

PART 2. MANAGEMENT OF MODERN SOCIO-ECONOMIC SYSTEMS A SECTORAL AND REGIONAL APPROACH

DIRECTIONS OF ADAPTATION OF AGRICULTURAL MARKET TO THE CLIMATE CHANGE

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One of the important environmental problems of the XXI century is the global climate change. Climate change for agriculture in Ukraine is conditioned, first of all, by global warming, the direct consequences of which are droughts, which adversely affect the yield of crops, since the weather component of the crop in our state is more than 50% [4].

Therefore, the most important task for land users is to search and implementation of effective methods for the accumulation and rational use of available moisture reserves in the soil.

It should be noted that the problem of moisture supply of plants has always worried scientists and producers, therefore, a constant search for techniques to create a favorable water regime of the soil was conducted. Even in the eighteenth century, a scientist agronomist O. O. Izmailsky wrote in his well-known agrarian book «How Our Steppe Has Dried Up»: «All the worries of the owner should be reduced to the sole purpose of increasing the part of the atmospheric moisture that is absorbed by the soil, if possible, adequately decreasing amount of atmospheric moisture, uselessly flowing from the surface of the soil» [5].

At the same time, the director of the Poltava experimental field B.P.Cherepakhin emphasized that in the conditions of the Forest-steppe, the efficiency of agriculture is based on soil moisture, while emphasizing «... everything in moisture, everything for moisture, everything for the sake of moisture.» In connection with global warming, these thoughts of the classics of agriculture become topical.

Today, there are three theories of climate change, which are associated with drought. Some climatologists believe that climate fluctuations (cycles) are probably related to the influence of solar activity, that is, with those internal processes,

resulting the appearance of spots on the Sun, which are gigantic electromagnetic vortex formations. Their number and size are not always the same. The variability of sunspots number has relatively well-ordered nature, it passes in wave-like way.

Now, a close relationship between solar activity and physical processes in the upper atmosphere is revealed, but scientists believe that solar activity also effectively affects the lower part of the Earth's atmosphere. Kh. P. Pogosyan [9] writes: «There is no doubt that the age fluctuations in the climate occur as a result of changes in the nature of the atmosphere general circulation. Similarly, the nature of circulation, obviously depends on solar activity and other astronomical phenomena».

Consequently, age fluctuations in the climate occur due to changes in the nature of the overall atmosphere circulation. I. E. Buchinsky [3] believes that the climate change is a common phenomenon in nature, has a relatively ordered nature and passes in a wave-like way. It causes many people to perceive that the climate «in our eyes» is changing. However, this evident climate change, is only its «natural» fluctuation, rather than a steady change in one direction.

Basing on the basis of the meteorological concept of nonlinear processes and predictability of the behavior of complex natural systems in the future, E. M. Biletsky and S. Stankevich [2] practically also tend to the fact that droughts are a common occurrence in nature due to the climate fluctuations. At the same time, they note that large-scale natural disasters that cyclically occur on the planet have already repeatedly occurred in the history of the Earth and human civilization.

An international group of scientists believes that global warming is caused by the displacement of geomagnetic poles of the earth's axis, which are influenced by space factors. As a result, the planet slightly slowed down its turn, about a second a year. Due to the loss of that second, the amount of released thermal energy exceeds all the energy produced by mankind as a result of its activity during the year. This caused a change in the albedo of the planet, its orbital parameters, an increasing the surface temperature, which seriously affects climate change, the emergence of threatening hydrometeorological phenomena, one of which is drought.

However, displacement of the geomagnetic poles of the earth's axis brought not only more heat. At the same time, changes in the «wind rose» are appear - as a result of the transformation of the global circulation of air masses on the planet, in Europe and in our country in particular [6]. Change of geomagnetic poles affects sea currents, the main of which is the Gulf Stream, whose flow rate has already slowed down by 20%, which also affects the climate of Europe. The air masses that are saturated with moisture from the Atlantic Ocean, primarily from the warm course of the Gulf Stream, moving above the vastness of Europe in the eastern direction, gradually irrigate the land with relatively regular rains. The movement of such air masses is a kind of obstacle for the invasion of cold air to our country from the Arctic (northern direction), or hot and dry air from the continental depths of Asia or Africa (eastern and southern directions). The easing of airflow pressure from the Gulf Stream side may be one of the causes of the penetration of these air currents,

which contribute increasing the temperature and drought [6].

Another theory of global climate change on the planet is anthropogenic impact on nature as climatologists believe. Scientists have proven that the changes that we are currently witnessing and which are projected in the future are largely a result of human activity: we burn fossil fuels, emissions from the transport industry and the scale of intensive agriculture are increasing. A significant increase in production emissions «warms up» our atmosphere, it rapidly increases the number of greenhouse gases (carbon dioxide, methane, nitrogen oxides, chlorofluorocarbons, etc.).

It should be noted that the «greenhouse» gases of our planet operate on the principle of hothouse: it passes visible light to the surface, and heats radiation kept in the middle. As a result, the temperature on the Earth's surface is suitable for life. But the more «greenhouse» gases in the atmosphere, more heat is delayed near the Earth's surface.

So, human activity strengthens the «greenhouse» effect, resulting in increasing the surface air temperature, and from the agronomic point of view, the Forest-steppe of Ukraine becomes a classical zone of arid climate and, in general, zones of risky agriculture are expanding.

It is likely that the influence of cosmic and anthropogenic factors on the planet climate is complex, droughts (spring, summer or autumn) will become a frequent phenomenon. Therefore, today global warming is seen as a fact, and the main problem here is the lack of moisture, its accumulation, preservation and rational use.

So, first of all, it is necessary to develop adaptation measures to the negative effects of weather that should organically enter the technology of agricultural production. Secondly, it is the introduction of technological measures for the accumulation, conservation and rational use of moisture, especially in the conditions of drought.

The measures of first group that can withstand climatic problems can be: the development of new zoning of the territory; the use of drought tolerant varieties and hybrids of crops adapted to a significantly less vegetative period; introduction of new (niche) drought-resistant crops; application of antistress chemical, biological and microbiological preparations, complex microfertilizers; pouring and composting; the use of humates, minerals (bentonite, etc.); control of the phytosanitary state of crops, and so on.

According to the National Academy of Sciences of Ukraine, over the past decades, the actual displacement of the boundaries of the country's natural and climatic zones is 100-150 km to the north. Vegetation conditions in the traditional subzone of the Northern Steppe (Dnipropetrovsk, Kropivnytsk oblasts, etc.) already correspond to the Southern Soil subzone. The subzone of the Northern Steppe gradually shifts in the territory of Cherkasy, Poltava and other regions, which traditionally were in the Forest-steppe zone [7, 10].

In such circumstances, the existing zonal set of agricultural crops is changing. First of all, in addition to the main crops (winter wheat, corn, sunflower), there are so-called niche cultures (hen, lentil, safflower, sorghum, millet, etc.), which have

high drought tolerance and export capacity. In connection with the warming in the south of Ukraine exotic cultures began to grow: kiwi, persimmon, banana tree, zisifus (Chinese date or unabi), peanuts, sweet potatoes, black pepper. Olive trees are sailing.

Secondly, in conditions of high dryness of the climate, moisture determines the level of productivity. Therefore, due to the increasing role of moisture as a limiting factor in harvesting, the stereotypes of the evaluation of efficiency of agricultural systems and technologies for growing crops are changing. Studying and implementation of the production of technological receptions and systems of agriculture, which allow receiving planned crops at the level of existing water supply, are becoming urgent.

The need to accumulate moisture in the soil in the autumn-winter and spring periods is growing, which can, with rational costs, to a large extent, ensure the physiological needs of agricultural plants during vegetation, in periods between the rainy days when drought occurs.

Firstly, it should be noted that the most significant for saturation of soil with water can be considered precipitation, reaching its surface (each millimeter of precipitation accounts for 10 tons of water per hectare).

Over the last 20 years, the average annual temperature in January and February has risen by 1-2° C, which has led to changes in the rhythm of seasonal phenomena - the fall rainfall significantly increased in the autumn-winter period. Therefore, one of the important sources of water supply in the soil is the flow of water from melting snow. In this regard, the role of snow retention is greatly increasing.

Let's consider the main elements of an intensive agricultural system in the context of moisture conservation and rational use of moisture [11]. Among them: the structure of sown areas, scientifically grounded alternation of crops in crop rotation, rational soil tillage systems, taking into account their impact on the conservation and rational use of moisture, plant care techniques, fertilization, pest and disease control, and the use of modern agricultural machinery.

An important role in regulating moisture provision of crops belongs to crop rotation. Agricultural crops are significantly different in their susceptibility to soil moisture and have a different effect on the water regime of the soil. For directional regulation of water regime in a soil-plant system, it is necessary to alternate crops in crop rotation, in which the rational use of plants of soil moisture is combined with the subsequent restoration of its reserves in the corresponding layers of soil.

It has been found that under such crops as corn and winter wheat and after occupied vapors, the reserves of productive moisture in deep layers of soil are sufficiently well recovered. Therefore, it is expedient to place these crops in the crop rotation after cultures with a deeply penetrating root system that dries the soil to a greater depth in order to restore the moisture reserves in these horizons.

Exploring the impact of soil cultivation on its water regime, it should be noted that the traditional cultivation of soil, the main species of which is plowing, for many

decades, has been able to provide humanity with food, but at the same time created a lot of problems associated with soil erosion, deterioration of their quality and drying [12]. The task of the modern soil cultivation system is to intensify production and simultaneously preserve existing natural systems, maximize accumulation and rational use of moisture setting in the soil. The plow goes to the background, while to the foreground comes out tools that only loosen the top layer of soil, which helps to maintain more moisture in the arable layer, reduce the sowing and, even more important, save energy.

Positive results, despite the weather cataclysms, have those farms that take into account climate change, and instead of deep plowing, carry out deep soil fracturing or its surface (shallow) cultivation, which has a greater effect on the accumulation, preservation and use of moisture. Its annual moisture content is 30-50 mm higher than of plowing, which is especially important during drought.

Fertilizers play an important role in the productive use of moisture. Each ton of soaked manure during the years of its operation in multi-crop rotation gives, in addition to 1 cwt in terms of grain, and every quarter of mineral fertilizers in standard tukes, when introduced into the main field crops (winter wheat, corn, barley, millet) - on average up to 1.5 cwt of grain. It is clear that the soil moisture plays an important role in fertilizer efficiency. For example, it is known that each additional millimeter of soil moisture can increase by 0.5 t / ha of crop, and in the period of drought additional 2.5 mm of water leads to an additional increase in corn yield by 0.5-0.7 t / ha [5].

It should be noted that in conditions of drought, the use of organic fertilizers, due to which the organic component of the soil increases, improves its water regime.

In conditions of climate change – global warming and increasing the frequency of drought, the study of moisture-saving agricultural systems, one of which is organic farming [1, 8], which agrotechnical techniques contribute to the accumulation, conservation and rational use of soil moisture, are becoming relevant.

One of the technological elements of this agriculture, which helps to improve the water regime, is soil protection, moisture-preserving, shallow soil cultivation at a depth of 4-5 cm, which creates a vertical orientation of aeration pores, preserves the natural structure of the soil, its capillarity, formed by the roots that is decomposed, and rainworms. The accumulation of moisture is also facilitated by the observance of scientifically grounded crop rotation, the introduction of perennial legumes, siderates, the use of humus, the use of trench remnants, and the unproductive part of the crop. Due to this, the organic mass increases in the soil, which makes the soil more loose and enhances the ability to retain moisture. Mulching of the field surface with plant residues also contributes to lowering the soil temperature and moisture evaporation. So, for organic farming, the moisture content of the soil in different periods of vegetation on average is 28-32% higher than the soil on which intensive farming is conducted.

The application of the organic farming system also contributes to the growth of

the water resistance of structural aggregates. The coefficient of water resistance of structural aggregates for the organic farming system was 10, and for intensive – 5.2.

With the prolonged use of organic technologies, the tendency of changing the parameters of the humus as waterproof part of the soil is also revealed. In the layer of soil 10-20 cm the total humus content for the organic system was 5.26%, for mineral – 4.70%. In individual fields, due to more intensive humification of organic residues, it reached a difference of 1.57%. Especially tangible process of soil formation on eroded lands, the yield of which, after a certain period after the introduction of the system, reached the indexes in plain fields.

The modern complex of agricultural machines and mechanisms for continuous and inter-row tillage of the soil complements the system.

It is logical that the increase of soil fertility positively influences the productivity of agricultural crops. But if under the condition of moisture lack at this level of fertility can not be high yield, the use of intensive methods will not increase them. But when grown products are certified as organic, there is an opportunity to get an additional 30-50% or more of its implementation.

Consequently, the widespread introduction of organic farming is the optimal response of the agro-industrial complex to global warming, as the technologies of this system allow more efficiently to accumulate and use moisture through crop rotation, small-scale tillage, organic fertilization and growing of siderates, the use of modern machines and mechanisms for soil cultivation. It allows to receive environmentally safe products, to store and even increase the soil fertility (to preserve the land).

Consequently, in conditions of increasing the climate drought, it is necessary to use systemic and science-based measures to adapt agrarian production to new climatic conditions. Confrontation with the constant deficit of moisture in agriculture is achieved at the expense of its accumulation and preservation by constantly applying modern energy resources and saving technologies of growing crops, minimizing soil cultivation, shortening the terms of spring field work, and generally adhering to the regulations for the use of all technological operations.

These measures contribute to the sustainable development of the agrarian sector of Ukraine, as they are based on the principles of the golden rule of ecology, which must be implemented at all times at the level of farms, - global problems of ecology are solved locally.

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