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Influence Of Traditional Technology And Direct Sowing The Winter Wheat On Agrophysical Factors Of Fertility The Dark Chestnut Soils.

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ABSTRACT

The article presents data on the influence of traditional technology and direct sowing on agrophysical factors of soil fertility in winter wheat crops cultivated by such precursors as peas for grain and sunflower. The results of the research showed that the supply of productive moisture varies depending on the phase of growth and development of winter wheat. The greatest amount of moisture in winter wheat is required in the period from the beginning of the spring tillering phase to the outlet into the tube. In this period, up to 70% of the water is consumed by the total amount consumed by the plants of winter wheat over the entire vegetation period. During this period, we have the largest amount of productive moisture in both the arable and the meter layers, corresponding to 24.8 and 139.8%, respectively. It is provided by such a predecessor as peas for grain and direct sowing. By traditional technology, this indicator is slightly smaller. Winter spike cultures have a large structure-forming potential, compared with spring spiked. They have a long growing season, a much better-developed root system, and better protect the soil from erosion processes. The conducted researches show that the greatest quantity of agronomically valuable aggregates is also noted in the phase of spring tillering on pea for grain and direct sowing. Throughout the growing season, the water resistance of soil aggregates was good and excellent. First of all, this is due to the peculiarities of the soils. Dark chestnut soils in the composition of absorbed cations are dominated by calcium, which in turn is a structure-forming agent.

Keywords: direct sowing, traditional technology, the supply of productive moisture, structural-aggregate composition, water resistance, the structural coefficient

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INTRODUCTION

Growth and development of plants largely depend on the fertility of the soil, and, consequently, the yield of crops [6, 8].

A significant increase in the yields of all agricultural crops can be obtained only against the background of progressive soil fertility, which is possible only with proper handling of the soil.

The physical properties of soils and the physical processes taking place in them are one of the most important factors in the creation of soil fertility.

In the various phases of growth and development of winter wheat, the precursors of winter wheat and methods of basic tillage affect the structural-aggregate composition, water regime, food, air [4, 5, 16]. An important part of all the basic methods of farming is the agrophysical characterization of soils: soil cultivation systems, crop rotation systems, farming systems in the broad sense of the word, that is, its main task is, first of all, the study of physical soil conditions, bringing them in line with the needs of cultivated plants [2, 3, 14, 7, 15]

Agrophysical factors are of great importance for the expanded reproduction of soil fertility, characterizing the optimal composition of the arable layer [12].

The soil is constantly evolving, so its fertility is a dynamic property that varies noticeably both in the natural state and in production use. From many natural factors and anthropogenic impact, the direction and rate of change in soil processes depend. Some elements of fertility are characterized by considerable dynamism and variability: water, nitrogen compounds and other elements of nutrition, soil structure, soil air content, temperature regime, etc.; others - mineralogical composition, soil-forming rocks, granulometric composition - are stable [9, 10, 17].

The fertility of any soil is determined by the complexity of its agroproduction properties, which directly affect the yield. Therefore, it is very important to study the influence of agrotechnical methods on the balance of humus.

Also, an important role in solving the problems of soil fertility belongs to differentiated agrotechnics in fields protected by forest belts, with varying degrees of water erosion and deflation of the cover [11].

Soil cultivation is an important link in the system of agrotechnical measures. Soil cultivation affects the mobilization of its fertility, the mineralization of organic matter and the physical properties of the soil [1, 14].

MATERIALS AND METHODS

To carry out research on the effect of traditional technology and direct sowing on agrophysical factors of soil fertility of dark chestnut, the following methods were used:

- determination of structural-aggregate composition by dry sieving method (B.A. Dospekhov, I.P. Vasiliev, A.Tulikov, 1987)
- Determination of water resistance of soil structure was carried out according to the method of P.I. Andrianov (1977)

The method is based on accounting for aggregates that have disintegrated in water over a certain period of time.

- Determination of soil moisture, maximum hygroscopicity, productive moisture was carried out by the weight method in a meter layer (B.A. Dospekhov, I.P. Vasiliev, A.M. Tulikov, 1987).

RESULTS AND DISCUSSION

The vital need for cultivated plants in water is necessary for obtaining high yields, therefore the creation of a water regime corresponding to the needs of crops is one of the main tasks of agriculture. An extremely important role in the conservation and proper use of moisture belongs to the soil treatment system. This is especially important for areas with limited water resources [13].

We conducted field experiments and studies aimed at studying the influence of various technologies of winter wheat cultivation on the water-physical properties of dark chestnut soils.

To obtain amicable shoots of winter wheat, it is necessary that the reserve of productive moisture in the 0-0.20 m layer is 20-40 mm. A moisture reserve of about 15 mm provides only satisfactory shoots. With a moisture reserve of less than 10 mm, shoots are usually thinned.

Indirect sowing, the reserve of productive moisture in the layer 0-0.2 m was 15.6 mm on the pea for grain, which is 0.8 mm larger than for sunflower. In the metering layer, this figure was 108.8 m, which is the same as for sunflower (Table 1)

Table 1: Effect of winter wheat cultivation technologies on the supply of productive moisture before sowing (2012-2017), mm

Culture	Predecessor	Before sowing		Spring tillering		Full ripeness	
		0-0,20	0-1,0	0-0,20	0-1,0	0-0,20	0-1,0
	directseeding						
winter wheat	peas to grain	15,6	108,8	24,8	139,8	12,1	96,1
winter wheat	sunflower	14,8	96,4	21,2	124,5	10,2	84,9
	traditional technology						
winter wheat	peas to grain	14,2	98,2	22,7	131,2	10,4	90,4
winter wheat	sunflower	13,1	90,4	19,6	114,6	8,6	80,1

According to traditional technology, the supply of productive moisture in both the meter and arable layer was lower than in direct sowing.

Autumn-winter-spring precipitation significantly increased the content of productive moisture in the soil. The obtained moisture reserves are most optimal for the development of winter wheat. They significantly influenced the production of the crop, since it is from these moisture reserves that the number of productive stems depends.

As research has shown, the reserve of productive moisture in the 20-cm layer and in the meter-thick soil layers during the spring tillering phase increases in both cultivation technologies. On direct sowing in the phase of spring tillering, he made a pea on grain as a precursor in the plow layer of 24.8 mm, and in a meter 139.8, and according to such a predecessor as sunflower 21 mm and 124 mm, respectively.

By traditional technology, these indicators are somewhat lower. According to peas for grain, this indicator is 22.7 mm in the plow layer, and in the meter, the layer is 124.5 mm.

In the phase of full ripeness of winter wheat, there was a sharp decrease in the availability of productive moisture both in the 0-0.2 m layer and in the meter. This is due to the fact that winter wheat, having received maximum development, both vegetative and root mass, most fully used the moisture reserves for the formation of the crop.

It should also be noted that weather conditions had a significant impact on the reduction of moisture reserves in the soil.

Indirect sowing, the reserve of productive moisture in the plow layer is in the range of 10.2 - 12.1 mm, and according to traditional technology, 8.6 - 10.4 mm. In the metering layer, the same dependence is traced.

On direct sowing in a metering layer of soil, the stock is more productive than the traditional technology and corresponds to 96.1 mm, while according to the traditional technology it is equal to 84.9 mm.

Well-structured soil better resists the destructive power of erosion, reducing the surface runoff of rain and meltwater, increasing the wind resistance of its surface. It is known that the soil can be structured under the influence of purely physical factors, which include: moistening and drying, freezing and thawing, squeezing, penetration of animals and roots through the soil, and soil cultivation, provided that it is carried out at optimum soil moisture.

Winter spike cultures have a large structure-forming potential, compared with spring spiked. They have a long growing season, a much better-developed root system, and better protect the soil from erosion processes.

As shown by the studies (Table 2), before sowing winter wheat, the number of agronomically valuable aggregates in direct crop varies in the range of 64.5 - 58.1%, according to traditional technology this indicator is lower and is in the range of 50.2 - 56.4%.

Table 2: Influence of cultivation technology on structural-aggregate composition before sowing of winter wheat (2012-2017),%

Culture	Predecessor	Unitdimensions, mm		
		10 and>	10 - 0,25	<0,25
direct seeding				
winter wheat	peas tograin	31,4	64,5	4,1
winter wheat	sunflower	35,1	58,1	6,8
traditional technology				
winter wheat	peas tograin	38,3	56,4	5,3
winter wheat	sunflower	42,2	50,2	7,6

The amount of the lumpy fraction and the pulverous fraction is also larger by traditional technology, the largest number of blocky and dusty fractions is recorded for sunflower and is 42.2 and 7.6%, respectively.

Water resistance - the ability of soil aggregates to resist the destructive effect of water - is acquired by soil aggregates as a result of binding of mechanical particles with organic and mineral colloidal substances, but to ensure that aggregates do not spread under the action of water, colloids must coagulate irreversibly.

Throughout the growing season, water resistance was good and excellent. First of all, this is due to the peculiarities of the soils. Dark chestnut soils in the composition of absorbed cations are dominated by calcium, which in turn is a structurant.

Before sowing, a large water resistance is observed in direct seeding and is in the range of 65.1 and 55.2%. According to traditional technology, 60.5 and 51.8% (Figure 1).

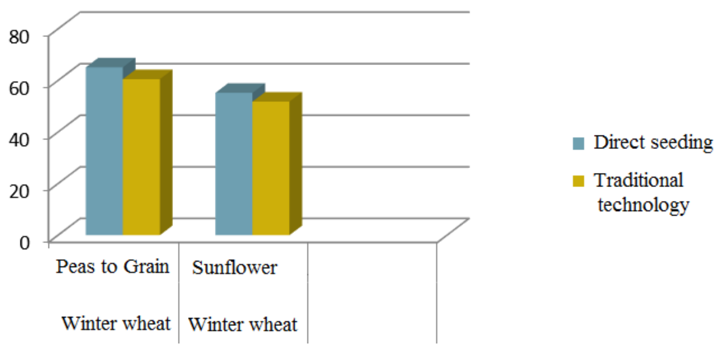

Figure 1: Water resistance before sowing of winter wheat,%

The coefficient of structure for direct seeding is slightly higher and for peas per grain is 1.8.

According to traditional technology, this indicator is lower and pea for grain is 1.3, and for sunflower 1.4 (Figure 2)

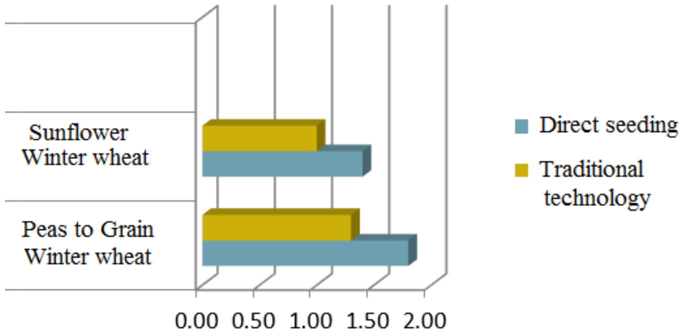

Figure 2: Coefficient of structurality before sowing of winter wheat

To the phase of spring tillering, there is an increase in agronomically valuable aggregates for direct sowing and according to traditional technology. Indirect sowing, the number of agronomically valuable aggregates is now in the range of 66.1 - 70.2%, and in the traditional 62.1 - 64.8%.

The amount of lumpy fraction is reduced and in direct seeding is in the range of 28.5 - 32.1%, and by traditional technology 33.1 - 34.7%. The amount of pulverized fraction is also reduced by both technologies (Table 3).

Table 3: Influence the cultivation technology on the structural-aggregate composition in the phase of spring tillering of winter wheat (2012-2017),%

Culture	Predecessor	Unitdimensions, mm		
		10 and>	10 - 0,25	<0,25
direct seeding				
winterwheat	peas to grain	28,5	70,2	1,5
winterwheat	sunflower	32,1	66,1	1,8
traditional technology				
winterwheat	peas to grain	33,1	64,8	2,1
winterwheat	sunflower	34,7	62,1	3,2

Water resistance of soil aggregates increases to the phase of spring tillering and in direct sowing is in the range of 70.2 - 62.4%, which corresponds to the good water resistance of the structure, and according to traditional technology 57.3 - 64.1%, which corresponds to the good waterproof structure. Higher values are noted for direct seeding (Figure 3).

The coefficient of structure in the phase of spring tillering of winter wheat is higher than before its sowing and in direct sowing is in the range 2.0 - 2.3 and according to traditional technology 1.7 - 1.8 (Figure 4)

At the stage of full ripeness, the number of agronomically valuable aggregates for direct sowing is in the range of 62.6 - 66.4%, and according to traditional technology 59.1 - 60.3%. The amount of lumpy fraction is also larger by traditional technology and is in the range of 33.3 - 33.5%

As studies of the structural-aggregate state of the soil in the arid zone have shown, the formation of a large fraction of the dust fraction is observed in the phase of complete ripeness of winter wheat, which makes this soil capable of undergoing erosion and deflation.

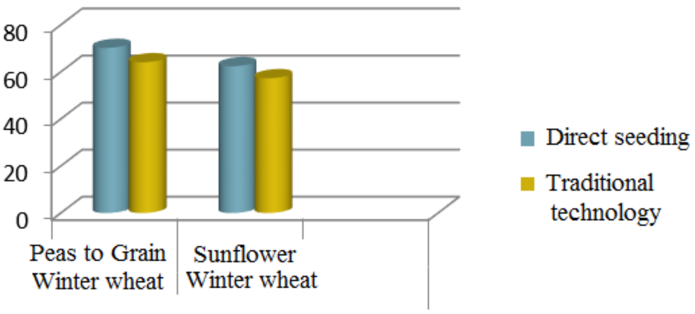

Figure 3: Water resistance in the phase of spring tillering of winter wheat,%

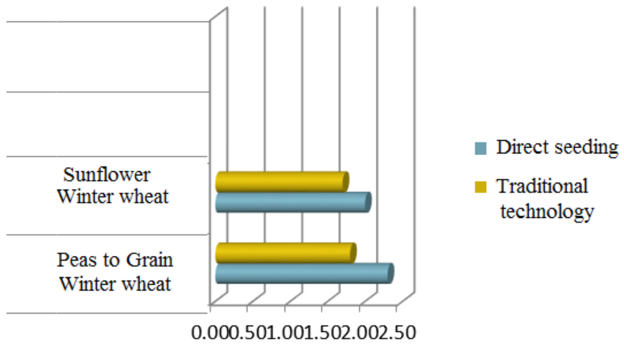

Figure 4: Structural coefficient in the phase of spring tillering of winter wheat

By traditional technology, it increases almost twofold. And is in the range of 6.4 - 7.4%.

The water resistance of soil aggregates to the phase of full ripeness in relation to the phase of spring tillering does not change significantly and varies by direct sowing within the limits of 64.4 - 71.2%, and by traditional technology 58.1 - 65.2% (Figure 5)

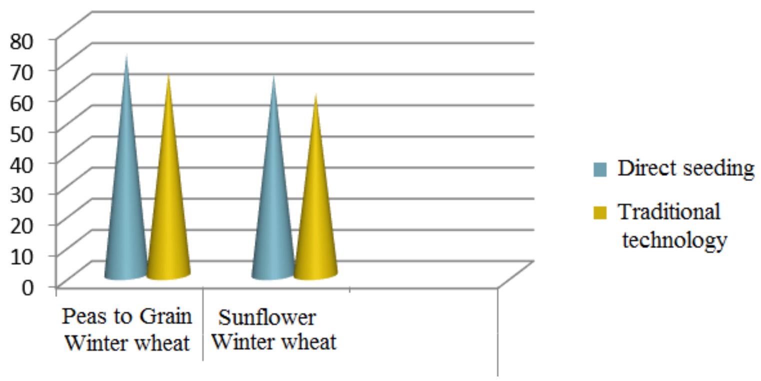

Figure 5: Water resistance in the phase of full ripeness of winter wheat, %

The structural factor in the phase of full ripeness is in the range 1.7-1.9 in direct seeding and in the range 1.4-1.5. In direct seeding, this indicator is greater than in traditional technology (Figure 6).

We also studied the influence of winter wheat cultivation technologies on density.

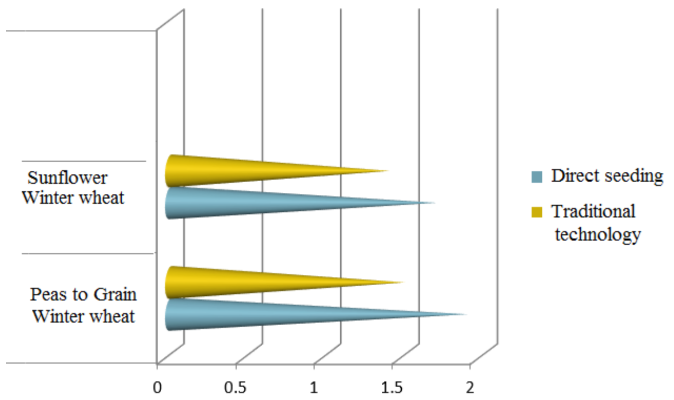

Figure 6: Coefficient of structurality in the phase of full ripeness of winter wheat

Before sowing winter wheat, in direct sowing, the soil density in the 0-0.1 m layer is in the range of 0.96-10.0 g / cm^3, according to the traditional technology, it is in the range 1.0-1.10 g / cm^3 (Table 4).

Table 4: Influence of winter wheat cultivation technologies on soil density (2012 - 2017), g / cm^3

Culture	Predecessor	Layer of soil, m	Density, g / cm^3		
			Before sowing	Shooting Bloom	Full ripeness
direct seeding					
winter wheat	peas to grain	0 - 0,10	1,0	1,10	1,22
		0,10- 0,20	1,14	1,22	1,26
		0,20 - 0,30	1,28	1,30	1,32
winter wheat	sunflower	0-0,10	0,96	1,12	1,20
		0,10- 0,20	1,12	1,20	1,26
		0,20 - 0,30	1,28	1,30	1,32
traditional technology					
winter wheat	peas to grain	0-0,10	1,10	1,12	1,24
		0,10- 0,20	1,16	1,24	1,30
		0,20 - 0,30	1,30	1.32	1,32
winter wheat	sunflower	0 - 0,10	1,00	1,16	1,22
		0,10- 0,20	1,15	1,22	1,28
		0,20 - 0,30	1,28	1,30	1,32

During the stalking phase, there was a significant compaction of the soil and its density over direct seeding already became within the range of 1.10-1.12 g / cm^3, and according to the traditional technology 1.12-1.16 cm^3.

During the full ripeness phase, the density for both technologies increased and lies in the range 1.20 - 1.22 g / cm^3 for direct seeding and 1.22 - 1.24 for traditional technology

Down through the layers, the density of the soil increases and reaches a maximum in the layer of 20-30 cm.

With conventional technology, the soil is more compacted compared to direct sowing by 0.02-0.04 g / cm^3, which results in the formation of a larger amount of pulverized fraction that wakes up into the lower layers and forms the so-called plow sole.

CONCLUSION

The study of the influence of traditional technology and direct sowing of winter wheat cultivation on the agrophysical properties of dark chestnut soils showed:

- In direct seeding before sowing of winter wheat, the supply of productive moisture in the 0-0.2 m layer amounted to 15.6 mm for pea, which is 0.8 mm larger than for sunflower. In the meter layer this figure was 108.8 m, which is the same as for sunflower

- the reserve of productive moisture in the 20-cm layer and in the meter layer of soil in the phase of spring tillering increases in both cultivation technologies. On direct sowing in the phase of spring tillering, he made a pea on grain as a precursor in the plow layer of 24.8 mm, and in a meter 139.8, and according to such a predecessor as sunflower 21 mm and 124 mm, respectively. By traditional technology, these indicators are somewhat lower. According to peas for grain, this indicator is 22.7 mm in the plow layer, and in the meter layer is 124.5 mm.

- in the phase of full ripeness of winter wheat, both technologies experienced a sharp decline in the availability of productive moisture both in the 0-0.2 m layer and in the meter. This is due to the fact that winter wheat, having received maximum development, both vegetative and root mass, most fully used the moisture reserves for the formation of the crop.

- before the sowing of winter wheat, the number of agronomically valuable aggregates for direct sowing fluctuates within the limits of 64.5 - 58.1%, according to traditional technology this indicator is lower and is in the range of 50.2 - 56.4%.

- in the phase of spring tillering the number of agronomically valuable aggregates increases and by direct seeding the values of this indicator are higher than in traditional technology

- Studies of the structural and aggregate state of the soil in the arid zone, the formation of a large amount of pulverized fraction is observed during the full ripeness of winter wheat, which makes this soil capable of undergoing erosion and deflation

- during the whole vegetation period the water resistance was good and excellent. First of all, this is due to the peculiarities of the soils. Dark chestnut soils in the composition of absorbed cations are dominated by calcium, which in turn is a structurant.

- with conventional technology, soil is more compacted compared to direct sowing by 0.02-0.04 g / cm^3, which results in the formation of a larger amount of pulverized fraction that wakes up into the lower layers and forms the so-called plow sole.

REFERENCES

[1] Vlasova O.I., Dorozhko G.R., Perederieva V.M. Fundamentals of adaptive-differentiated soil cultivation. Vestnik APK Stavropol. 2015. 52. 45-52

[2] Vlasova O.I., Perederieva, V.M., Volters, I.A., Tivikov, A.I., Trubacheva, L.V. Change in microbiological activity under the effect of biological factors of soil fertility in the central fore-caucasus chernozems. Biology and Medicine, 2016. 7(5), BM-146-15

[3] Goryanin O.I., Shcherbina E.V., Medvedev IF Influence of technological systems on the water regime of the soil in the steppe Zavolzhye. Agrarian Scientific Journal. 2017. 4. 16-20

[4] Denisov E.P., Solodovnikov A.S., Linkov A.S., Chetverikov F.P. Agrophysical processes of formation of reserves of productive moisture in. Agrarian Scientific Journal, 2014. 8. 10-15.

[5] Dorozhko G.R., Petrova L.N., Lobankova O.Yu., Lysenko I.O., Mandra Yu.A The Influence of Cultivation Technologies and Fertilizer Systems on The Productivity of Winter Wheat on Leached Chernozem. RJPBCS. 2017. 8(6). 819-82.

[6] Drepa E.B., Khitrov E.V., Ekzekov M.B. Efficiency of direct seeding in the zone of unstable hydration. In the collection: Modern resource-saving innovative technologies for cultivating agricultural crops in the North Caucasus Federal District. 78th scientific-practical conference. 2014. 83-85.

[7] Drepa E.B., Golub A.S., Bezgina Ju.A., Donets I.A., Mukhina O.V Effect of Density Soil on Productivity of Winter Wheat in Terms of Area with Moderate Moisturize. RJPBCS. 2017. 8(6). 805-808.

[8] Esaulko A.N., Fursova A.Yu., Grechishkina Yu.I., Belovolova A.A., Gorbatko L.S.Influence Of Fertilizers And Methods Of Soil Cultivation On The Dynamics Of Mobile Sulphur Chernozem Leached To The Winter Wheat Crops In The Zone Of An Unreliable Moistening Of Stavropol Territory.RJPBCS. 2016. 7(3) . 2578 – 2581.

[9] Esaulko, A.N., Fursova, A.Y., Grechishkina, Y.I., Belovolova, A.A., Gorbatko, L.S.Influence of fertilizers and methods of soil cultivation on the dynamics of mobile sulphur chernozem leached to the winter wheat crops in the zone of an unreliable moistening of Stavropol territory. RJPBCS. 2016. 7(3). 2578-2581

[10] Esaulko, A.N., Trubacheva, L.V., Vlasova, O.I., Volters, I.A., Perederieva, V.M.Effect of protective forest strip on the crop productivity in the central fore-caucasus.Biosciences Biotechnology Research Asia. 2016.13(1). 129-134

[11] Il'inskaya I.N., Safonova I.V., Batishchev V.I. Comparative evaluation of agrophysical properties of soils in the Central Irrigated Zone of the Rostov Region. Agrophysics. 2012. 2(0,6). 50-59.

[12] Kurachenko N.L.,KartavykhA.A., Rzhevskaya N.I. Reserves of productive moisture in agrocenoses of wheat cultivated in resource-saving technologies. Bulletin of Krasnoyarsk State Agrarian University. 2014. 5. 58-63.

[13] Perederieva V.M., Vlasova O.I., Volters I.A., Trubacheva L.V., Shutko A.P. Dynamics of Agrofito-Cenosis Segetal' Flora of Winter Wheat in Long-Term Soil Treatment. RJPBCS. 2017. 8(6). 782-786.

[14] Rykov V.B., Kambulov S.I., Kambulov I.A. Changes in soil density under various soil cultivation technologies. Herald of the agrarian and industrial complex of Stavropol. 2016. 1(21). 38-43.

[15] Khitrov E., Ekzekov M., Zakharov A., Katsevich E., Perevertailo A., Drepa E.B. Influence of technology of cultivation on the basic physical properties of soils. In the collection: Education. The science. Production - 2013 77th Scientific and Practical Conference. 2013. 208-209.

[16] Głąb T., Pużyńska K., Pużyński S., Palmowska J., Kowalik K. Effect of organic farming on a Diagnostic Luvisol soil physical quality, 2016, Geoderma 282. 16-25.