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PASTUKH N.R.,
NSC "Institute of Agriculture NAAN"
e-mail: pastukh_n@ukr.net

INFLUENCE OF FERTILIZERS AND TILLAGE OF CHORNOZEM TYPICAL ON OF TRANSPIRATION COEFFICIENT OF THE WINTER WHEAT UNDER CONDITIONS OF LEFT-BANK FOREST-STEPPE

In article shows influence of different fertilizes systems and tillage on value of transpiration coefficient of the winter wheat. As a result, statistical analysis found a correlation between quantity of productive moisture and yield capacity of winter wheat.
Keywords: *The coefficient of transpiration, productive moisture, nutrients, by-products*

Introduction. Ground water has fundamental importance for providing plant life and microorganisms, and for many physical and chemical processes in the soil. In the body of the plant contain 75-90%. With the arrival and movement of water in plants associated all of life's processes. If available water, air and heat plant seeds germinate, grow tissue, coming in the plant and moving nutrients within it, occurs photosynthesis and formation of new organic matter.

Improving water regime of typical chernozem, located in the area with water resources, through efficient use of water precipitation is the main task of applying methods of tillage with leaving of stubble. To do this, using a tools of chisel, disk, and other types, that allow significantly reduce human impacts on soil, introduce advanced technology scheme of tillage.

According to reports, for the constant plowing of crop residues occurs replenishment of organic matter, water-holding capacity of which in 5-10 times higher than the mineral fraction of the soil, forming it structure, optimizing it water permeability and moisture capacity.

At the same time, based on many experiments it is concluded that the surface tillage is more effective in arid conditions. Herewith In the soil accumulates more moisture, which provides an equal rise of winter crops.

In the agro-climatic conditions of Ukraine the maintenance of soil moisture has an especially important because of its territory is situated in the area of insufficient (on south) and unstable (on north) moistening.

Among the large number of arrangements on moisture accumulation and the impact on the water regime in the direction of its optimization in traditional farming systems is tillage, which is a complex events of income, redistribution, accumulation and evaporation of soil moisture.

The purpose of research: set the changes of water regime of typical chernozem for different systems of fertilizing and tillage under the winter wheat in the conditions of left-bank Forest-steppe of Ukraine.

Materials and methods. Research was carried out on Panfils research station of National Scientific Center "Institute of agriculture of the national academy of agrarian sciences of Ukraine" (v. Panfilu, Yagotun d-ct, Kiev region) during 2010-2012 years. The soil of experimental plots is chernozem typical, arable layer is characterized by:

- humus level (by Tyunn) – 3,90 %
- level – 6,15
- easy hydrolysable nitrogen (by Kornfield) – 15,0
- liable phosphorus and exchange potassium (by Chirikov)
- 22,0 and 13,5 mg accordingly.

Experimental design layer on challenge three fertilizing system in three types of soil tillage (no-till, moldboard plowing and beardless plowing). Preceding crop was soybean.

Table 1 submits the fertilizing research.

Table 1

The winter wheat fertilizing of a technological experiment at Panfyly's experiment station

№	Technology's model	Fertilizers					
		Main input			Feeding with nitrogen		
		N	P_2O_5	K_2O	II-III	IV-V	VII-VIII
1	Biologized technology (Bp*)	-	-	-	-	-	-
2	Basic technology	16	16	16	30-40	30-40	
3	Intensive technology		90	90	30-40	50-60	30
4	Superintensive technology	Targeted doze for a planned yieid 8 t/he N_{120} P_{60} K_{90}					

Notes: By-product*

Biologized technology allowed to provide plants with nutrients only from preceding by-product (soybean) and by from organic residues mineralization.

There were also embraced three kind of soil tillage in the experiment that were influencing to certain extend the research results:

- no-till – is a soil tillage that allows only the culture seeding-down;
- 0-20 cm deep plowing – is a common used toil handling that means the tilled layer is getting turned in not less than 135°, and is also crumbled, ploughed, partially stirred and weed plants are clipped off;
- tilling the soil without or before plowing – is soil handling without turning the tilled layer and that helps to save on the soil-bed more than hay crop residues.

Soil samples were selected through a layer of 20 cm to a depth of one meter. The value of moisture reserves determined in accordance with ISO 4362:2004 "Quality of soil. Indicators of soil fertility".

Results and discussion. According to the reported sources and as per data of the number of scientists the amount of winter wheet's transpiration coefficient is in between 300-450 mm., and the general water discharge for a unit of dry substances depends not only of conditions of culture cultivation but also from ecological conditions that are of soil and meteorological ones [2].

The weather conditions analysis of years 2010-2012 show that the conditions were rather favourable for winter wheat cultivation. The autumn-winter periods of winter crops' vegetation differed in temperature raise and quantum satis of precipitation, therefore the plants were bushing and had hibernated in the perfect state. Comparing all the previous years of investigations it is necessary to point out that unlike the distinct difference of weather conditions of years 2011 and 2012, when the first one was the year of dry seasons and the second one was rich in precipitations, the third year was favourable for getting the prospected crop.

Table 2

The influence of black soil's fertilization and processing on the transpiration coefficient level and on the winter wheat's crop

№	Tillage	2010		2011		2012		Average	
		mm	t/he	mm	t/he	mm	t/he	mm	t/he
1	No-till – fertilizers (BP)	352	**1,9**	287	**2,6**	143	**5,8**	261	**3,4**
2	No-till – $N_{16}P_{16}K_{16}$	237	**3,0**	268	**2,9**	148	**5,8**	218	**3,9**
3	No-till – $P_{90}K_{90}$	390	**2,0**	304	**2,8**	140	**6,6**	278	**3,8**
4	No-till – N_{120} P_{60} K_{90}	276	**3,2**	340	**2,7**	146	**7,0**	254	**4,3**
5	Beardless plowing – fertilizers (BP)	411	**1,3**	247	**2,5**	121	**5,7**	260	**3,2**
6	Beardless plowing - $N_{16}P_{16}K_{16}$	278	**2,4**	308	**2,4**	142	**5,7**	243	**3,5**
7	Beardless plowing - $P_{90}K_{90}$	287	**1,9**	251	**2,5**	115	**6,1**	218	**3,5**
8	Beardless plowing - N_{120} P_{60} K_{90}	351	**2,9**	481	**2,3**	180	**6,6**	337	**3,9**
9	Plowing – fertilizers (BP)	365	**1,7**	291	**2,4**	136	**5,7**	264	**3,3**
10	Plowing – $N_{16}P_{16}K_{16}$	172	**3,2**	239	**2,6**	130	**5,4**	180	**3,7**
11	Plowing – $P_{90}K_{90}$	301	**2,0**	248	**2,7**	123	**6,1**	224	**3,6**
12	Plowing – N_{120} P_{60} K_{90}	306	**2,1**	290	**2,5**	125	**6,4**	240	**3,7**

The soil wetness under the winter wheat is assured first and foremost with the moisture residual reserves of reaped a predecessor, and with its accumulation in a autumn and winter period [8].

To get a dry matter of 1 metric ton there was utilized a broader range of humidity in 2010 in comparison to 2009 (the year of the experience start), and it ranged in between 172-411 mm.

The least humidity loss (172 mm) in the given vegetation period was recorded in plowing with minimum agricultural chemicals ($N_{16}P_{16}K_{16}$) usage. Maximum humidity loss (411 mm) was observed in no till farming without using fertilizers (table 2).

The reason for less unproductive humidity loss is also the ploughing that makes soil clots with air gaps in between. These clots structure causes the immense humidity loss. The evaporation decrease in no till also correlates to temperature decline due to a mulch of nutrient deeds.

M.K. Shykula's and H.V.Nazarenko's researches on typical chernozems [9] elucidated that no-till farming provides plants with 30-50 mm higher humidity in comparison to the tillage. After stubble's deads prevent the unprofitable moisture evaporation of topsoil, reduce temperature fluctuation by slowing down cooling rate in autumn and heating rate in spring, increase topsoil water infiltration, help to retain snow, prevent the soil crust, improve the soil agrochemical property.

An important role in decrease the transpiration coefficient plays fertilizers. K.A. Timiryazev writes: "… for plants that are fertilized (especially with nitrogen), the relation between created organic matters and humidity loss for evaporation is decreasing, it means in every weight unit of organic matter the fertilized plant evaporates less than the one that didn't get its fertilization" [2, 10].

It was dry weather in a vegetation period of winter wheat in 2011, a rainfall was once only just before gathering the crops in. The kind of weather conditions influenced the value of transpiration coefficient, it ranged in between 239-481 mm. Its maximum value was observed in zero tillage and with maximum fertilizers distribution ($N_{120}P_{60}K_{90}$) and got 481 mm. The least value (239 mm) was in soil ploughing along with its fertilizing of $N_{16}P_{16}K_{16}$.

The year 2012 was favourable to gather crops of winter wheat. There was nearly same depth of precipitation, therefore the transpiration coefficient value is small and ranges in 115-180 mm. Its smallest value (115 mm) was noted in zero tillage while using fertilizers $P_{90}K_{90}$. Its maximum value (180 мм) was noted in subsurface tillage using maximum dosage of fertilizers ($N_{120}P_{60}K_{90}$).

The data analysis of humidity utilizing for getting a winter wheat crop shows that the humidity usage depends on the predecessor, fertiliser and tillage system [11].

As a result of statistical processing of research data it is found that:

- There was elucidated the tight correlation between the productive humidity in a soil layer of 1 m depth and winter wheat yield (correlation code r=0,72, determination code D=51,8 %);
- Due to unfavourable weather conditions in the year 2011 the correlative relationship between the amount of productive humidity of typical chernozem and the grain productivity didn't exceed r=0,33 (determination code D=11,0 %,): in a soil layer of 0-20 cm - r=0,33 (determination code D=11,0 %), of 0-40 sm - r=0,22 (determination code D=4,8 %), 0-100 см - r=0;
- 2012 was the most favourable year to produce a good yield of winter wheat. Tight correlative relationship was established between the productive humidity in a soil layer of 0-20 cm (correlation code r=0,79, determination code D=62,4 %), a bit less tight correlative relationship is set within the soil layer of 1 m. (correlation code r=0,60, determination code D=36,0 %).

Conclusions. It is elucidated that the agri-meteorological conditions expressed in terms of transpiration code have tight bond with the winter wheat yield, the determination code is in range of 0 to 62.4%.

References

1. Under P.W. Organic matter, nutrient, and pH distribution in no-tillage and conventional tillage semiarid soil / P.W. Under // Agronomy Journal. – 1991/ - Vol. 83. – P. 186-189.

2. *Лактіонова Т.М.* Структура та порядок використання бази даних «Властивості грунтів України» (Інструкція)/ Т.М. Лактіонова, В.В. Медведєв, К.В. Савченко, О.М. Бігун, С.М. Шейко, С.Г. Накісько. - Харків: Апостороф, 2010. – 96 с.

3. *Вериго С.А.* Почвенная влага: монография / С.А. Вериго, Л.А. Разумова. − Л.: Гидрометеоиздат, 1973. − 328 с.

4. *Роде А.А.* Основы учения о почвенной влаге / А.А. Роде. - Л.: Гидрометеоиздат, 1965. - Т.1. - 663 с.

5. *Уланова Е.С.* Агрометеорологические условия и урожайность озимой пшеницы: монография / Е.С. Уланова. − Л.: Гидрометеоиздат, 1975. − 302 с.

6. *Чирков Ю.И.* Агрометеорология / Ю.И. Чирков. – Ленинград: Гидрометеоиздат, 1979. – 320 с.

7. Якість ґрунту. Показники родючості ґрунтів: ДСТУ 4362:2004. – [Чинний від 2006-01-01]. – К.: Держспоживстандарт України, 2006. – 18 с.

8. *Чумак В.С.* Наукове обґрунтування ефективності сівозмін і добрив у Північного Степу України: автореф. дис. на здобуття наук. ступеня д-ра с.-г. наук: спец. 06.01.01 «Загальне землеробство» / В.С. Чумак. – Дніпропетровськ, 2000. – 32 с.

9. *Шикула Н.К.* Почвозащитная безплужная обработка полей / Н.К. Шикула // Сельское хозяйство. – М.: Знание. – 1990. - №3 – 64 с.

10. *Лактионова Т.Н.* О закономерных связях между гидрофизическими и физическими свойствами почв / Т.Н. Лактионова, В.В. Медведев, О.Н. Бигун, И.В. Гайворонский, С.Н. Шейко // Агрохімія і ґрунтознавство. – 2007. – Вип. 67. – С. 42 – 53.

11. *Шаповал І.С.* Агробіологічні основи формування стійких урожаїв пшениці озимої на чорноземах типових Лівобережного Лісостепу України: Монографія / І.С. Шаповал. – Чорнобай: Чорнобаївське поліграфічне підприємство, 2012. – 332 с.

Анотація

Пастух Н.Р.

Вплив добрив та обробітку чорнозему типового на транспіраційний коефіцієнт пшениці озимої в умовах Лівобережного Лісостепу

Досліджено вплив різних систем удобрення та обробітку ґрунту на величину транспіраційного коефіцієнта пшениці озимої. У результаті статистичної обробки встановлено кореляційний зв'язок між кількістю продуктивної вологи у грунті та урожайністю зерна культури.

Ключові слова: *транспіраційний коефіцієнт, продуктивна волога, поживні елементи, побічна продукція*

Аннотация

Пастух Н.Р.

Влияние удобрения и обработки чернозема типичного на транспирационный коэффициент пшеницы озимой в условиях Левобережной Лесостепи

Исследовано влияние различных систем удобрения и обработки почвы на величину транспирационного коэффициента озимой пшеницы. В результате статистической обработки установлена корреляционная связь между количеством продуктивной влаги и урожайностью зерна озимой пшеницы.

Ключевые слова: *транспирационный коэффициент, продуктивная влага, питательные элементы, побочная продукция*