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EVALUATION OF PRECIOUS ECOLOGICAL CONDITIONS FOR FRUIT TREES PLANTATIONS IN THE MIDDLE FARM FIELD

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Abstract

Research over three years has allowed us to highlight the extension of the fruit plantations in Glodeni district. In the area of fruit plantations, the apple showed 98.1% of the total area of the trees. The structure of the species of fruit plantations does not correspond to the requirements of the national economy and requires optimization through the ecological reconstruction of the existing orchards. All orchard soils have at the top of the profile a dilapidated layer with an average depth of 57.3%, non-homogeneous by color, structure and other morphological indices, with physicochemical properties and nutrient assurance, which mostly determines the spreading the root system and the productivity of the fruit plantations. It was highlighted that the 3 years average values of real production were lower than the potential one, which requires more favorable conditions for fruit plantations.

Key words*: agro ecology, tree species, fertility, pretability.*

INTRODUCTION

The efficient exploitation of the ecological, technological and socio-economic conditions of each unit or area is one of the main objectives of agricultural science and practice, fruit growing being an important place in the creation of agricultural resources, being known from ancient times one of the branches main and economically efficient agriculture in our country. Fruit growing previously occupied approx. 6-7% of the area of agricultural land, providing 20% the benefit from the marketing of agricultural production. Average fruit production amounted to 950 thousand tons per year, while the average production per hectare was - 7.3 tons.

Assessing the condition created in this basic branch of the agro-industrial complex, there is a sharp decrease in the global fruit harvest averaging 2.5 times. Under these conditions, it is necessary to carry out profound research on the substantiation of the sustainable development prospects of the fruit growing branch (Babuc, 2012; Dadu, 2011).

Currently in the Republic of Moldova most of the fruit plantations have exceeded the age of 20-30 years, they can be more easily affected by changes in the environment: climate, relief, hydrology, soil etc., with low production potential and reduced exploitation value. In accordance with the concept of sustainable fruit growing, the strategic direction consists in the efficient exploitation of existing orchards with the potential for unproductive productivity and their gradual replacement with new type orchards with modern assortment and modern technologies adapted to the concrete production conditions for efficient use of the ecological, biological, technological, economic potential of each land sector and agricultural enterprises (Babuc, 2012; Dadu, 2011; Ursu, 2006; 2011).

The purpose of the research was to monitor the ecological conditions and to highlight their suitability for the fruit trees in the Glodeni district. Research objectives: highlighting the structure of existing fruit plantations; the characterization of ecological conditions and the assessment of the productivity of fruit trees for the scientific argumentation of ecological micororionation of fruit growing, which contributes to the more efficient utilization of the natural resources of the Glodeni district located in the Middle Prut Plain.

MATERIALS AND METHODS

Research methods are accepted in organic research and fruit growing. For the characterization of climatic indices, published materials

of the State Hydro meteorological Service of the Republic of Moldova (BSHS, 2015-2017; Pedological Report, 2011) were used. The elements of the relief were established as a result of the expeditionary observations in the field and on the basis of the pedological research materials of the Research Institute for Territorial Organization of the Republic of Moldova (Pedological Report, 2011). The morphological characteristics of the soils in the fruit plantations have been studied in the field. The soil samples in the laboratory were determined: hygroscopic humidity; soil texture; the content of humus by the Tiurin method in the modification of Simacov; carbonate content - gas-volumetric method; determining the content of Ca^{++} and Mg^{++}; bulk density-the metal cylinders method (Andriuca, 2015; Ursu, 2006).
Global harvest by species was determined 15-20 days before harvesting after the amount of fruit normally grown on 25 typical trees per hectare. On each tree, choosing 1-2 skeleton branches, which is equivalent to a crown sector (1/4) on which the fruit was weighed. Then the fruit mass was calculated at a tree and in tones' per hectare (Babuc, 2012).

RESULTS AND DISCUSSIONS

The plots of fruit plantations in the Glodeni district extend over an area of 2239.2 ha. Of the total area of the fruit plantations, the weight of the apple species is 91.8% (2057 ha), the cherry species is only 6.6% (150 ha) and the cherry 0.9% (19 ha) and the apricot 0.6% (13 ha). The proportion of fruit trees in existing orchards differs from the proportion of national economy requirements, which provide for the northern fruit plant: apple - 68%, hair - 12%, plum - 12%, cherry - 4%.
All fruit trees are privately owned - in the agricultural cooperative production (CAP) - 22.5 ha, in limited liability companies (LLC) - 1561.3 ha, peasant farms - 328.6 ha.
Relief and hydrographic network. The fruit plantations are located on various relief elements, plateau, slope with different north-western, west, south-western, southern, 1-3°, 3-5°, 5-7° inclined to the upper, middle and lower the slopes, the valleys of the Prut River, the smaller rivers Camenca, Căldăruşa, Ustia. The altitude of the relief elements varies from 90 m to 200 m above sea level. Reluctant relief causes the distribution of environmental factors. On flat fields, light, heat, water, nutrients, wind intensity are almost evenly distributed. On the sloping land, biotope elements record variations, which in turn generate variations in growth, tree metabolism, productive potential - quantitative and qualitative etc. As a whole, the relief elements of the locality cause the formation of three types of microclimate: moderate cold with the sum of the active temperatures Σ ta $\geq$ 10°C and above 2888-2934°C on the altitudes of 180-200 m above sea level; moderately warm with the sum of the active temperatures Σ ta $\geq$ 10°C and above 2957-3049°C on the slopes: E, 1-3°, upper, altitude 130-170 m, SE, 3-5°, middle slope altitude 130-170 m; SW, 5-7° mid, altitude 130-170 m; warm with the sum of active temperatures 3072-3164°C on the SW slopes, 5-7° medium, altitude 80-120 m.
The deviation of the fruit trees on the slopes from those on the plateau was up to 253°C. Soil varieties on the fruit trees are also different: argiloiluvial chernozem, chernozem leveled strongly deep lute-clayey on the plateau with an altitude of 180-200 m. On the slopes or highlighted leached chernozems weak and moderately eroded clay-clayey and clayey; moderate and mildly moderate to moderate deep chernozems, and deeply clay-clayey chernozems.
On all the soils of the fruit plantations, a very pronounced layer degraded around the depth of 0-60 cm, which is very inhomogeneous according to their color and structure, with the succession of the genetic horizons interrupted due to their techno genic mixture, ie they are technogenode soils - formed with precipitations physic-chemical modifications.
Characteristic of the ecological conditions of the fruit plantations in the Glodeni district.
Climate conditions over the five years of research have been characterized by different thermal humidity regimes. The average annual temperature increased from 9.3°C (2014) to 10.5°C (2015), and in the following years it remained at the same level of 9.8°C. The humidity regime of Glodeni ranged from 382 mm (2015) to 69 mm (2014) years. In 2017 the rainfall was recorded with a moderate value of 578 mm compared to 2016-602 mm and 2018-615 mm (Figure 1).

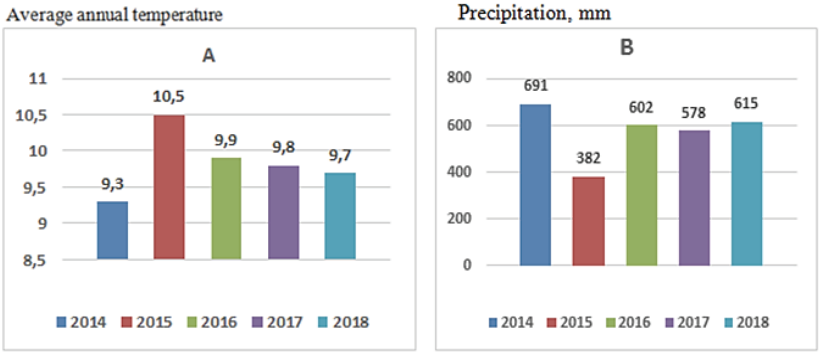

Figure 1. The thermal (A) and humidity (B) of the territory, Glodeni district, 2014-2018 (Meteorological Station Bălți)

Based on these results, the most dry years - 2015, wetter - 2014 and moderate - 2017, after the heat and humidity regime, 2017 were highlighted.

According to the particularities of these years the thermal moisture regimes on the territory of the rayon in the vegetation period (Figures 2 and 3).

The deviation of the fruit trees on the slopes from those on the plateau was up to 253°C. Soil varieties on the fruit trees are also different: argiloiluvial chernozem, chernozem leveled strongly deep lute-clayey on the plateau with an altitude of 180-200 m.

On the slopes or highlighted leached chernozems weak and moderately eroded clay-clayey and clayey; typical mild chernozems and strongly humid strongly profound and deeply clay-clayey chernozems.

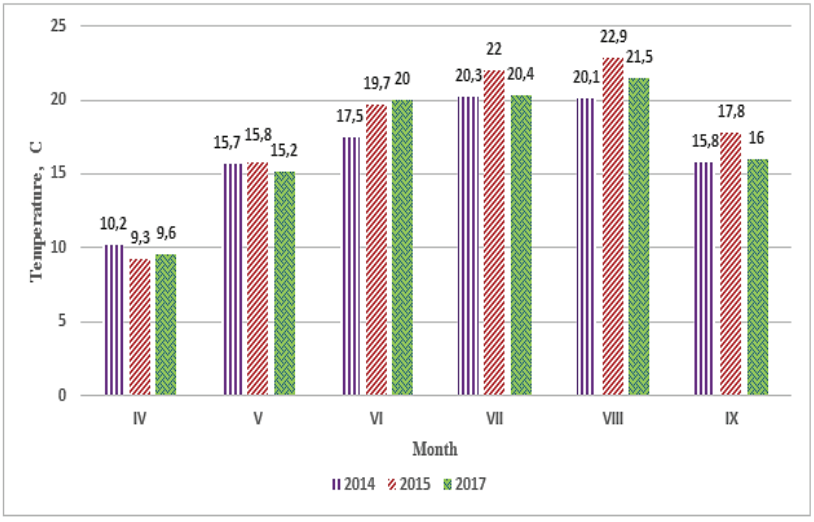

Figure 2. The thermal regime of the territory of Glodeni district during the vegetation period

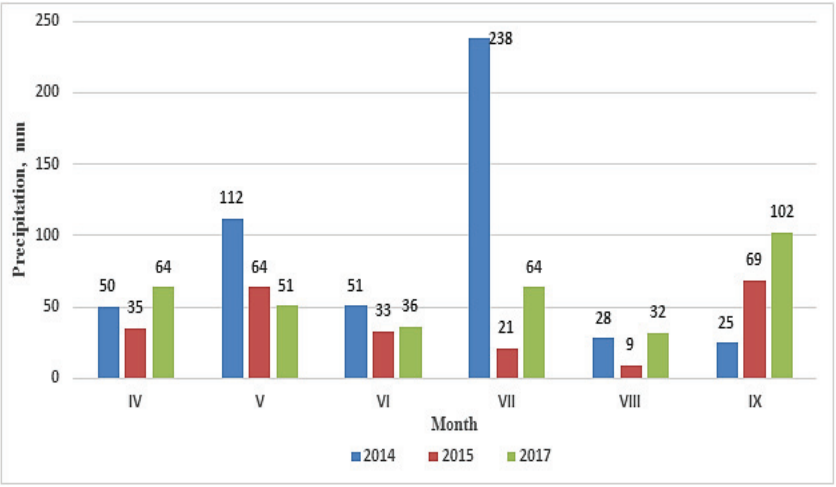

Figure 3. The precipitation regime during the vegetation period in the Glodeni district

On all the soils of the fruit plantations, a very pronounced layer degraded around the depth of 0-60 cm, which is very inhomogeneous according to their color and structure, with the succession of the genetic horizons interrupted due to their techno genic mixture, ie they are technogenode soils - formed with precipitations physico-chemical modifications.

From the data analysis, it is observed that the strongly clay-clayey chernozem is characterrized by a content of physical clay within the limits of 53.1 without significant changes in profile. The bulk density in the loose layer was recorded at a level of 1.25 g/cm^3 optimal for the penetration and penetration of the fruit roots, moderate humus of 3.35%. Ensured with nitric nitrogen Na-NO_3, phosphorus - P_2O_5 and potassium - K_2O is relatively optimal for fruit crops.

As a result of the complex analysis of the climatic, microclimatic, relief and soil conditions of the fruit plantations, three ecological fruit trees were found, which showed a different level of fruit productivity (Table 1).

Table 1. Productivity of the fruit species depending on the ecological conditions of the fruit trees in the Glodeni district, 2014-2018

Species	*Ecopedological conditions*	*Harvest, t/ha*		
		minimum	*maximum*	*average*
I microraion				
Apple 327 ha	Plate 200 m, Σ t ° ≥ 2888 °C, moderate cold, argiloiluvial chernozem, strongly deep lute-clayey	11.1	16.5	13.9
Cherry tree 46 ha		5.6	7.7	6.7
Cherry 19 ha		4.7	5.3	5.0
Apricots 13 ha		5.2	6.6	6.0
II microraion				
Apple 439 ha	Versions NV, V, SE, SV upper and middle 1-3° and 3-5°, 130-175 m Σ t ° ≥ 2950 - 3050 °C, moderately warm, weakly and moderately eroded lemon chernozem, typical moderate chernozem and low humidity, deep clay and lotus	7.4	13.8	10.2
Cherry tree 42 ha		6.5	8.6	7.5
III microraion				
Apple 80 ha	Versions S, Lower, 1-3°, 80-125 m, warm Melting point: 3072-3164°C, strong deep clay, clay chernozems	7.2	7.9	7.5
Cherry tree 10 ha		6.3	8.2	7.1

The deep-lute chernozems in the fruit plantations have a 49.8% physical clay content, the bulk density values of 1.23-1.29 g/cm^3, indicate good conditions for the penetration and development of the fruit tree roots. Higher humus content - 4.15% (increased), the nitrate content is estimated to be high (over (4.5 mg), relatively optimal for phosphorus (5.4 mg) and potassium (29 mg/100 g soil). Moderately eroded lemon chernozems have the 50.0% clay content of the clay-loamy texture of the soil. Bulk density values (1.29 g/cm^3) are optimal

plant growth limits (1.1-1.3 g/cm^3). The humus content is 2.82%. The content of mobile forms of plant-accessible substances of moderate nitrates (3.3 mg), low phosphorus (2.3 mg) and moderate potassium 11.8 mg/100 g soil.

Typical moderate humid humorous moderate profound clay-clayey clay has a 47.9% physical clay content characteristic of the clay-clay soil variety. The bulk density in the loose layer - 1.20 g/cm^3 is considered to be optimal for root expansion and development, as the restrictive limits are 1.4-1.5 g/cm^3. Humus content 4.67% (increased). The content of mobile forms of substances is moderate for NO_3 (6.2 mg), P_2O_5 (3.2 mg), K_2O (15.2 mg/100 g soil).

The typical low humus-rich clay-humus typical chernozem has a physical clay content of the variety (45-60%). Bulk density 1.22 g/cm^3 - optimal for penetration and development of fruit plants. The humus content - 3.15% in the sloped layer is considered to be relatively optimal for the fruit plants. The sum of their exchange cations (basics) in the value of 31.93 me/100 g soil condition the good humus fixation and the long-lasting maintenance of its quantity and quality. Reaction of the soil solution, pH 7.5, low alkaline pH in the loose layer. The nitrification capacity in the high depleted layer over 4.5 mg/100 g of soil (6.5 mg/100 g of soil), the moderate mobile phosphorus content (2.6 mg/100 g of soil), the potassium content 12.9 mg/100 g soil also moderate.

The deeply clay-clayey chernozem is characterized by a clay content within the limestone-clay range (45-60%). The bulk density of 1.24 g/cm^3 is optimal for fruit plants. Low humus content (2.57%). The amount of exchange bases 30.75 me/100g soil, characteristic of the soil subtype and the chernozem layer of humerus. Reaction of weak alkaline soil to moderately alkaline soil. Content of mobile NO_3 - increased form (6.9 ml/100 g soil).

One of the main clues to characterize the efficiency of using natural resources and the application of performing processes is the productivity of cultivated plants. The harvests of the fruit crops in the Glodeni district during the years 2015-2017 were varied depending on ecological conditions.

In micronorade III the fruit maturation was recorded 8-11 days earlier compared to the micro world I on the plateau. The level of lower apple and cherry yields under the conditions of micorotherion II may be due to the degree of erosion of soils, which is characterized by the reduction of the humus-accumulative fertile horizon to the unroasted soil and the moderate thickness of some soil soils.

In the ecological conditions of the plateau the altitude 180-200 m, the moderate cold microclimate, the argiloiluvial chernozem soils and the strongly dewormed clay-clayey chernozem, the apple harvest was higher (13.9 t/ha) compared to the apple on the slopes (microdoraion II and III).

CONCLUSIONS

The fruit plantations in the Glodeni district are located on various relief elements (plateau, slopes with 1-3-3...1-3 slope, northern, eastern, southern, western, 80-200 m altitudes) in different thermal microclimate, moderately hot and warm, chernozems soils: moderate and weak humid, strong and moderately deep carbonate, weakly and moderately eroded, which can be divided into three ecological fruit trees.

The productivity of fruit plantations has been established in the years of research (2014-2018), which has been characterized by different quantitative indices on species, depending on the ecological conditions of microdorations.

Some limiting factors of fruit tree productivity have been highlighted: physical clay content, compaction, depth and carbonate content, degree of erosion.

Fruit plants are very complex biological systems and to use them in the interest of man, it is necessary to know them. In order to establish the appropriate crop technology necessary to obtain maximum yields for each species, it is necessary to know the organography and the requirements of each fruit tree species.

Sustainable development of fruit growing requires very large investments, which will be covered by the private sector, through allocations from the state budget and foreign

investments. Current programs too provides for the creation of a state fund for the development of fruit production in Republic of Moldova.

Sustainable development of fruit growing requires gradual replacement of orchards exhausted with intensive and super intensive orchards with productivity potential and fruit quality 1.3-1.5 times higher than the previous level in the base rational use of ecological, biological, technological, and economic resources characteristic of each field sector and fruit growers.

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