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ASSESSMENT OF PRODUCING ABILITIES OF FARMLAND IN A LIMITED WATER SUPPLY ENVIRONMENT OF UZBEKISTAN

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ОЦЕНКА ПРОДУКТИВНЫХ ВОЗМОЖНОСТЕЙ СЕЛЬСКОХОЗЯЙСТВЕННЫХ УГОДИЙ В УСЛОВИЯХ ОГРАНИЧЕННОГО ВОДОСНАБЖЕНИЯ УЗБЕКИСТАНА

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Abstract. This article is investigated the calculation of the natural soil productivity of agricultural land plots in the current conditions of limited water supply in the Republic of Uzbekistan, which is considered one of the developing countries of Central Asia, i. e., it studies both theoretical and methodological aspects of determining the soil assessment and issues of economic land assessment based on it. That is why the rational and efficient use of irrigation water in today's restricted distribution is one of the most important issues for any economy, and it is important to consider the evaluation of soils and economic evaluation of irrigated land, a land assessment, the positive solution of a number of economic issues.

Аннотация. В статье приводится расчет естественной продуктивности почв земельных участков сельского хозяйства в современных условиях ограниченного водоснабжения Республики Узбекистан, которая считается одной из развивающихся стран Центральной Азии, т. е. исследуются как теоретические, так и методологические аспекты определения почвенной оценки и вопросы экономической оценки земель на ее основе. Именно поэтому рациональное и эффективное использование оросительной воды в условиях сегодняшнего ограниченного водораспределения является одним из важнейших вопросов для любого хозяйства, и крайне важно учитывать данные почвенной и экономической оценки орошаемых земель при принятии положительного решения по ряду хозяйственных вопросов.

Keywords: agricultural land, economic productivity, gross income, irrigated land, limited water distribution, mechanical composition of soil.

Ключевые слова: сельскохозяйственные угодья, экономическая продуктивность, валовой доход, орошаемые земли, ограниченное водораспределение, механический состав почвы.

Introduction

In the current chain of economic reforms in the system of agricultural land use and in the condition of creating market economy in the Republic of Uzbekistan, it is necessary to determine the production potential of soils scattered in agricultural fields, namely to conduct objective assessment of land and to determine the normative value of land. It is important to use it in solving problems. The distribution of water to irrigated areas in the country requires a special approach to the assessment of the production capacity of these lands, because in the case of limited water distribution all irrigation systems in the area should be full, and the fields should be economically efficient, technologies should be available. However, till today, most irrigation systems in the country's regions do not meet these requirements. This, in turn, contributes to the lack of irrigation water in the fields in the prescribed amount and, consequently, reduces the natural production capacity of the soils, that is, their natural fertility. Therefore, in the context of limited water distribution, a scientifically sound solution to this problem has a positive effect on the results of soil bonitation, i.e. the production capacity of the soils, which allows for a more objective assessment of the economic (normative) value of irrigated land.

Farmers, who have become major agricultural producers in recent years, improve the economic efficiency and productivity of their land, improve the fertility of their land, the efficient use of available material and technical resources, labor and financial resources, and, above all, these improvements depend on better irrigation water use. The latter factor is of particular importance, as the agriculture of the country has moved to a limited water distribution in recent years, which also requires efficient use of this resource. On the other hand, inadequate water supply to irrigated land for plants growth and high yields contributes to their productivity and limited production capacity of irrigated lands [7, 16]. That is why it is important to take into account these conditions when determining the normative value of farm land.

In today's limited water distribution, many parts of Uzbekistan are already using advanced water-saving techniques and technologies for solving problems. Such as sprinkler irrigation, drip irrigation, surface irrigation, surface irrigation, furrow irrigation, etc. Irrigation and drainage systems play an extremely important role in all Central Asian countries people. But the condition of these two systems has deteriorated over the past decades. Different types of irrigation systems are used in almost all regions of Uzbekistan to address water shortages. Today farmers are efficiently using furrow irrigation systems in Fergana valley [21]. For many years the main agricultural crop has been cotton, and over the past four years, cotton fields have been declining in the country. Cotton requires much more water than other agricultural products. As a consequence of this, the quality of fertile soils had dramatically dropped, and then salinity of lands had significantly increased at that time. From year to year, with the decline in soil fertility, farm incomes also declined automatically. Understanding crop selection and spatial distribution are the key elements for every farmer under the condition of limited water supply environment of Uzbekistan [22].

Materials and methods

The research shows that according to the official data of the State Committee Davergeodezkadastr which is only responsible for conducting state land policy, in due January 1, 2018, the total number of farms in the country is 153385, including 50651 in cotton and 7914 in wheat growing, 8915 in cattle breeding, 48159 in horticulture, 13441 in viticulture, 6772 in vegetable growing, 3372 in beetles and 14162 in other areas [9]. Their total area is 6839.4 thousand hectares, including 3400.9 thousand hectares of planting land, 290.2 thousand hectares perennial plantations, 32.7 thousand hectares arable land, 2522.9 hectares pastures and hayfields. unused land is 952.7 thousand hectares [9]. Most of these areas (68.9%) are irrigated lands. The degree of their use is inseparably linked with the natural fertility of soils in these areas. Soil science has shown that the most important feature of the soil is its fertility [5, 6, 12, 15, 20]. The fertility of each soil is directly related to the process of its formation, and its fertility changes constantly during the development of the soil. Its change is more rapid, especially under the influence of human activities.

The regional peculiarities of soil-climatic, geomorphological and hydrogeological conditions of the republic, in particular, the fertility of soils, in many respects are connected with human activity and natural factors [19, 27, 28, 29]. Therefore, secondary salinization is observed in areas where groundwater flow is limited, and water erosion is occurring on the slopes. These processes undoubtedly have a significant negative impact on soil fertility. Along with the above, non-observance of norms and timing of irrigation in accordance with the soil-climatic conditions of the area, especially the requirements of the plant, can also lead to a decrease in soil fertility [2, 3, 13, 14, 23, 24]. A number of soil scientists [2, 4, 5, 8, 10, 11, 18] believe that the irrigated soils in the republic are less humus by nature. Nevertheless, it plays an important role in soil fertility. Irrigation water plays a special role in the free cultivation of humus and nutrients in soil. Therefore, timely irrigation of crops during the growing season increases soil fertility and facilitates the absorption of mineral and organic fertilizers into the soil. It should be noted that in the conditions of irrigated farming the quality of soils varies constantly. As a result of human activities, there is an increase in the productivity and quality of land due to the improvement of the soil-reclamation condition of lands. It is also important that the fields are supplied with irrigation water. On the other hand, the demand for irrigation water for crops sown in the fields must also be considered.

For example, cotton crop during the growing season requires 4,000–6,000 m^3 of water per hectare, 3000–4000 m^3 of corn and 6,000–8000 m^3 of water per hectare, depending on the soil and variety of plants. The water consumption of crops is also closely linked to the fertility of soils in the area. Consequently, the provision of these agricultural crops with irrigation water at their level is one of the important factors of high yields. This has been confirmed by a number of soil scientists and practitioners [3–5]. In particular, agronomic soils, water, air and heat regimes, microbiological activity of the soil vary greatly under the influence of irrigation water, with significant positive changes in the microclimate conditions of the irrigated area [4–5, 8]. With the irrigation water, fuzzy particles enter the soil, resulting in their accumulation in certain areas, and consequently a fertile layer is formed. Water is a highly soluble fluid that allows the nutrients in mineral and organic fertilizers to be fully absorbed into the soil and improves the nutritional profile of plants [2]. As a result of maintaining a favorable weather regime through irrigation, microbiological processes in the soil, ammonification and nitrification, and the development of free-living nitrogen-bearing bacteria, are significantly improved. As a result of irrigation, the process of plant growth is intensified, there is a strong root system in plants, which allows the soil to be enriched with plant residues and organic matter [2, 5, 8].

The above studies suggest that the moderate use of irrigation water improves soil fertility and improves its quality. This will certainly increase the production capacity of these irrigated lands and increase their normative value. However, in today’s limited water distribution, it is difficult to achieve this result on all irrigated areas, as it can be seen only in areas where main and local irrigation networks are built in modern type, where the maximum amount of water is reached. It should be noted that today in irrigated regions of the republic there are not so many regions with such conditions. Most of the irrigation systems in the areas that have been irrigated since ancient times are ground-based, that is, 36.0–38.0% of the ground water is discharged from the depths of the river until it reaches the field. According to the Suvloyiha Institute, there are 32,200 km of canals in the country. 28.0% of the main canals and 36.0% of the 86.8 thousand km of the local irrigation canals need to be repaired and to be concreted [17, 27].

Consequently, part of the crop area does not have enough irrigation water to meet the standards. This, of course, will have a negative impact on the soils and production capacity and the economic value of the irrigated lands in these areas. Taking this into consideration, today, it is advisable to add one more corrective coefficient on irrigation water supply to the existing correction coefficients in the existing methodology of comparative assessment of the productivity of irrigated soils. As it is known, soil valuation is a comparative assessment of the natural fertility of soils, that is, natural production opportunities. This method of valuation, namely the method of calculating the soil valuation, was developed for the irrigated soils of the Republic of Uzbekistan, created in the middle of the 20th century, and subsequently improved significantly.

Today, the evaluation of irrigated soils is carried out using this improved methodology. First of all, a 100-point appraisal scale is used. Appraisal scale of irrigated soils in Uzbekistan is based on long-term soil researches, agrochemical and agricultural observations. The genesis of their origin for all soils, the period of irrigation and culturalization were taken into account as a general assessment framework on the evaluation scale. This basic scale of assessment was developed and put into practice in the optimal conditions, that is, salinity and non-erosive mechanical composition, based on the quality of the soil well drained. According to this method, the bonit score from the basic assessment scale is based on thermal resources of certain soil areas, as well as a number of diagnostic signs of specific soils, including mechanical composition of soil, salinity, soil drainage, soil washout, gypsum depth, groundwater depth. and correction coefficients for site rock hardness [1].

They are developed on the basis of soil studies under special laboratory conditions and are considered in the process of soil evaluation. Consequently, the bonit score of each particular soil is calculated by multiplying the correction coefficients by the soil characteristics of the bonitet points derived from the evaluation scale. That is:

$$Bt = Bsh*K1*K2*K3*\ldots*Kn \quad (1)$$

The main difference between the economic valuation of agricultural land and the value of soil valuation is that bonitirovann mainly examines the state of soils, not taking into account the economic conditions of agricultural production. In economic evaluation, land is regarded as the main production tool of agriculture. At the same time, the quality of land plots in terms of economic productivity at the level of agricultural intensity achieved during this period will be highlighted. It is calculated by taking into account natural and economic conditions of production, location of land plots, labor and material costs of agricultural production. Economic valuation of lands has always been one of the most difficult problems of the appraisal system, as the use of land in different sectors of the economy requires different approaches to their evaluation. In addition, the current market economy in Uzbekistan calls for a more cost-effective assessment of land, such as other production facilities. The study of existing scientific and practical developments shows that to date, a number of methodologies for economic evaluation of agricultural land have been developed and implemented in Uzbekistan. In particular, in the 70s of the last century, a temporary alliance method [21, 26] was developed in the framework of the former Soviet Union. According to this methodology, the evaluation of agricultural land in the irrigated regions of Uzbekistan was carried out, and the results were put into practice.

According to the methodology, according to the purposes and requirements, the economic evaluation of lands is divided into general and private. Private assessment is designed to determine the effectiveness of cultivation of a particular crop under different soil conditions, and a general assessment is to identify indicators of agricultural land use efficiency at the current level. However, in the 1990s, Uzbekistan's transition to a market economy, in particular the change of land use patterns, the transition to multifunctional farming, the need to establish and diversify farmland on agricultural land, and the transfer of land use on a paid basis causes the need to develop a new methodology. Based on the research, this methodology has been developed, namely, "Interim method of determining the qualitative, economic and cost value of agricultural land in the Republic of Uzbekistan" [22, 25]. This method is today known as the method of determining the normative value of agricultural land.

According to this methodology, the normative value of agricultural land is calculated using the average bonit score of soils, normative net income, rate of profit, intensity of economic and agricultural production, location adjustment and special adjustment coefficients based on local conditions. Specifically, normative net income (NI_n) is defined as:

$$NI_n = \frac{GDP_n * P_n}{100} \quad (2)$$

where, GDP per 1 - standard gross product per irrigated land, thus.

Pn is the rate of return for lands with different productivity (using specially developed norms).

Normative value of 1 hectare of irrigated land is determined using the following equation:

$$B_n = \frac{NI_n * K}{P} * 100 \quad (3)$$

where P is the percentage of bank loan capital (accepted at 5.0% in Uzbekistan),

K — Corrective coefficient on intensity of economic and agricultural production (specially developed for regions and districts of the republic).

Even in determining the normative value of farm land based on this methodology, we recommend that the adjustment factor will be adjusted to the local level of irrigation water supply in the adjusted local conditions.

Results and Discussion

However, the proposed correction of irrigation water supply coefficients is one of the factors that does not allow solving the problem positively. The fact is that soil boundaries do not correspond to the boundaries of land plots or fields of farms, because the soil boundaries are formed due to the natural processes taking place in the area, and the land boundaries are artificial boundaries.

Usually, the borders of farm fields are irrigation canals, road networks, collector-gardens. Therefore, the level of irrigation water available to each field depends on the availability of irrigation networks and canals that allow irrigation water to be supplied to the field. Hence, the adjustment coefficients for irrigation water input can only be entered after the average soil bonit score for each crop area is calculated, that is, the average bonit score for each field is determined by this equation [1]:

$$B_{ave} = \frac{B_1 * P_1 + B_2 * P_2 + B_3 * P_3 + \cdots + B_n * P_n}{P_1 + P_2 + P_3 + \cdots + P_n} \quad (4)$$

where: B1, B2, ... Bonit score of the soils dispersed in BP

P1, P2 P3, … Pn- area occupied by soils, ha

Then, using the correction coefficients adopted to provide field irrigation water, we can calculate the average bonit of soils scattered in the field, namely:

$$B_{ave} = B_{ave} * K_c \quad (5)$$

where — K_c is an adjustment to the level of irrigation water fields. It is recommended that these adjustments are as follows (Table).

Table.

RECOMMENDED CORRECTION COEFFICIENTS

Level of water supply, percent	K_c	*Level of water supply, percent*	K_c
100.0	1.00	50.0	0.75
90.0	0.95	40.0	0.70
80.0	0.90	30.0	0.65
70.0	0.85	20.0	0.60
60.0	0.80	10.0	0.55

In order to apply these coefficients, the average bonitet points for each farm field and total farm land are then calculated based on the level of irrigation water available for this farm, and the actual production potential of the farmland. Then we think that it is expedient to calculate the normative value of irrigated arable land according to the current methodology based on the latest soil valuation data. In particular, Rakhim-Ata in the Rovatak district of the Urtachirchik district of the Tashkent region of the Republic of Uzbekistan was 78 points, without taking into account the fact that the soils distributed on the territory of the farm were provided with irrigation water. The actual natural fertility of soils in this farm can be considered to be quite high. However, this conclusion can make the farm more difficult, as irrigation water for most of the farmland over the next 3 years is on average 92%. Taking into account the average bonitet of economic soils, this indicator is now 74 points. Determining the normative value of farm land using this bonitet score is about 0.8 million soum more than in the previous year. It is this index that allows to determine the real potential of farm land.

Conclusion

Thus, it can be concluded from the above studies that the proposed methodology of determining the natural fertility or natural production capacity of irrigated soils allows for a more accurate calculation of the normative value of irrigated land in today's limited water distribution. This, in turn, will allow farmers to effectively organize their land use and sustainable use of irrigated agricultural land.

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