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Improvement of the existing technology of cadastral assessment of irrigated crop land in case of Uzbekistan

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Abstract. The article examines and analyses the existing methods of cadastral assessment of irrigated agricultural lands, especially the existing methods for comparative assessment of the quality of irrigated lands, specific proposals and recommendations for further improvement of this methodology on the basis of adaptation to today's limited water distribution conditions; specific proposals and recommendations for further improvement of this methodology on the basis of adaptation to today's limited water distribution conditions; specific proposals for the simplification and simplification of the methodology for determining the normative value of land, which is carried out annually in the country, using the data of soil assessment, have been developed and are comprehensively substantiated.

1 Introduction

Efficient and effective use of any means of production, first of all, depends in many ways on knowing its main and most important features and using them in place[1]. This rule applies, first of all, to land resources, which are considered the main means of production of any industry, agriculture and forestry, and are located on the territory of the country and have different natural, socio-economic and ecological conditions[2]. It is inextricably linked to the best possible use of agricultural land, especially irrigated agricultural land, in today's highly competitive market environment. This problem, in turn, requires a scientifically based solution to the issues of cadastral assessment of such land areas. True, to date, a number of methods of cadastral evaluation of irrigated agricultural land have been created using them, the audit of irrigated soils is carried out, audit data In general, it is the normative value of arable land[3].

A number of practical issues related to the organization of land use are being solved using these data, i.e. soil assessment and land normative value data[4]. However, the water supplied to irrigated agricultural land is sharply limited in the following years, land areas are being brought to the market, some negative processes are limited due to the failure of irrigation systems, i.e. the water provided on the basis of a special limit is filled to the fields as a result of lack of access, sharp deterioration of land reclamation condition, weed invasion of fields,

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etc.), large areas of land are left out of agricultural circulation[5]. In order to positively solve these problems, first of all, it is necessary to carry out scientific research on improving the current methodology of land cadastral assessment. Therefore, the topic chosen to solve the problem raised for research is relevant [6–9].

2 Materials and methods

Studying a large number of scientific sources, based on many years of scientific and methodological experience in the field of land evaluation, it can be noted that the process of cadastral evaluation of agricultural land includes two stages: comparative assessment of the quality and natural fertility of the soils spread over the land areas, i.e. soil assessment and economic (normative) land assessment based on this assessment data [2,10–15]. Therefore, there are special methodologies at each stage, and as a result of research, recommendations are developed to improve both methodologies to a certain extent based on today's existing conditions. In this case, the level of irrigation water supply of irrigated cropland is taken into account as one of the main indicators. In addition, it is planned to simplify the existing methodology of determining the normative value of irrigated agricultural land as much as possible and make it understandable to everyone. Based on the above, in this research, the analytical analysis, accounting, grouping and monographic research methods are widely used[16].

3 Results and discussion

As mentioned above, cadastral assessment of agricultural land includes two stages, i.e. soil inspection and economic assessment of land. Soil assessment mainly consists of a qualitative comparative assessment of the natural fertility of soils distributed in a certain area. Due to the presence of specific characteristics of the soil formation and development process, different soils are formed on individual plots of land. Based on their development characteristics, these soils have different nutrient elements and include different physical and agrobiological conditions. Therefore, land plots have different natural fertility.

It is known that was to consider the need to base soil quality assessment on their stable natural properties that do not change due to human influence in a short period of the first time V.V. Dokuchaev pointed out: "First of all, it is necessary to evaluate the soil as a natural body, regardless of the human attitude and time conditions, that is, to study the composition of the soil, to know its physical properties and the subsoil layer, and on this basis, only one, therefore, it is possible to determine the comparative value of soils". Based on this rule, as a result of the joint research of the scientific research institute "Soil science and agrochemistry" and the scientific design institute "Uzdaverloyiha" in 1966, the method of validation of irrigated soils of Uzbekistan was created. Based on this methodology, B.V. Gorbunov, N.V. Kimberg, G.M. Konobeeva, V.N. Lee, M.I. Kochubey and S.P. The principles of irrigated soil validation developed by Suchkov lie. Development and irrigation of new land areas, from the point of view of the presence of gypsum layers in the soil scattered in these areas and the need to take this situation into account, as well as the negative impact on the quality of the soil, which indicates that various erosion processes in the scattered soils in the irrigated regions have increased somewhat in recent years[17–19]. Due to the need to take into account the secret, the method of determining the assessment of drained soils has been improved several times (in 1989 and 2000).

It is well known that the inspection of irrigated soils is carried out taking into account the requirements of the main agricultural crops grown on them. Since cotton is considered the main crop for the irrigated farming conditions of Uzbekistan, a 100-point rating scale was created based on the requirements of this crop, based on the genetic composition of the soil, the period of irrigation and the level of culture. Using this rating scale, specially designed correction coefficients are calculated depending on the distribution region, location and other natural characteristics of each soil obtained separately (mechanical composition, salinity level, condition of the subsoil layer, depth of gypsum layer, etc.). credit scores of individual soils are determined by using [20]:

$$Bi = Bas.* K1* K2 *K3 *K4 *K5 *K6 \quad (1)$$

where: Bi - is the calculated credit score of a specific soil,
Bas- a high credit score from the main scale,
K1 - the coefficient of taking into account that the area where the soil is located is provided with thermal resources;
K2 - the c oefficient for taking into account the mechanical composition of soils;
K3 - the coefficient for taking into account the level of soil salinity and land reclamation;
K4 - the coefficient for taking into account the drainage of the subsoil layer;
K5 - the coefficient for taking into account the susceptibility of soils to erosion;
K6 - is the coefficient of accounting for the amount of gypsum in the soil and the yield of the layer.

It is on the basis of this methodology that till today, the works of soil inspection on the irrigated agricultural lands of the republic are carried out, the results of which are used to solve various economic issues (Figure 1).

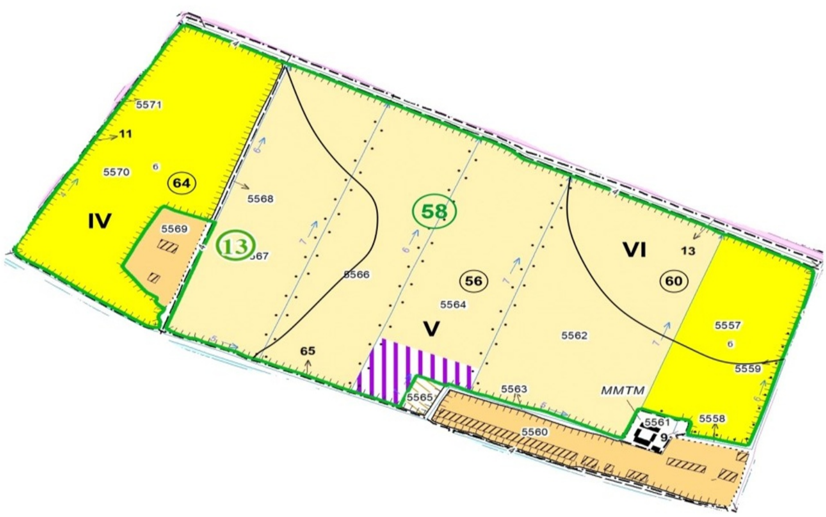

Fig. 1. Inspection of soils in the agricultural area

It should be noted that in the conditions of irrigated agriculture, the quality of soils is constantly changing. As a result of human economic activity, the level of productivity of the land is increased due to the improvement of the soil melioration condition. It is also important to supply the fields with irrigation water. On the other hand, it is necessary to take into account the demand for irrigation water of the agricultural crops planted in the fields. For example, cotton crop requires 4000-6000 m^3 of water per hectare, corn -3000-4000, vegetable crops - 5000-8000 m^3 of water per hectare, depending on the natural characteristics of the local soil and the type of crop. The norms of water consumption of crops are also inextricably linked with the fertility of the soils spread in this area[20–23]. Therefore, providing crops grown in agriculture with irrigation water at the level of their standards is a guarantee of high yield. This rule has been confirmed by a number of soil scientists and practitioners. Under the influence of irrigation water, the agronomic properties of soils, water-air, heat and nutrition regimes, microbiological activity change in many ways, great positive changes occur in the microclimate conditions of the irrigated area. This situation has also been proven as a result of a number of studies. In addition to the above, muddy particles enter the soil with irrigation water, and as a result of their collection and accumulation in certain places, a fertile layer is formed. This situation has been proven many times in practice. Water is a highly soluble liquid, which allows plants to fully absorb nutrients from mineral and organic fertilizers applied to the soil and improves plant nutrition. As a result of maintaining an optimal water-air regime in the soil by irrigation, microbiological processes, ammonification and nitrification processes, and the development of free-living nitrifying bacteria take place, as a result of which nitrogen nutrition of plants is significantly improved. As a result of irrigation, the process of plant growth is greatly enhanced, a strong root system is formed in them, which allows the soil to be enriched with plant residues and organic matter[24–27].

It can be seen from the above studies that the use of irrigation water at the standard level improves soil fertility and improves quality characteristics. This, in turn, increases the production potential of irrigated land. But in the conditions of today's limited water distribution, it is very difficult to achieve this in all irrigated croplands, which can only be achieved with main and local irrigation networks of a modern type, with a high efficiency coefficient, that is, irrigation sent based on a certain limit. The main part of the water can be observed only in the areas where it reaches the crop fields. But today, not all irrigation systems in the irrigated regions of the republic have such conditions. In particular, according to the information provided by the "Suvloyiha" Institute, today 72.0% of the total main and inter-farm irrigation canals, 64.0% of the internal irrigation networks have concreted concrete or tray system [21]. Therefore, certain parts of the crop fields do not receive irrigation water of the specified standards. This condition, without a doubt, has a negative impact on the quality of irrigated soils.

For this reason, despite the implementation of special state programs for the improvement of the reclamation condition of irrigated lands for the last 14-15 years, the soil quality index remains around 54-55 points in the republic. Therefore, in conclusion from the above, we propose to introduce special correction coefficients for the supply of irrigation water to the soil during the audit of irrigated soils in the conditions of today's limited water distribution. Including such a correction coefficient in the evaluation system allows to determine the comparative objective value (in units of points) of the natural fertility of soils in conditions of limited water distribution. Based on the conducted field observations, conversations with the heads of local farms, practical provision of fields with irrigation water, the correction coefficients were developed and recommended to the evaluation system in the Table 1.

Table 1. To provide water for irrigation of agricultural fields depending on the correction coefficients

Level of water supply, percentage	K_c	Level of water supply, percentage	K_c
100,0	1,00	50,0	0,82
90,0	0,95	40,0	0,80
80,0	0,92	30,0	0,77
70,0	0,90	20,0	0,72
60,0	0,87	10,0	0,70

But placing the additional correction coefficient we propose among the correction coefficients accepted in the existing methodology does not allow to solve the problem positively. The fact is that the boundaries of soils do not correspond to the boundaries of farm plots or fields, because the boundaries of soils are formed depending on the natural processes occurring in this place, and the boundaries of fields are artificial boundaries. . Irrigation canals, road networks and collectors are usually the boundaries of farm fields. Therefore, the level of irrigation water supply to each field depends on the existing condition of irrigation networks and canals that allow to bring irrigation water to this field. Therefore, the correction coefficients that are planned for irrigation water supply can be introduced only after determining the average soil quality index for each crop field, that is, to prevent each is the average credit score of a field. Usually this is defined by the following equation [5]

$$B_{o'rt.d} = \frac{B_1R_1+B_2R_2+B_3R_3+\cdots+B_nR_n}{R_1+R_2+R_3+\cdots+R_n} \quad , \qquad (2)$$

where: B1, B2,...... Bp- is the credit score of the soils distributed in the field,
R1, R2 ..... Rp - area occupied by soils, ha

Only after that, it is possible to calculate the average quality of the soil scattered in the field using the correction coefficients (Ba) adopted for the supply of irrigation water to the fields, that is:

$$Ba = Bo'rt.d \times Kc \quad , \qquad (3)$$

where, K_c - is a correction to the level of irrigation water supply to fields

It is recommended to calculate the average credit score of each field or contour soil using this equation. Such calculation allows to accurately assess the quality of the soil depending on the local conditions, in particular, the level of irrigation water supply to the fields. This can be seen from the following concrete example. In particular, the real value of the average productivity of the fields based on the inclusion of the coefficients of the levels of irrigation water supply into the quality scores of the soils scattered on the borders of 8 cotton-grain farms operating in the A.Khidirov massif, Shovot district, Khorezm region can be determined in the Table 2.

From the data in Table 2, it can be seen that, in fact, which farm fields are well supplied with irrigation water, the quality index of the soil spread in them is higher. In this, of course, it is very important to always keep the irrigation networks in order and working condition. In fact, despite the fact that farms 1, 7 and 8 use large cultivated areas, due to the good level of irrigation water supply, the quality indicators of their soil were also preserved in the previous state.

Table 2. Average productivity indicators of farm soils, taking into account the level of irrigation water supply

№	Farms	Cultivated area, ha	According to the existing methodology, the average quality of soils, points	Coefficient of accounting for the level of irrigation water supply, K	Soil credit score
1	Solijon bobo	132,1	62	1,00	62
2	Raxmat-Ermat	102,0	70	0,95	67
3	Baxmal momo	86,4	70	1,00	70
4	Mustaqillik	92,3	60	0,92	55
5	Baxtli	104,6	55	1,00	55
6	SHarifboy	102,2	58	0,90	52
7	Xitoylik	120,1	64	1,00	64
8	Qilich bobo	114,2	68	1,00	68
	By region	1265,0	62	0,95	59

It is known that the normative value of irrigated agricultural land is primarily based on soil inspection data. In general, according to the existing, improved methodology, the normative value of the main agricultural crops per hectare is determined as follows.

The calculated amount of profit from irrigated arable land for land of different quality is determined according to the following formula [20]:

$$R_{pr}=\frac{\frac{N_{psk_1}1*Pk_1}{100}*R_{n1}+\cdots+\frac{N_{psk_n}*Pk_n}{100}*Rn_n}{Pk_1+Pk_2+\cdots Pk_n} \quad , \quad (4)$$

where: R_pr- calculated profit from irrigated arable land for 1, thousand soums;

$N_{psk1},\ N_{psk_n}$ - normative productivity of agricultural crops, thousand soums / ha;

Pk_1, Pk_n - cultivated areas, ha;

R_{n1}, Rn_n - the calculated amount of agricultural production benefits obtained from different crops on lands with different soil quality, in percent.

Based on the above, the cadastral value of irrigated arable land for 1 is determined using the following formula [20]:

where: R_pr- calculated profit from irrigated arable land for 1, thousand soums;

$N_{psk1},\ N_{psk_n}$ - normative productivity of agricultural crops, thousand soums / ha;

Pk_1, Pk_n - cultivated areas, ha;

R_{n1}, Rn_n - the calculated amount of agricultural production benefits obtained from different crops on lands with different soil quality, in percent.

Based on the above, the cadastral value of irrigated arable land for 1 is determined using the following formula [20]:

$$S_n = \frac{R_{pr*}K_1K_2K_3}{P} * 100 \quad , \quad (5)$$

where: S_n - normative cadastral value of irrigated arable land, thousand soums/ha.;

R_{pr} - calculated profit from irrigated arable land, thousand soums/ha.;

P - the percentage of capitalization of the calculated profit is generally accepted as 5.0%;

K1 - is the coefficient of accounting for the level of intensity of farm management and agricultural production;

K2- is the coefficient for calculating the method of water release for irrigation;

K3 - is the coefficient for calculating the percentage of crop loss

The coefficient, which takes into account the method of water release into the farm internal irrigation system (running water or machine method) for irrigating commodity agricultural products, in a single expression for the republic, running water for all irrigation areas with certain coefficients depending on the percentage of irrigation.

The coefficient that takes into account the loss of crops and the corresponding loss of value in the case of placement of agricultural fields in protected areas where the use of chemical substances is prohibited is based on the credit score and share of agricultural fields on the plot of land in a unified order across the republic adopted [3,23].

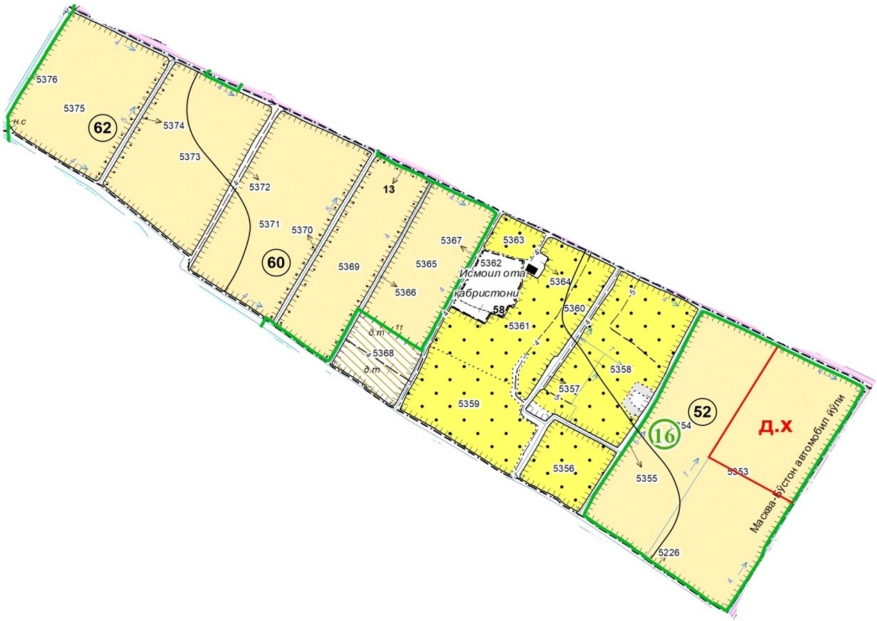

Fig. 2. Inspection of soils in the agricultural area

It is necessary to admit that the normative value of irrigated cropland is calculated on the basis of the above calculation books, and the results are used to solve various issues in practice. The fact is that such accounting books are quite complicated, and in most cases they cause difficulties for local experts. That is why, in our opinion, it will be useful to simplify it a bit. Therefore, it is suggested to use the following equation in determining the normative value of such lands:

$$Sn = BB \text{ x } O‘B\text{x } MK \text{ x } SK \text{ x } XN, \quad (6)$$

where: Sn – normative value of irrigated arable land, soums;
BB- land credit score (from 0-100);
O’B- 1 point price based on calculations;
MK – regional coefficient;
SK- coefficient of water supply;
XN- the factor for taking into account the loss of crops, if agricultural fields are located in protected areas where the use of chemical substances is prohibited.

The basic normative value for agricultural contours is expressed in soums. The level of economic management and the intensity of agricultural production are taken into account through specially developed regional coefficients for the administrative-territorial structures of the republic and regions. In general, the methodology proposed above simplifies the calculation of the normative value of agricultural land.

When determining the economic (normative) value of irrigated arable land, state purchase prices for cotton and wheat, which were the main agricultural crops until recent years, were accepted and such evaluations were carried out. However, due to the cancellation of state orders for these crops in the following years, and the acceptance of contract prices for the grown products, it is now necessary to accept these prices when conducting such an assessment. This situation causes the normative value of irrigated cropland to increase by almost 1.5-1.6 times. This, in turn, leads to a significant increase in rents paid to the state for land. The following data confirm this once again in the Table 3.

Table 3. Economic (normative) value of farm land

№	Farms	Based on state purchase prices, the value of 1 hectare of land, million soms	Rent (0.95%) soum/ha	Based on contract prices, the value of 1 hectare of land, million soums	Rent (0.95%) soum/ha
1	Solijon bobo	54386	516670,0	87018	826671,0
2	Raxmat-Ermat	61212	581510,0	91818	872271,0
3	Baxmal momo	61212	581510,0	91214	866533,0
4	Mustaqillik	49632	471500,0	75441	716690,0
5	Baxtli	47328	449616,0	70992	674424,0
6	SHarifboy	48862	464189,0	78179	742700,0
7	Xitoylik	56324	535078,0	84486	802617,0
8	Qilich bobo	60210	571995,0	93931	892344,0
	By region	51326	487597,0	80068	760646,0

In fact, the account books in the Table 3 show that the amount of rent charged based on determining the economic (normative) value of irrigated arable land using contract prices is on average 320,000 soums more than the amount of rent calculated on the basis of state purchase prices. . If we multiply this value by the amount of irrigated arable land of A.Khidirov massif, it is 404.8 mln. amounts to soums, that is, the land rent charged to the state will increase by that much. If we generalize this by district, region, it is a big value.

4 Conclusion

Based on the research conducted, it can be concluded that there is a need to enhance the existing methods of cadastral assessment for irrigated agricultural land. It is advisable to implement soil inspection procedures informed by these improved methodologies, which would facilitate the calculation of normative values for simplified land based on the resulting inspection data. The application of this methodology not only streamlines the calculations involved in the assessment process but also establishes a foundation for achieving objective and accurate results. Furthermore, such improvements are likely to lead to a significant increase in the rental income accrued by the state.

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