

# STABILIZATION OF THE LAND USE AS A BASIS OF ADAPTIVE AGRICULTURE DEVELOPMENT IN THE LIGHT OF THE V. DOKUCHAEV'S DOCTRINE

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The importance of V. Dokuchaev doctrine in the development of scientific bases of agriculture, conservation of soil fertility, rising the efficiency of land use in Ukraine in the present situation and the future in the context of adaptive agriculture development as a basic sector of agricultural production is highlighted. The necessity of optimization in Ukraine land use for reforestation and sustainable land development are substantiation.

**Key words:** *land use, reforestation, agriculture, soil fertility, crop.*

It has been 130 years since the comprehensive research on the survey of Russia chernozems under the supervision of Professor V.V. Dokuchaev was completed. On the basis of these materials in 1883, the book "Russian Chernozem" has been published, and in 1892 book "Our Steppes Formerly and Now" has been issued. This publications laid the beginning of the science of reclamation of agricultural landscapes by transforming them into cultural water-conserving agricultural landscapes, relevance of scientific statements have not been lost so far.

The scientific heritage of V.V. Dokuchaev is important for soil conservation and improving the efficiency of land use in Ukraine in the current conditions and in perspective, particularly in the context of adaptive agriculture which is the basic sector of agricultural production.

Large spaces of Ukrainian lands in the past have determined the extensive system of land use and management.

Expansion of arable land areas has always been the only means of increasing crop production, resulting in a plowed reached almost 82 % and in some areas - 96 %. The development of the total land fund is about 60% (for comparison, in the U.S. - 12%). This led to the development of unprecedented erosion. Annual soil loss reaches 600 million tons, including more than 20 million tons of humus. A third of nutrients and to 16 billion cubic meters of water is lost. The area of degraded soils increases each year about 90 thousand hectares, and annual net revenue loss is about 3.0 billion US dollars [1].

Problems of land use brewing for a long time. Even after 1861, for 37 years, the size of cultivated areas in Ukraine reached at the time unprecedented limits in the world. The area of forests in the Poltava district decreased from 34 % of the total area of up to 7 %, in Lubny district - respectively from 30 to 4 %. In the period from 1887 to 1921 in eight provinces of Ukraine (without Tavrian) forest area decreased by 1.5 million hectares. This was the main cause of our steppes illness [2].

Thus we can state that more than 100 years ago advancement of Steppe to Forest Steppe and Forest Steppe to Polissya began and continues now.

In agriculture the law of nutrients return to the soil is completely disregard previously and now. The annual loss of humus, due to unbalanced application and removal of organic matter and soil erosion, has been reached 0.8 t from 1 ha. The deficit-free balance of nutrients in the soil provided about 10 % of the need.

From the cycle removed of 4 million tons of reactant nitrogen, or 139 kg per 1 ha of land due to the reduction of manure production and application, reducing the areas of leguminous crops and perennial legumes, and reduction of nitrogen fertilizers application. Yield increments in recent years in Ukraine are mainly provided with humus mineralization as a result of moisture supply improvement, and a factor of efficiency increasing of the intensification facilities remains unused because of their absence.

According to scientists, the reserves of nitrogen in the chernozems of Ukraine, though exhausted in humus, are sufficient to grow crops for 100-200 years. If soil will only be dung, just 25-30 % of nutrients removed by crops returns. In the sod-podzolic soils in the plow layer reserves of nitrogen are sufficient for a maximum of 50 years.

Evidence that Ukraine had soils with a humus content of 10 % brought in the book of Professor V.V. Dokuchaev "Russian Chernozem" published in 1883. In particular, the average index for Kharkiv region was 7 %. Over 100 years of land use humus content decreased by a third. By the way, there were soils in 1912 the Kyiv region humus content in which reached 6,8 %. Now they are not.

As it is known, an indicator of soil fertility is crops' yield, and especially its quality. In the prewar years, the protein content in wheat grain in Dnipropetrovsk, Kharkiv and Zaporizhia regions was 18,5 % in 1998 it decreased to 15,5 %, and later - to 13,4 %, and now it is at the level of 8,10 %.

By the way, in the 80's of last century in Canada it was found that for each previous 10 years protein content in wheat grain decreased by 1 %. The humus content decreased by 50-60 % in the plow layer for 60-70 years in the grain- fallow crop rotations with 30-40 % of bare fallow. Government of Canada for the program to revive the soil fertility has allocated 1.7 billion \$. On the areas of millions hectares the bare fallow has been substituted by the so-called "dry irrigation" - the application of high doses of mineral fertilizers, and tillage changed [3].

In Ukraine is high time to take extraordinary measures to improve the use of land by land tenure stabilization and termination of humus and water losses in the soil. First of all, we should restore the broken relation between natural systems - areas of forests, waters, meadows, sown areas; stabilize the ecological balance in agricultural landscapes, about which V.V. Dokuchaev over 100 years ago wrote.

To do this, one need to reduce the land areas under cultivation by at least 10 million hectares. They have to be changed to the natural grasslands. One need to afforest the arable land on slopes of 3 ° and more, a part of the non-chernozem plowed soils, lands contaminated with radionuclides and heavy metals, water conservation lands and those on which crops growing is not effective. Conversion of arable lands to natural grasslands provides conservation and preservation the land for future generations [4].

It is necessary to increase the area of grassland at least 2.7 times in Ukraine, and the area of the woods in 1.8 times. The great importance in maintaining and improving of land use are the principles of landscape ecology-farming systems. On this basis, scientists of NSC "Institute for Soil Science and Agrochemistry Research named after O.N.Sokolovsky" developed contour-reclamation system of agriculture, the development of which was included in the program of the government. Implemented in farms of Obukhov and Kagarlyksky districts of Kyiv region, this system prevents the reduction of soil and nutrients losses in 5 times, water losses in three times and enhances the field productivity by 20-30 %. In Kagarlyksky district which is the base area to implement in the production the scientific developments of the NAAS, over

5,000 hectares of low-yield and erosion-prone lands withdrawn from cultivation and transferred into natural grasslands so that grain production by 30 % exceed that achieved in the most productive years in the history.

In developed countries, land under cultivation has long been optimized. For example, in the U.S. for two years (1982-1983), areas of privately owned arable lands decreased by 26.4 million hectares, and now the area of land under cultivation are at level of 1900.

After 2000, the rate of withdrawal from cultivation of long optimized arable lands in the EU is 17.5 %. In France in 2002, 2 million hectares is no longer treated.

In a world the natural grasslands determine the profitability of beef and dairy cattle. Their area twice exceeds the area of arable land. In Ukraine, the area of arable land is 5 times higher than the area of natural grasslands, and per capita they in 9 times lower than in developed countries. By the way, nearly 1 million hectares of meadows and pastures of hydrographic fund lands were plowed in the eleventh to twelfth five-years.

At the lands output of cultivation one need by force of law to change the status of their application, for three or four years to recover many-species agronomically valuable vegetation, which is deep adapted to local conditions and is able to regenerate itself. This will provide production of at least 4 million tons of meat or 15 million tones of milk for 6-7 months on pasture feed (and saving 5.6 million tons of grain).

According to the experts of the UN excessive plowing is the cause of land degradation and desertification, irrigation and deforestation of areas.

It is worth to mention 200 years ago, half the territory of Ukraine was covered with forest, before the collapse of the Soviet Union - about 14.3 %. Stocks of ripe wood depleted, ripe timber stands was only 6 %, but without the Carpathians it was 4 %. Today in Ukraine afforestation area is 15.9 % of the total territory, it is the lowest in Europe. Especially low afforestation is in Zaporizhya and Mykolaiv regions – 4 %, Kherson region- 4.7 %, Dnipropetrovsk region- 5.2 %, Odesa region – 6.0 %. In general, in the Steppe zone afforestation area is 6.6 %.

Without going into the theory of global warming, which is increasingly refuted by scientists around the world, it is appropriate to recognize that forests and grasslands not know what is erosion and drought. This is factors of climate stabilizing they soften harmful influence of weather anomalies.

The analysis shows that the expansion of arable land over the past 200 years, leads to droughts, and subsequently to major crop failure, decline of cattle and terrible famine. Crop failures and poor harvests took more livestock than epizootic [5]. The biggest disaster of agriculture was drought in 1891, when the millions of people were starving and dying, the cattle was succumbing.

Famous scientists of that time V.V. Dokuchaev, P.A. Kostychev, C.A. Timiriazev developed measures to overcome the effects of drought. Their works are heretofore relevant. Just then the catch phrase of C.A. Timiriazev came: "Possession of land is not only the right or privilege, but a heavy duty liability that threatens to trial of descendants". In the following year (1892) it is known to be published V.V. Dokuchaev book "Our Steppes Formerly and Now" [6, 7].

However, the degradation of the topsoil is continuing catastrophically. To a large extent the result of unstable land use was drought in 2003, as well as dust storms in 60 years of the last century. Droughts, the likelihood of which in the Kiev region was once in 100 years, recently repeated approximately every 10 years.

To optimize and stabilize the land use we need to take into account evidence-based, proven by practices worldwide regulations that the level of tilled soil should not exceed a maximum of 50 % from crop rotation area, and area of afforestation should be 25-30 %. Banks of canals, reservoirs, rivers all other water sources should be forested and forest shelterbelts should be recovered.

Afforestation rate is set in 30 % in the European Union. Afforestation of France is 27,6 % and now measures is taking to expand the area covered by forest to 30 % of the territory. In Poland, 28,6 % of territory is forested, but the lands of the former state farms (1,0 million hectares) is also withdrawn under afforestation. Hungary, having already 20 % of the forested area of 6 million hectares of land under cultivation has put under afforestation 1,5 million hectares. Currently, intensive afforestation is held all over the world. Calculations show that Ukraine must prove afforestation minimum to 25,7 %, while the area of land covered with forests, will be 15,5 million hectares.

For centuries, mankind has tried to overcome the dependence on natural disasters - drought, heavy rains, floods, hurricanes and other adverse weather events, which are not decreasing, but increasing. It is no mere chance yield of many crops in Ukraine in some years up to 80 % depending on the vagaries of the weather.

In Ukraine there is a vital need to improve sustainability of farming systems based on stabilizing land use and enhance their adaptability, increasing effectiveness of the intensification of the industry.

First of all, one needs to prevent soil degradation, to optimize the regime of organic matter and humus status of soils that remain in cultivation. The accumulation of soil organic matter is one of the important sources of replenishment of nutrients and powerful factor in increasing the biological activity of soil, their water and physical parameters improving. To do this, the bulk, and sometimes all subsistence crop production to be used for fertilization.

We have to introduce the crop rotations, which are the basis of agriculture. Crop rotations in Ukraine are so deranged that in 2013 there was not enough forecrops to sow in time basic food crops e.g. winter cereals. The analysis shows that the share of adopted crop rotation ensure yield increase 1,0-1,4 t/ha of winter wheat and 1,0 t/ha of corn.

Efficient land use is not possible without chemical soil reclamation. Ukraine has about 10 million hectares of acid soils. In the Forest-Steppe zone area of acid soils increased by 1,8 million hectares. Agricultural policy required each year to have over 10 million tons ameliorants, which application in recent years declined. And one of the reasons for this was the lack of defecate.

We all know that the land has no price no water, no life in it, as measures of the accumulation, preservation and rational use of water cannot be overstated. Retention in the area of field of 1 m<sup>3</sup> of water and use it to create a yield costs 10 times less than it supply from any source for irrigation.

The main factor in the formation of yield and ensuring of its quality is the active ingredient of fertilizers. In crop production the share of fertilizers in energy consumption excess of 60 %.

Application of fertilizers should be brought to 8,9 million tons of nutrients or 270-330 kg/ha of sown area to form the necessary amounts of competitive production. Calculations of scientists from NSC "Institute of Agriculture of NAAS" show that all available organic matter is not enough to form only gross yield of grain, provided by the National Program to 2015. One need to add additionally 1,3 million tons of nitrogen active ingredient.

Reduction the area of land under cultivation, increasing the area of greenlands and afforestations with maintaining and restoring the integrity of land systems, technical re-equipment of agriculture industry are impossible without state subsidies. These measures should be included in the program of the government. In the basis of the public policy one need to put UN Concept of 1992 on the environment in which it was proclaimed: "Satisfaction of the vital needs of the present generation must not be achieved at the expense of such deprivation ability of future generations".

Historical experience shows that mankind has always opposed advances in science, the scientific and technological progress to extreme conditions.

Both now and in the future competitiveness of food security is the most important, therefore, the preservation of land, stabilization of land use and on this basis, improving the efficiency of agriculture will be highly appreciated by future generations.

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