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CLIMATE FACTOR'S LAWS FOR THE PERFORMANCE OF AGRICULTURAL ECOSYSTEM IN FOREST-STEPPE

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Purpose. *Examine the patterns of climatic factors influence on crop yields.* ***Methods.*** *Statistical analysis of long-term data Lubny Poltava region. Calculation the coefficient of performance climate by S. A. Sapozhnikova and hydrothermal coefficient of Selyaninov.* ***Results.*** *The features of climatic conditions influence on the winter wheat and maize yield.* ***Conclusions.*** *At this stage it is necessary to investigate the dynamics of the correlation unstable climatic conditions during the growing season, which could lead to a change in weather conditions, crop-growing area.*

Keywords*:* ***climatic factors, agricultural ecosystem, productivity, crop, yield, the coefficient of performance climate, hydrothermal coefficient of Selyaninov.***

Introduction. Among the complex factor's group, climatic occupy a special place because they directly affect all processes in the ecosystem, conditions and limits of environmental tolerance organisms. This climatic factors determine the productivity of crops. The agricultural ecosystem state under changing climatic factors impact will vary considerably [6,8].

Analysis of recent researches and publications. By definition Y .O. Tarariko [5], sustainable development of agricultural ecosystems should be based on the need to adapt to climate conditions change. In addition, the present problem is relevant, given the volatile and dynamic nature of such changes. Thus, the main task at this stage should be to focus on the most complete use of the unique natural and bioclimatic potential [7].

The purpose. The study of climatic factors influence patterns in terms of Lubny (Poltava region) on the crop's yield, particularly in the context of unstable changes in environmental conditions

Methods. We have analyzed long-term data (1996-2015) yield crops and meteorological parameters that characterize the temperature and mode moistening of Lubny (Poltava region). Calculated coefficient of the climate performance by S. O Sapozhnikova. For complex characteristics moistening used hydrothermal coefficient of Selyaninov. For statistical data was used Microsoft Excel.

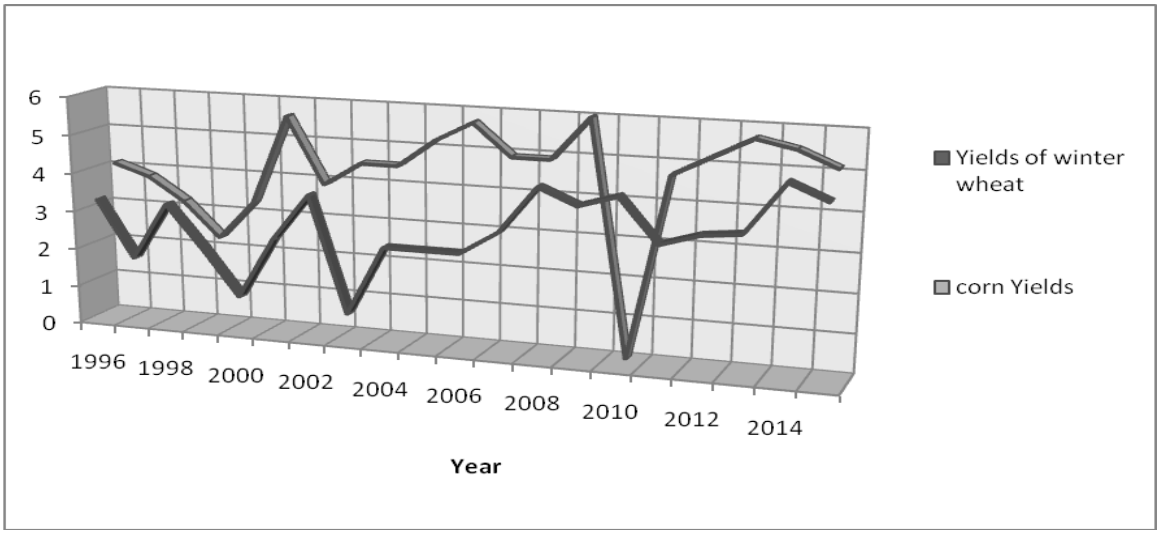
The results. According to the agricultural zoning of Ukraine, Lubny agricultural lands are situated in the forest-steppe zone of black soil. The average annual temperature of the forest-steppe zone is 7-8^{0}C above zero.

The amount of rainfall for the year is 500-600 mm, most of it (70-75%) falls during the warm time of the year. The growing season lasts 190-210 days. The sum of active temperatures (above 10^0C) is 2645^0C. This balance of weather conditions is optimal for obtaining high yields of grain crops [1].

Analyzing the dynamics of crop yield depending on the changing of the climatic conditions during 20-year period was determined that they yield performance of winter wheat ranged from 0.8 t/ha to 4.9 t/ha, while corn ranged 2,3-6 t/ha. The average yield of winter wheat was 3,1 t/ha, and corn – 4,4 t/ha. Annual dynamics of this indicator is displayed in picture 1.

First of all, it was found, that uneven dynamic, changes of crop yields caused by the balance of the climatic conditions of the area, have a considerable influence on the performance of all components of agro-ecosystems.

Thus, the lowest yield of winter wheat was recorded in 2000 and 2003 (pic.1), in particular due to the extreme weather conditions. A winter season these periods is characterized by unstable climatic changes by individual parameters. The result was the creation of a powerful ice crust. A liquefaction of the crop in early spring in 2000 was 25-32% and caused the growth of weeds. Meanwhile, heavy rains in June with strong winds and hail caused the lodging of crops. The ratio of these conditions affect the final yield (0.8-1 t/ha). The maximum yield performance of winter wheat was recorded in 2008-2010 and 2014-2015 years. (pic.1). First of all, the corresponding values are caused by abnormally warm temperature conditions with enough precipitation for winter-spring periods. At the same time, one should consider the fact, that such weather conditions are not typical for the winter season in the region under study.



Pic.1. Winter wheat and corn yield during the period of 1996-2015 years.

In turn, the low rate of yield of corn was recorded in 1999 with the exception of 2010, when the harvest was completely lost. (Pic.1). The temperature conditions in June and July in 1999 was higher, than the other years. At the same time, the reserves of productive moisture in a meter layer of soil under the corn went down to 0-3 mm. Relative humidity for 5 days

reached less than 30%. This phenomenon is described as atmospheric drought. (Long and significant lack of rains with high temperature in the growing season). The result of the ratio of stressful environmental conditions became bad crop capacity in 1999 - 2.3 t/ha. The dynamics of the number of days of drought during the research are presented in table 1.

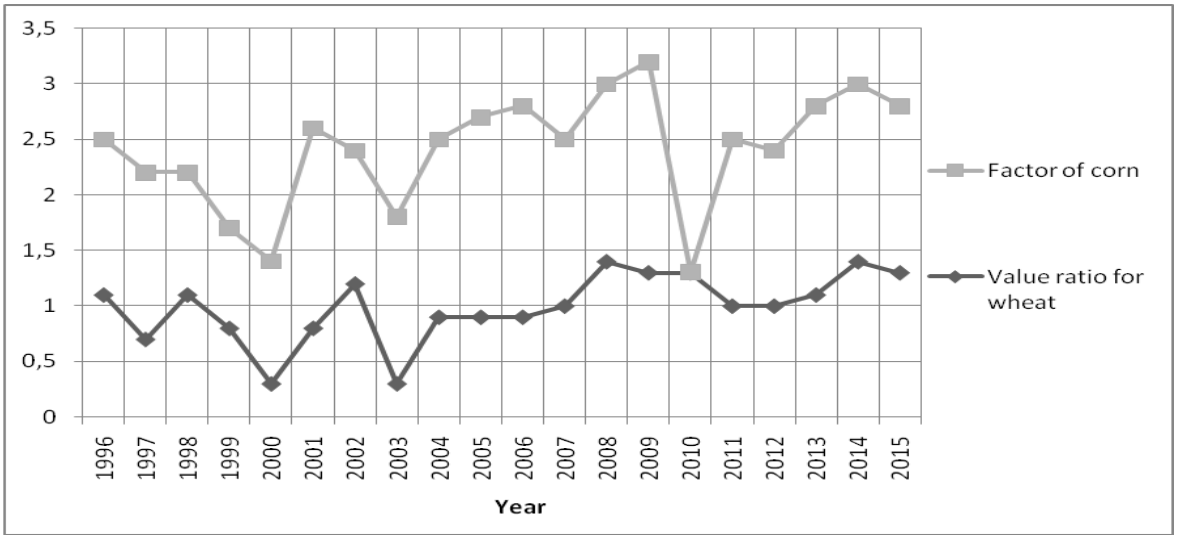
After analyzing, the data the trend of increasing percentage balance in dry days (from 2-10% – at the beginning of the research period to 10-17% – at the end) was followed while about 10-15 years ago, atmospheric drought was uncharacteristic phenomenon for the studied region.

The maximum values of corn yield was recorded in 2001, 2006, 2009, 2013 and 2014 years. These figures are particularly associated with optimal summer temperature conditions sufficient rainfall, which is the determining factor for the growth and development of this culture.

1. The number of days of drought, according to the meteorological station of Lubny district during the 1996-2015 years.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Days	19	14	12	37	12	7	29	17	8	30	14	56	24	43	48	37	32	38	62	54
Days, %	5	4	3	10	3	2	8	5	2	8	4	15	7	12	13	10	9	10	17	15

To determine the state of functioning of agro-ecosystems in compliance with changing climatic conditions of the territory and the use of agro-climatic potential crops, scientists introduced the concept of performance evaluation of agricultural climate [4,5]. In particular, we have carried out calculations a given coefficient by S. O. Sapozhnikov's method (Pic. 2).

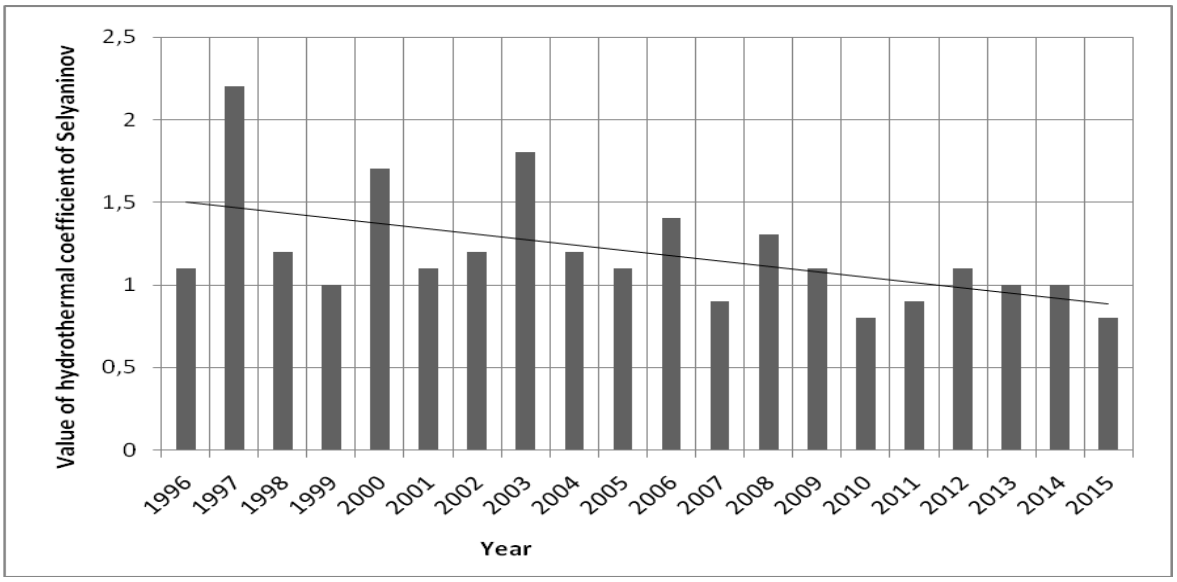


Pic. 2. Dynamics of productivity environment for winter wheat and corn during the period of 1996-2015.

Analysis of existing data indicates the existence of a direct relationship between the ratio of climatic parameters and yield of crops. As shown in the graph winter wheat (2000 and 2003) and corn (1999) in critical years, coefficient of performance climate was the lowest - 0.3 and 0.9 respectively.

To determine the state of soil moisture we have made Selyaninov's calculations. This figure varies according to geographical latitude: in the area of inadequate moisture. It ranges from 0,3-0,7 in the zone of enough moisture - from 0,8 to 1,1 and in the zone of excess moisture - more than 1,1 [1].

Analysis of the collected values reflects a clear pattern of the reducing its size in recent years, as evidenced by the trend line in Picture 3.



Pic.3. Sielianinov's dynamics hydrothermal coefficients (HTCY) during the period of 1996-2015.

In particular, the corresponding values of hydrothermal coefficient point to the increase of dry climate of territory during the last years. Rationing anomalies in the HTCY standard deviation formalizes the definition of drought (A. N. Zolotokrylin).The calculations of the standard deviation for the 20-year period (HTCY) correspond to the meaning less, than 1.2. Sielianinov's rate is classified as weak drought, that is uncharacteristic and adverse effects for the region.

Discussion. Climatic resources of the study area (which belongs to the forest-steppe physiographic zones) at this stage can be considered to be generally favorable for growing crops. However, the value of the most environmental factors is homogeneous enough. The analysis of long-term data (1996-2015years) shows the change of certain parameters that directly determine the efficiency of agro-ecosystems.

The calculation of the HTCY defines the relationship between the ratio of climatic parameters and crop yield. The coefficient was the lowest in the period of unfavorable climatic conditions. Thus, Selyaninov's determination (HTCY) indicates the growth the droughty climate particularly in recent years, which may cause the agro-ecosystemand process misbalance.

So, it is necessary to take into account the dynamics of fluctuation of climatic factors in recent years, first of it can lead to changes of the weather conditions in the area of cultivation and unpredictable affects productivity of agro-ecosystem in general. This issue is very important and needs further investigation.

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ОСОБЛИВОСТІ ВПЛИВУ КЛІМАТИЧНИХ ЧИННИКІВ НА ПРОДУКТИВНІСТЬ АГРОЕКОСИСТЕМ В УМОВАХ ЛІСОСТЕПУ

Г. П. Довгаль, **Н. О. Волошина**

Мета. *Вивчити закономірності впливу кліматичних чинників на урожайність сільськогосподарських культур.* ***Методи.*** *Статистичний аналіз багаторічних даних Лубенського району Полтавської області. Розрахунок КПК за методом С. О. Сапожникової та ГТК Селянінова.* ***Результати.*** *Досліджено особливості впливу кліматичних умов на урожайність озимої пшениці та кукурудзи.* ***Перспективи.*** *На даному етапі необхідно досліджувати нестійку динаміку співвідношення кліматичних факторів впродовж сезону вегетації, що може привести до зміни погодних умов на території вирощування культур.*

Ключові слова*:* ***кліматичні фактори, агроекосистема, продуктивність, сільськогосподарська культура, урожайність, коефіцієнт продуктивності клімату (КПК), гідротермічний коефіцієнт Селянінова.***

ЗАКОНОМЕРНОСТИ ВЛИЯНИЯ КЛИМАТИЧЕСКОГО ФАКТОРА НА ПРОИЗВОДИТЕЛЬНОСТЬ АГРОЭКОСИСТЕМ В УСЛОВИЯХ ЛЕСОСТЕПИ

А. П. Довгаль, Н. А. Волошина

Цель. *Изучить закономерности влияния климатических факторов на урожайность сельскохозяйственных культур.* ***Методы.*** *Статистический анализ многолетних данных Лубенского района Полтавской области. Расчет КПК по методу С. А. Сапожниковой и ГТК Селянинова.* ***Результаты.*** *Исследованы особенности влияния климатических условий на урожайность озимой пшеницы и кукурузы.* ***Перспективы.*** *На данном этапе необходимо исследовать неустойчивую динамику соотношения климатических факторов в течение сезона вегетации, что может привести к изменению погодных условий на территории выращивания культур.*

Ключевые слова*:* ***климатические факторы, аграрная экосистема, производительность, сельскохозяйственная культура, урожайность, коэффициент производительности климата, гидротермический коэффициент Селянинова.***