AgroLife Scientific Journal - Volume 6, Number 1, 2017
ISSN 2285-5718; ISSN CD-ROM 2285-5726; ISSN ONLINE 2286-0126; ISSN-L 2285-5718

AGROPHYSICS QUALITY ASSESSMENT AND SOIL MOISTURE BY APPLICATION CONSERVATIVE SYSTEM OF SOIL TILLAGE NO-TILL FROM VARIOUS AGROCOENOSES IN REPUBLIC OF MOLDOVA

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Abstract

Conservative agricultural system is a generic term utilized to define different modalities or agricultural management practices to land use in view sowing crops. The purpose of this paper is to agrophysics quality assessing and soil moisture by application of the conservative system of soil tillage No-till in Republic of Moldova. Conservation of soil tillage system offers more favorable conditions dense root system of plants (Aon et al., 2001; Barzegar et al., 2004) compared to hoes crops (maize). In this conservative system of work of carbonate chernozem (No-till) occurs water conservation under depth of 60 cm. According to planning for the year 2016 at the experimental resort Chetrosu were founded research polygons with conventional and conservative work of the soil - No-till within the stationary with crop rotation and permanent crop - maize. Crop rotation and research variants for the agricultural years 2014-2015 and 2015-2016 are presented in Table 1. Soil water reserves in the vegetation active phases of the autumn wheat were lower in compacted layers compared to the adjacent horizons (Boincean, 2013; Rusu et al., 2013). To moisture available to plants (17-20%) compared to 12-13% of withering coefficient, soil moisture and penetration resistance negatively correlated (r = 0.6-0.7).

Key words*: agrocoenoses, crop rotation, No-till, soil moisture, Republic of Moldova.*

INTRODUCTION

Agriculture practiced in Republic of Moldova currently faces a number of major problems that seriously affect rural development. Following the extension of soil degradation processes due to conventional agriculture and technological mistakes, throughout the years, were studied and implemented in practice so-called conservative agricultural technologies.

These conservative technologies have significantly contributed to strengthening and improvement of soil fertility and productivity and consequently other environmental resources (Guș, 1997).

The most important component of technological of conservative systems, as in case of conventional is represented by soil tillage - module gas raising, the processing - and the introduction of the seed (www.icpa.ro).

According to some official data of global agricultural production volume decreased by about 35% in the first half of the 90 s and 20% in the second half, now being less than half of the years 1989 to 1991 (Boincean, 2013; Cerbari, 1997).

In these circumstances it recorded an increase year on year, imports of food products. In addition, it is unanimously recognized that practiced conventional agricultural system is no longer profitable involving new and new production expenses. As a result, sharply were reduced farmers' incomes and increased the poverty. However, it also caused a number of serious environmental problems. Thereby, at present there is growing demand for replacement to thereof with a more efficiently agriculture conservative system ensure the long term sustainable use of land, preventing and/or minimizing soil degradation, restoring both its productive capacity and resilience, and support processes of life (www.icpa.ro).

Conservation agriculture as a form of sustainable agriculture should become part of any strategy and agrarian policy and environmental protection of any strategy and policy that provides long term assurance of food and water in sufficient quantity, quality

and affordable for the entire population (Cerbari, 1997; www.maia.gov.md).
Promoting the system of conservation agriculture in variants adapted to soil conditions and requirements of main crops in the region to ensure competitive production quantity and quality, lower-cost and high returns in terms of improving characteristics and functions of soils within the agro-ecosystems, renaturation and reproductive extended pedogenesis process and environmental protection (Boincean, 2013; Rusu et al., 2013; www.maia.gov.md).

MATERIALS AND METHODS

Organizing a natural crop rotation should take account of economic and organizational conditions and agrobiologic conditions of the plants. If natural conditions for economic unit are generally known at the beginning of each agricultural year the economic agent should analyze economic and organizational conditions and agrobiologic requirements of the plants to achieve the most effective crop rotations (Cerbari, 1997).
In the year 2016 have been founded seven fields with comparative works - plow land and conservation work (No-till), by 3 agrocoenoses - autumn wheat, sunflower maize repeated crop and maize in crop rotation.
All research variants include comparative agroecosystems - plow land and No-till (Aon et al., 2001; Boincean, 2013; Rusu et al., 2013). The experience includes basic crops practiced in Republic of Moldova.
According the proposed objectives (the year 2016) in the research polygon Chetrosu was investigated: the moisture, reserves of soil moisture in traditional systems of soil tillage (plowing) of conservative works for the next agrocoenoses: sunflowers, predecessor - autumn wheat; autumn wheat, predecessor - the bean; maize into crop rotation, predecessor - maize; permanent crop maize.

RESULTS AND DISCUSSIONS

Conservative agricultural system is a generic expression used to define different modalities or practices in agricultural management of land use in view sowing crops.
Its introduction has been determined, of the one part, the fact that intensive work of the soil in addition to the positive consequences immediately generated and amplified various negative processes whose remaining effects have been accumulated over time leading to increased soil degradation, especially in arable and under arable layer, and on the other, the technical progresses achieved in the field of mechanization in the construction of performance agricultural machinery, both for soil loosening as well as for sowing, as well as the successes achieved in the branch of plant protection products for the efficient control of weeds, diseases and pests. Therefore, it is an alternative that would lead both to the removal of at least some of the risk factors and their negative consequences and to reduce the difference between natural agroecosystems and of artificial strong. The economic crisis and rising prices of fuel and lubricants are also factors that favored definition of the concept about the conservatively agricultural system (Gus, 1997; Boincean, 2013; Rusu et al., 2013).
The research results showed that in the initial phases of active biological development of autumn wheat (first decade of May) soil moisture under plowing constituted at 18-20% (Figure 1) under the conservative work was approx. 2% less than since the plants here were better developed.

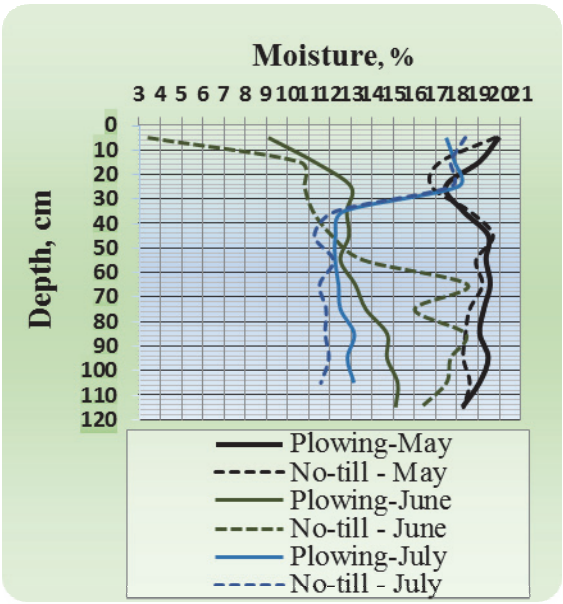

Figure 1. Soil moisture (%) in the traditional system (plowing) and conservatively of soil tillage (No-till)

Over a month (June), moisture in the upper of the soil profile in agrocoenoses at autumn wheat crop version with plowing have 9-15% or 72 mm in the layer of 0-50 cm. Moisture in May-June - 114 mm as shown in Figure 2.

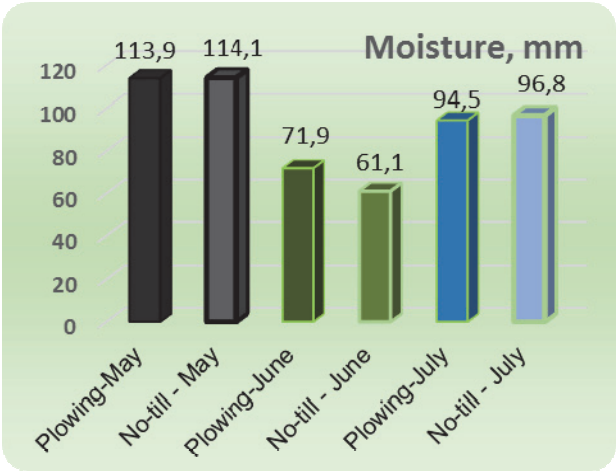

Figure 2. Variation of soil moisture (mm) in agrocoenoses in May-July, 2014-2016

Comparative data of soil moisture in mm does not highlight water conservation in the layer of 0-50 cm, but the evaluation of the data for the depth of 60-120 cm shows that humidity has been used more productively by 2-3% higher in the variant No-till (Aon et al., 2001; Rusu et al., 2013), comparison with plowed variant (Figure 1 and Figure 2).

Crop rotation and research variants for the agricultural years 2014-2015 and 2015-2016 are presented in Table 1.

Estimated economic effects of the application of conservation agriculture system consist in achieving productions, at worst case practically equal to those obtained in the conventional technology (95-100%) while reducing the number of mechanical works by replacing plowing and preparatory work of germinating bed with little works or direct sowing, which reduces fuel consumption by about 30%, of the consumption of workforce by 20% and increased productivity by 50%.

Table 1. Crop rotation in the research variants for agricultural years 2014-2016

Field no.1	Field no.2	Field no.3	Field no.4	Field no. 5	Field no. 6	Field no. 7
Agricultural years 2014-2015						
Autumn wheat (1)	Beans (1)	Maize single culture	Grain maize (1)	Beans (2)	Grain maize (2)	Autumn wheat (2)
Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till
Agricultural years 2015-2016						
Sunflower	Autumn wheat (1)	Maize single culture	Grain maize (1)	Autumn wheat (2)	Grain maize (2)	Grain maize (3)
Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till	Plowing / No-till

On this path the profile is expected to increase more than 15% compared with conventional technology.

The results of soil moisture change along with the agrocenosis development are most visible to the expression of soil moisture in mm (Figure 2). Comparative evaluation of soil moisture reserves at beginning of active period of vegetation (month of May) for various agrocoenoses show: 113-114 mm autumn wheat (Figure 2). The data obtained in June, indicating preservation of soil moisture (72 mm compared to 61 mm) in maize, version with No-till conservation work. The results show different water conservation by agricultural system applied and the agrocoenoses, type root system (Barzegar et al., 2004; Rusu et al., 2013).

It should be noted that the assessment of soil moisture be expressed both in % and in mm, and the soil moisture content requires research, not only in the superficial layer (0-50 cm), but the whole layer of the soil (Figure 1) since the water in the surface layer is actively consumed of the root system.

It was established that the reserves of soil moisture in agrocoenoses of sunflower, maize permanent crop, maize in the crop rotation

during periods of intensive development of plants (Barzegar et al., 2004; Guan et al., 2015) are lower than in the early period of vegetation, water conservation trend.

Differentiations most significant research variants were found in autumn wheat, where moisture reserves in the 0-50 cm layer was 84.2 mm in the plowed variant and 104.2 mm in the No-till variant, the end the vegetation period in July (Table 2).

Usually, the total moisture reserves calculations were performed at steady state of the soil (April, May).

Hoes crops these trends are manifested weaker after total moisture reserves of 0-50 cm of soil layer. Comparative evaluation of soil water content of agroecosystem with autumn wheat, month of May and July are shown in Figure 1.

At the same time, it is expected to improvement and capitalization rain water by 10%, reduce vulnerability to drought and water consumption

Table 2. Soil moisture, % depending on tillage system and agrocoenoses, in the Chetrosu Research Station - on July 6, 2016

Depth, cm	Sunflower (predecessor - autumn wheat) Field no. 1				Autumn wheat (2) (predecessor - beans) Field no. 5			
	Plowing		No-till		Plowing		No-till	
	%	mm	%	mm	%	mm	%	mm
0-10	11.6	13.5	11.2	15.0	15.1	19.3	15.7	19.6
10-20	11.1	13.1	12.1	16.6	12.8	15.6	15.8	21.2
20-30	12.6	16.0	13.1	17.4	13.1	18.1	15.4	21.1
30-40	13.0	16.1	14.9	19.7	11.7	15.9	15.4	21.1
40-50	13.1	16.5	16.5	19.1	11.3	15.3	16.4	21.2
50-60	13.7	-	17.6	-	10.7	-	14.3	-
60-70	15.8	-	18.0	-	10.8	-	12.3	-
70-80	16.8	-	18.0	-	10.3	-	12.1	-
80-90	16.3	-	17.7	-	10.2	-	11.6	-
90-100	17.6	-	17.2	-	10.1	-	11.3	-
100-110	17.1	-	17.4	-	9.6	-	11.3	-
Total		**75.2**		**87.8**		**84.2**		**104.2**
Depth, cm	Maize (predecessor - 2nd year maize of use) Field no. 4				Permanent crop - maize (35 years) Field no. 3			
	Plowing		No-till		Plowing		No-till	
	%	mm	%	mm	%	mm	%	mm
0-10	11.6	13.7	11.2	14.1	12.4	13.3	13.4	18.9
10-20	15.0	18.0	13.5	18.5	13.6	15.2	13.8	19.2
20-30	15.8	18.0	15.4	19.6	14.9	16.4	13.5	18.5
30-40	17.3	19.9	17.2	19.4	15.1	17.8	14.4	18.3
40-50	18.0	21.2	17.9	20.8	18.0	19.9	16.6	20.3
50-60	17.9	-	18.2	-	18.3	-	18.3	-
60-70	17.6	-	18.0	-	18.3	-	19.1	-
70-80	17.5	-	18.1	-	18.1	-	19.4	-
80-90	17.4	-	17.6	-	18.2	-	19.0	-
90-100	16.7	-	17.5	-	17.1	-	18.4	-
100-110	16.1	-	17.5	-	16.8	-	17.4	-
Total		**90.8**		**92.4**		**82.6**		**95.2**

to irrigation which contribute to increased productions stability by 10-20% as well as improving characteristics and functions of soil by increasing the surface content by reducing of polluted surface runoff.

Speaking of soil conservation tillage system, from Republic of Moldova researchers stressed that crop rotation is productive provided that of soil tillage systems are implemented simultaneously, fertilization, of weed control, diseases and pests.

They noted that in the conditions of our country, 80% of agricultural lands are located on slopes, claiming that on these lands is necessary to apply erosion control technologies of soil tillage.

They provide minimal soil work to maintain partial or total of vegetal waste on the soil surface.

The variant No-till of soil tillage it provides direct sowing in the stubble or on the field with crop residues of the preparatory plant.
It needs a transition period of 5-7 years for the system of conservation agriculture to balance. During this period, from various causes, the actual production capacity of soils may be lower than for the use thereof as conventional agriculture (Cerbari, 1997; 2010).
Conservation agriculture contributes to the creation and storage of organic matter in the soil being an important method of carbon sequestration and conservation. This result contributes to a more productive soil, better protected from wind and water erosion and that requires less fuel for the seedbed preparation. We must go to another level in the regarding the conservation by focusing on soil quality (Rusu et al., 2013).

CONCLUSIONS

Application of the conservative system of soil tillage No-till in Republic of Moldova require complex adaptation to specific soil conditions, climate, agrocoenoses, plant protection technology and agroecosystem surface, conditions and technological methods of soil water conservation.
It was established that soil disturb in the agro-ecosystem expressed by moisture, significant reflecting precursory and conservative of soil tillage system offers more favorable conditions root system of dense plants, compared with hoes crops (maize, beans).
In the conservative system of work of carbonate chernozem (No-till) occurs conserving water under depth of 60 cm.
In assessing available water of plants from conservative of soil tillage system a significant role belonging reserves located below a depth of 1m.
Soil water reserves in the active phases of vegetation of autumn wheat were lower in the compacted layers compared to the adjacent horizons.
According to the concept of European Commission on Agriculture and Sustainable Development - Conservation agriculture aims to increase agricultural production through the integrated management of the land fund, optimizing the use of natural resources and contributing to the reduction land degradation; conservation agriculture system is not suitable for compacted soils, which first require aeration.
In the phase of herringbone (in May) was recorded conservation of water reserves on the autumn wheat version - No-till, directly influenced by the physiology of plant growth and water availability.
In of pedologic drought periods conservative of soil tillage systems No-till conserved important water accessible at agrocoenoses on maize - repeated culture.

ACKNOWLEDGEMENTS

This research work was carried out with the support of Center for Research Funding, Fundamental and Applied (*CFCFA*), Republic of Moldova and also was financed from Institutional Project 124/ by 04/21/2015 (56 583).

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