotope [5, 10].

In the fruit-growing ecosystem, an essential role rests with the soil, which must provide the plant with physiological elements necessary for development. Soil with all its properties is one of the four terms of the relationship relief - climate - plant - soil. The fruit species being multi-annual plants, they need to find in their soil every year their natural culture environment, which will allow them to perform under optimal conditions the growth and fruiting processes. For trees, as for other crops, the soil has a dual function, as an active fixing support and as a reservoir of nutrients. Unlike most crop plants, trees must develop over time a strong root system, well anchored in the soil, capable of supporting a large load of fruit. For a normal functionality of the root system, the trees need a volume of soil consisting of fine material, loose and fully friable, at a thickness of at least 100 cm. The compact horizons behave as a mechanical obstacle to the penetration of the roots, or physically-chemically inert, reducing the edaphic volume, becoming a restriction factor. The edaphic volume in the fruit ecosystem influences the adsorption with exchange that is established between soil and plant, being dynamic as the roots grow, depending on the conditions of humidity, aeration and the activity of microorganisms, by a complex of ecological factors (relief, soil, climate, etc.). and the anthropics that control it [5, 10].

The comparative analysis of the land assets of Rudi shows that the total area of the orchards constitutes 934 ha or 30.5% of the total area of the locality. From the total area of the apple orchards, the seeds of the apple orchards represent 740.2 ha or 79.3%, and the seed species 193.3 ha or 20.7%. Among the seed species the apple predominates - 74%, and the hair constitutes only 5.3%. Among the tree species predominate plum (15%), the other species together make up only 3.8% (cherry 2%, cherry 1.8% and walnut 1.9% of the total area of apple orchards (Figure 1).

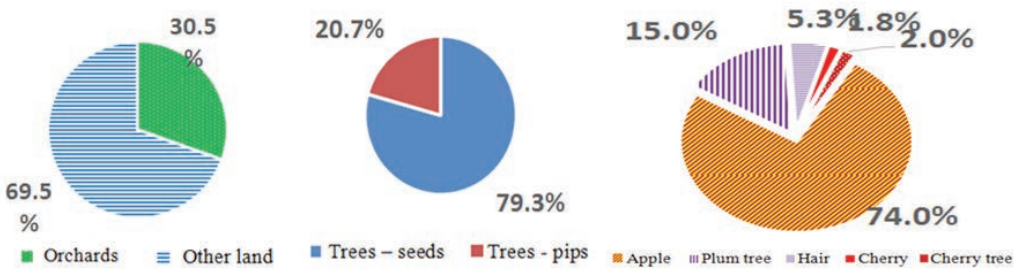


Figure 1. The fruit-growing agroecosystem, Rudi, Soroca district

Compared with the economic requirements, the weight of the apple species is necessary to be at the apple - 63%, the hair - 15%, the plum - 10%, each 3% apart for the cherry, cherry and walnut the total area of the orchards. Due to these considerations in the ecological reconstruction of the fruit-growing agroecosystem, the proportion of fruit-growing species in the orchards of the locality must be optimized, especially the area of cherry plantations up to 3% of the total area.

The cherry orchards are located on the plateau with a slope 1-20 south and partly the upper slope with a slope 1-30 southwest, the altitude 200-220 m above sea level. The soil cover investigated is strongly soft-clay loam-clay, typical temperate humifer moderately moderate and strongly eroded, and deep loam-clay.

The soft gray soil has a subtype of transition to the type of chernozem. The soil profile is humidified at the top, poorly differentiated morphologically and texturally. The humus content (Table 1) in layer 0 - 10 cm constitutes 2.43% - low. To depth the values of humus content gradually fall to 1.47% - very low because it is within the limits of humus content below 2%. In horizon C - parental rock the humus content decreases to 0.67% - 90-100 cm layer and 0.31% - 120-130 cm layer. Carbonates appear at depths of 120-130 cm in small quantity (1.5%). Soil reaction - pH decreases from 6.2 (0.10 cm) to 5.5 (40-50 cm) and then slowly increases with depth to 7.4 (120-130 cm). The amount of adsorbed cations decreases with depth (28.2 me-0-10cm; 25.15 m.e-90-100 cm). The most pronounced hydrolytic acidity is at the top of the profile (1.36-1.82 me per 100 g soil) [11]. The values of the physical clay content vary within the limits of 48-52% and confirm the loam-clay texture and the compact soil placement throughout the profile.

The vertical gray soil is distinguished by the differentiation of the profile, with an eluvial character in the horizon A illuvial in the horizon B. Horizon B also evidently vertex-cracked, hard, structure in prismatic blocks, with glossy, smooth, slippery surfaces, so the soil appears practically unstructured, massive. Relatively moderate to high humus content (0-10cm) - 3.2% and very low from 15-25cm to 120-130cm. Carbonates appear from 120-130cm in larger quantities (9.0%), weak acid reaction (6.6-6.8) and neutral (7.2-7.6). The cations adsorbed in the upper amount constitute 33.7 me., and at other depths vary between 21.7-29.9 me per 100g soil. The physical clay content (<0.01mm) increases to 72.4- 73.5%) and confirms the illuvial character of horizon B, with a very compact settlement.

The smoothed chernozem soil has the characteristic profile of the grained structured humidified chernozem, hydrostable with the main diagnostic character the lack of

carbonates on the whole profile. Humus content in the upper horizon - 3.59-4.46% slowly decreasing with depth to 0.63% in the layer 120-130cm. Carbonates appear below horizon B at depths of 90-100cm (3.52%) forming a maximum at depths of 120-130cm (9.26%).

The climatic conditions during the years of the research were characterized by different thermal (temperature) and humidity (precipitation) regimes (Figure 2).

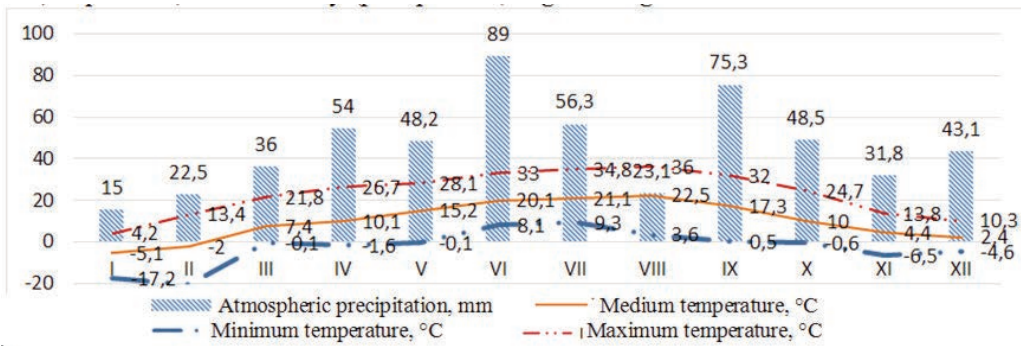
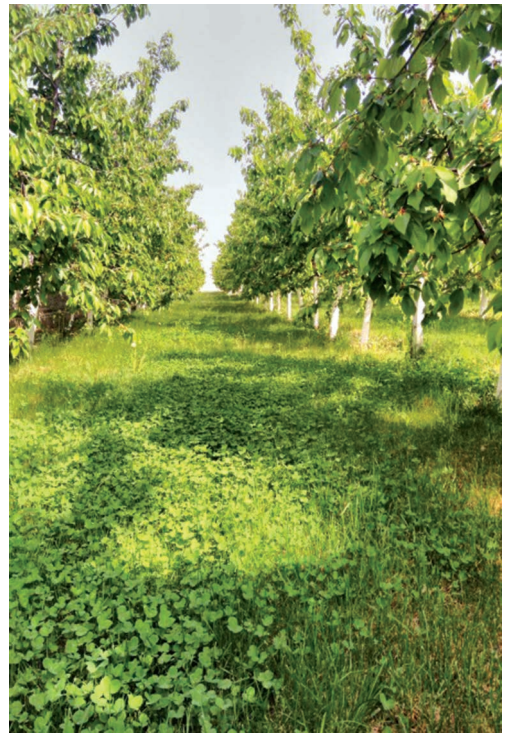


Figure 2. Climatic indices, 2017

1. Beginning of flowering

2. Flowering



3. The end of flowering

Figure 3. Unfolding cherry flowering phenophases

Thus as a whole, the humidity of the cherry plantations was better in 2016 and 2017 compared to 2015, which also determined the development, the productivity level of the cherry tree agroecosystem in Rudi.

It was studied the course of the main flowering phenophases and the flowering (ripening) of cherry fruits (Figure 3). The flowering and the ripeness of the cherry depending on the ecological conditions of the Rudi Soroca district is shown in table 2.

Table 2. Flowering and fruit maturity of cherry, depending on the eco-pedological conditions of the village of Rudi, district of Soroca

Eco-pedological conditions	Flowering			Maturity
	beginning	end	time	
1. Plateau	25.04	6.05	12	7.06
2. Plateau 1-20	25.04	7.05	13	11.06
3. Plateau - chernozem	22.04	2.05	11	7.06
4. Plateau, 1-30	19.04	27.04	9	5.06
5. Plateau, 5-80	17.04	24.04	8	2.06

In 2017, during the beginning and end of flowering, the same laws were established, only in other calendar terms.

The productivity of agricultural crops, including cherry, is the main index needed for economic evaluation and the ecological conditions in which their development takes place.

In 2017 the cherry harvest values depending on the ecological conditions ranged from 9.71t/ha - the southern slope variant, 5-80 inclination with typical moderate humerous chernozem soil strongly eroded up to 16.3 t/ha - variant of the plate with strongly polished chernozem soil deep mourning clays. In the variant of the typical moderate humorous, the values of cherry harvests in the rainier years (2016, 2017) increased compared to the corresponding dry year (2015) from 7.42 and 9.15 t/ha to 11.1-12.8 t/ha and 10.6-12.2 t/ha. This was conditioned by the washing with rainwater of the carbonates from the active root zone (0-60 cm).

The average values of the crops ranged from 9.7 t/ha variant of the southern slope, inclination 5-80, with typical moderate humiferous chernozem soil strongly eroded up to 14.6 t/ha variant of the plateau with strongly loam-clay highly polished chernozem soil. The average value of the cherry crop in the ecological conditions of the clay-loam ash-gray plateau decreased by 32% compared to the average value of the crop variant of the deep-clay-soft-clay-soft (13.7 t/ha) ash. The average value of the cherry crop in the ecological conditions created in the south-western slope 1-30, the typical moderate and strong eroded humiferous chernozem decreased correspondingly by 22.1% and 33.5% compared to the average crop from the variant of the polished chernozem strong deep clay-clay. The decrease of the crop in this case is conditioned by the degree of erosion of the soils and the increase of the content of carbonates in the area of spread of the roots of the plants from 4.02-5.13% to 8.76-10.15% CaCO3 (Table 3).

Table 3. Cherry productivity in the ecological conditions of Rudi, Soroca district

Eco-pedological conditions	Harvest t/ha			
	2015	2016	2017	Mediate
1. Plateau	11.20	14.70	15.20	13.70
2. Plateau 1-20	7.86	9.90	11.40	9.32
3. Plateau - chernozem	11.90	15.60	16.30	14.60
4. Plateau, 1-30	9.15	12.80	12.20	11.38
5. Plateau, 5-80	7.42	11.10	10.60	9.71

In the cherry orchards in Rudi Soroca district, succeeding from the results of the researches carried out and the analysis of the bibliographic synthesis, it is necessary to apply some procedures to prevent compaction, soil erosion, increase of carbonate content in the area of active root extension, increase the humus content and its quality in the upper layer of the soil to optimize the regimes of food, water, air, heat, oxidation-reduction, biological activity of the soil, without manifesting toxicities in the soil [1, 2, 9, 12].

Removal and prevention of compaction, reduced aeration of the soil (especially ash-clay loam) by deep drifts more than once every 3-4 years with at the same time introduction of the humiferous soil materials and organic fertilizers (manure, compost).

Preventing surface erosion and reducing erosion by grassing the intervals between rows planted with trees. During the vegetation, the systematic mowing and mowing grass, when the plants reach the height of 15-20 cm. 4-5 mowing per summer. Being regularly mowed, the green table serves as mulch. Usually mazariche and radish (oats) are similar. After 4-5 years, the intervals are set in autumn at a depth of 12-14 cm, and the free ones are sown with the same herbs for understanding. In relation to the superficial spread of the roots to the cherry, the soil remediation works in the area near the tree are performed at a lower depth (8-10 cm).

CONCLUSIONS

The cherry orchards are located on the plateau with a slight inclination 1-20 south, the upper slopes inclining 1-30 south-west and 5-80 south, the altitude 200-210m above sea level. Soils: strongly argillic-deep-clay loam (4.5 ha), deeply argillic-loam (0.5 ha) deep gray ash, strongly luto-clay (10.3 ha) strongly sandy chernozem, typical moderately eroded humiferous chernozem (1.0 ha) and strong (0.5 ha) climatic conditions were characterized by annual average temperatures of 9.1 ^{o}C (2015), 8.23 ^{o}C (2016) and 8.28 ^{o}C (2017) and annual rainfall 341.9 mm (2015), 644.5 mm (2016) and 542.8 mm (2017).

Ecopedological conditions directly influenced the productivity of cherry. It was pointed out that the earlier development of the cherry vegetation phenophases took place under the ecological conditions from the upper south-western slopes, 1-30 and south, 5-80 with the soils moderately moderate and strong eroded humiferous chernozem. In the ecological conditions of the plateau with vertical clay-clay loam soil the fenophases of cherry vegetation were delayed up to 6-10 days.

The productivity of cherry was established higher under the conditions of the plateau with soft gray soil and strongly loam-clay deep polished chernozem, the three-year average value correspondingly being 13.7 and 14.6 t/ha with a variation in the dry years (2015) from 11.2 t/ha up to 11.9 t/ha, and in humid years (2016, 2017) from 14.7-15.2 t/ha to 15.6-16.3 t/ha.

The decrease of cherry productivity by 32% in the variant of cherry cultivation on a plateau with a slight inclination 1-20 towards the west, a deep gray clay-lute, deep vertical soil, occurred due to the fine texture (67.1- 73.5% physical clay), compaction and reduced aeration, and the decrease of this index by 22.1% and 33.5% in the south-western slope 1-30 and south 5-80 inclination with typical moderate and strong eroded humiferous chernozem was conditioned by the degree of erosion of soils and the increase of carbonate content in the area of spreading tree roots from 4.02-5.13% to 8.76-9 % CaCO3.

The results of the researches can be used in the practice of reconstructing the multi-annual plantations, as a basis for the programming of the crops and the elaboration of the system of differentiated, ecopedological technological processes argued for cherry cultivation in Rudi, without degrading the environment.

BIBLIOGRAPHY

1. ANDRIEȘ, S. V. Agrochimia elementelor nutritive. Fertilitatea și ecologia solurilor. Chișinău.: Partos, 2011. p. 32-36. ISBN 978-9975-51-203-9.
2. ANDRIEȘ, S., NOUR, D., și alții. Eroziunea solului. Chișinău.: Pontos 2004, p. 190-196. ISBN: 631.459+632.125)082.
3. ANDRIUCA.V. Lucrări Metodice la disciplina Ecopedologie pentru studenții specialității - 424.1„Ecologie". Chișinău. CE. UASM. 2015. 54 p.
4. ASANICA, A., PETRE, Gh., PETRE, V. Înființarea și exploatarea livezilor de cireș și vișin. București. 2013 p. 9-21 ISBN: 978-973-40-0985-5.
5. BABUC, V. Pomicultura. Chișinău. 2012. 486 p. ISBN: 978-9975-53-067-5.
6. BALAN, V. Pomicultura. Chișinău. 2001. 150 p. ISBN: 9975-906-39-7.
7. BUDAN, S. Aspecte tehnologice privind cultura cireșului și vișinului. Iași. M.A.I.A. 1985, p.176-181.
8. Buletinul Serviciului de Stat Hidrometeorologic. Chișinău. 2015-2017, p. 39-45.
9. CERBARI,V., ȚARAN, M. Agricultura verde șansa de salvare a cernoziomurilor Moldovei de degradare În.: Agricultura Moldovei nr. 9-10, 2015, p. 13-18. ISSN 05825229.
10. DONICA, I., și al. Cultura cireșului. Chișinău. 2005, 120 p.
11. Materialele cercetărilor pedologice a localității Rudi raionul Soroca. Chișinău.: ICTOT în Republica Moldova 2011. 59 p.
12. Programul național complex de sporire a fertilității solului în 2001-2020. Chișinău.: 2001, p. 61-68. ISBN 9975-938-25-6.
13. URSU, A. Raioanele pedogeografice și particularitățile regionale de utilizare și protejare a solurilor. Chișinău.: 2006, p. 83-92. ISBN 978-9975-62-035-2.