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PROBLEM OF DEFICIENCY OF WATER IN STEPPE

The purpose. Assessment of urgency of deficiency of water in Steppe. **Methods.** Orders of meteorological observations for weather stations of the country are used. **Results.** Record-keepings show that in days with a heat (30°C and above) and windy weather evaporation rate of water from soil on fields of experimental station attains 3 – 5 and even 7 mm for a day. **Conclusions.** One of the priority directions of development of provisions of withstanding to losses of moisture from soil is the maximum weakening rate of ground stratum of air and assistance in rising level of its relative humidity for formation of more favorable microclimate for sowings of cultivated plants. Evapotranspiration rate of agricultural plants can be reduced essentially at condition when ground stratum of air will have a higher level of relative humidity and lower wind speed than traditional one for the region (for the majority of kinds of plants speed of air in range of 1 – 3 m/s is optimum).

Key words: steppe, moisture, rainfall, warm, vaporization, wind, soil.

Steppe zone in our country is not only planted fields from horizon to horizon, thin threads silted rivers and steppe wind beneath your mighty hot rays of the sun. Steppe zone is almost half the country's arable land. Therefore, it will depend on climate and situation specific weather in this climatic zone each year, feels the whole agricultural sector of the state economy and the international food market. [1]

The trend of climate change in recent decades complicates the already not simple situation in environmental soil and climatic zone steppe, especially in the growing crops.

Problems in the steppe zone are many, but two are most acute, soil erosion and general environmental degradation and growing water scarcity in the region.

In the historic old when the steppe expanses retain natural vegetation, soil erosion was negligible: the most dangerous places have emerged and evolved slowly ravines that nature and gradually stopped transformed vegetation in gullies and gorges. The

process of disinflation had no conditions for increasing because of the ground is well developed herbaceous vegetation [2, 3, 4, 5].

Steppe river deep enough and healthy, were protected by trees and shrubs that formed natural gorges. Catchment area were zadernovani and surface movement ground dribnozemu almost happened due to a significant deceleration speed of the surface water vegetation after rains and melting snow [6].

In the process of human development zone steppe, especially after the elimination Zaporozhska sitch, where most areas were distributed to large landowners and plowed under arable land, began a rapid degradation of the region. It manifested itself in different terms from the rapid decrease in the number and species composition of wildlife and plants, liquidation and so small ravine and forest areas for economic needs, to the activation of soil erosion as water and wind. As a result of the steppe in the spring was the phenomenon of "dust storms" when thousands of tons of powerful black soil dry air flows, rising from the exposed surface fields tolerated for hundreds of kilometers and namitaly drifts dribnozemu height of several meters [7, 8, 9].

The regular recurrence of droughts and harsh neurozhayiv made people able to think and analyze, even in the late 19th century to pay attention to such a complex environmental problem, which has created unreasonable economic activities on arable lands.

Classic research VV Biotechnology, VG, Rotmistrov and many other local scientists revealed the main causes of problems and steppe zones defined directions of its successful solution [9, 10, 11]. Modern economic activity arable lands in the steppe zone is much like the one that took place in the region of 150-200 years ago. Then other varieties grown and had a different level of technical equipment of farms had higher margin nature, but trends of processes and expected outcomes are very similar.

Climate change in the direction of growth of arid and continental accelerating and complicating undesirable trends emerging on arable land steppe zone as a result of irrational economic activity [12,13]. Modern steppe zone consists of the Northern Barrens and Southern Barrens, which, depending on the direction of movement in the territory seamlessly into each other. Common problems in farming soil-climatic zone common. However, in the Southern Barrens they appear clearly because of the greater amount of heat that enters and therefore less rainfall in this region compared to the northern steppes [14-16].

Materials and Methods

Research and analysis of meteorological conditions, vegetation characteristics of agricultural crops were conducted in 2013-2015 on arable land Askaniya State Agricultural Experimental Station of the Institute of irrigated agriculture NAAS of Ukraine.

The basis of the analysis results were used systems meteorological measurements and observations that were made during the research. Methodical basis of observations and measurements were used meteorological observations regulations that apply to the meteorological stations of the country [17].

Research results

The region, which includes the research station has the warm season that lasts from 272 days in 2013year to 310 days in 2015 year.

The duration of the warm period of $+ 5^{\circ}\text{C}$ temperature threshold was from 228 to 250 days, respectively. The duration of the warm period of the temperature hreshold $+ 10^{\circ}\text{C}$ also quite significant and was in the range from 177 days to 246 days.

The region receives a large amount of solar heat. During the research for the sum of positive temperatures $+ 5^{\circ}\text{C}$ threshold ranged from 3858°S in 2013rotsi to 3995°C in 2015year. On the threshold of $+ 10^{\circ}\text{C}$ sum of effective temperatures ranged from 3746°C in 2013year to 3950°C in terms 2015year.

The warmest summer month - July. The average temperature in July ranges $21-23^{\circ}\text{C}$.

The number of days with temperatures exceeding 30°C during the observation was 26 days in 2013year to 34 days in 2015year.

In high air temperatures in the summer months the southern plains region has a constant problem of shortage of water for arable lands have no irrigation. For the year field research station during the studies received from 320 to 367mm of rain. This amount of rainfall combined with a little amount of temperature to form the necessary reserves of moisture in the soil.

Analysis of rainfall during the year proves that in a research station almost $2/3$ of their number comes in the warmer months and only 1.3 in the cold period.

Given this feature legitimately argue that the maximum rainfall coming on arable land during the cold season was low: in the range of 107mm (winter 2013 \ 2014rr) to 122mm conditions in winter 2014/2015 years.

However, it is winter precipitation have special value to farmers. This is an opportunity to accumulate moisture and keep soil. In the cold season the region has a positive water balance.

In the warm season on cropland came from 213 mm to 249mm conditions 20013y. the conditions 2015year.

Analysis of heat balance in the region shows that from 2004 to 2014years. The average annual temperature increased by $1,6-1,7^{\circ}\text{C}$. That is in the area of climate research station became warmer. But change is not only heat. The ongoing changes in the nature of income rain on arable land.

Measurements of precipitation and flow of their character over the years of research show that the days of the effective rainfall (more than 10mm of water) during the year was less. In the days following 2013 year 9, 2015 year - 6. The average for 7.2 years of research was the day of effective precipitation. If we define the period of time between the effective precipitation of rain in the warm season (including inefficient loss including rainfall) + 10°C with a threshold, such precipitation coming into arable land with an average interval of 24.6 - 34.2 days. Moisture coming from one medium effective rain on cropland ranges from 29,5mm (2013) to 2015 in terms of 36,6mm. However, the average level of humidification able to deviate greatly depending on the situation with the weather. In terms of sustainable anticyclone periods without rain can last region in general 65-90 days or more.

In the warm season the water regime in Southern Barrens has vypoťnyy, ie water evaporation from the soil exceeds precipitation coming from the atmosphere. Hydrothermal coefficient less than unity. Rain, including effective research station in the region traditionally fall in the form of intense downpours with thunderstorms. Assessment of intensity of torrential rains proves that one minute falls from 5 - 7 to 10 mm of water. Under one minute per hectare of arable land 50-100ton enters the water. The average for the region effective intense rain from the storm can last up to 10 minutes. Rain with less intensity drops loss lasts longer. The measurements show that the rate of fall of rain drops is 28-32km / h. Large drops of rain water intensive as fast a substantial margin of kinetic energy. Under their blows on the naked surface of arable land leads to the destruction of soil structure and its capillarity manifested in reducing its ability to absorb moisture. As a result, cropland poorly absorb rainfall heavy rain. Rainwater flow moves in the open field and its high speed leads to intense erosion of arable layer. Manifested water erosion.

Having developed plants in agricultural crops reduces energy intensive rain drops leaf surface taking and dampen the kinetic energy of rain drops. In such conditions the soil better absorb moisture rainy. Rainwater not absorbed by topsoil layer of soil after intense rains traditionally moves in the open field to the humble places. Depending on the intensity of rain and its duration and presence on the field surface developed vegetation and terrain features the crossbar goes from 5 to 50% more volume of precipitation.

However, rainfall in the warm season in the region does not guarantee their productive use of cultivated plants during the growing season.

For the main research station as for the southern steppe in general, characterized by windy weather. The combination of high temperatures and strong winds (wind speed 5-8m/sec. to 15 or more) makes it difficult to provide agricultural crops needed moisture. For air in the warm season in the steppe zone of Southern characteristic is the low relative humidity. Traditionally, during the period from April to September inclusive relative humidity surface air is 16 to 55% [17]. The combination of these

factors leads to intense evaporation of arable soil. Counts show that in the days of high fever (30°C and above) and windy weather, evaporation of water from soil to crop research station is 3 - 5 and even 7 mm per day.

Manifested combination of classic action of physical laws for gas in the interaction of the air flow above ground and capillaries of the soil containing moisture. In the air flow increase of velocity (dynamic pressure) decreases static pressure (air flow sucks water from the soil as spray from the container). In accordance with the increase of wind speed active tightening effect of water vapor with topsoil increases.

The presence of mulch (shredded ground with damaged capillaries) was able to show only a partial positive safety results. Mulch of crop residues showing more defensive efficiency, but its layer must be powerful enough (about 5cm thickness). A thin layer of plant debris was ground slows the speed of air flow and therefore easing the process of evaporation (evaporatsiyi) will be insufficient.

Evaporation of water including from the soil, the process is endothermic (absorption of heat) and comply with the provisions of the second law of thermodynamics. According to Clausius- Kleyperon formula to convert 1 gram of liquid water to spend a couple 2257Dzh heat. The main source of energy for all the processes on arable lands have sunlight. Sunshine in the region is long in the country and is 2150-2350 hours per year. The most intense sunshine in July. During the measurement sunshine lasted from 330 to 358 hours per month, or 10,6- 11.5 hours daily. The energy of sunlight on the opaque surface soil is transformed into heat and delivers its intense heat. Evaporation of water partially reduces the temperature of the soil surface. However, such cooling effective only in the presence of moisture in the upper soil layer. After drying the top layer it is heated to temperatures that are extreme for the growing season of crops ($50-70^{\circ}\text{C}$ in the summer months).

The capillary system of the soil raises free water from a depth of 1.5 -2,0m more topsoil to the surface and it evaporates easily.

The average loss of effective rain (29-37mm) under conditions of drought and high winds (5-7m / sec. to 15 and over) was effective for crop plants, especially when the conditions are still little developed and can not significantly reduce the rate of air flow surface soil. Rain takes a short period of water stress plants, which was caused by deficiency of moisture transpiration processes weaken because of higher relative humidity. However, such conditions improve crop growing season is very short. Even moderate evaporation (3mm/day) intense rain stocks would last only 10 days, the presence of strong winds (6-8m/sec) and high temperature (over 30°C) moisture that came with effective rain (30- 36mm) to the topsoil, will again be converted into steam for 4-6 days.

These research results digitally argue conclusion which at one time came in the early 20th century known expert steppe agriculture VG Rotmistrov, who claimed: "Summer rain not able to get the harvest of crops in the absence of winter moisture reserves in the soil".

Based on the analysis of software wet arable land in the steppe zone of the South and the characteristics of rainfall and the specific costs of their arable lands rightly say:

Conclusions

1. The problem of the region is not only a limited amount of moisture that comes over a year on arable land. At each m^2 in Southern Barrens enters the year 320-367 liters of water.

The main problem is the complexity of this moisture to accumulate, preserve the soil and efficiently to the needs of the crops of cultivated plants.

2. The nature of rainfall in the form of short intense showers provision requires rapid and effective infiltration of rainwater into arable soil and subsoil on arable land.

3. A significant amount of heat and coupled with constant strong winds and low relative humidity according to the objective physical laws leads to intense evaporation from the soil and through the effect of capillarity dry deep layers of arable land.

4. One of the priorities of development measures confrontation moisture loss from the soil by their limited stocks is weakening the maximum speed of the surface air and promoting its level of relative humidity for a more favorable microclimate for crops of cultivated plants.

5. The intensity of transpiration of crop plants can be significantly reduced on the condition that the surface layer of air will have a higher level of relative humidity and lower traditional wind speed region (for most species air movement 1-3m / sec. Is optimal).

6. The successful farming conditions in the Southern Barrens not need specific protection techniques and integrated scientific system counteract undesirable factors: the active soil erosion, high velocity air over arable land, increasing its relative humidity, prevent overheating and increased soil surface albedo solar radiant energy, and others.

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