Innovative organization and increase of efficiency of agricultural melioration measures of Uzbekistan

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Abstract. Global population growth and the deepening of globalization processes make it necessary to increase the production of food and other material goods for human consumption in proportion and to improve their quality from an environmental point of view. The analysis shows that in world practice, this problem is often solved by extensive factors, mainly by expanding the area under agricultural crops. However, the limited amount of available arable land is estimated at Rs 1,500 mln. hectares. Therefore, it can be said that almost all the reserves of arable land have been used by mankind. Therefore, the development of additional lands and the prevention of the possible ecological crisis, and on this basis the efficient use of arable land, in turn, necessitates the reproduction of natural resources on the basis of innovative solutions and ensuring a balance between human economic activity. The role of land melioration as one of the factors of intensification of agricultural production is high and plays a primary and key role in ensuring the efficiency of the sector.

1 Introduction

Agriculture as a branch of material production differs from all other branches in that land is the main and irreplaceable means of production. Sustainable development of the economy will depend, first of all, on the correct solution of the attitude to land, in particular, on improving soil quality [1-5]. Improving the natural quality of soil is carried out primarily through agrotechnical methods. However, agro-technical methods alone will not be sufficient to take care of the plants and exploit their potential yields [6-8]. Although the soil has the ability to manage its water and air regime, standardize adaptive routes and increase productivity over the long term, it differs from agro-technical methods and, most importantly, serves to create a solid foundation for their economical and efficient use, increasing crop yields. and the application of melioration factors and measures that directly affect the quality of products is an objective necessity [9-13].

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Improving the natural quality of soil is carried out primarily through agrotechnical methods. However, agro-technical methods alone will not be sufficient to take care of the plants and exploit their potential yields [14-16]. Although, as noted above, in this case, the soil can manage its water-air regime, adjust the direction of adaptation and increase productivity over the long term, it differs from agrotechnical methods and, most importantly, is sustainable in its economical and efficient use [17]. It is an objective necessity to apply land melioration factors and measures that serve to create the soil, increase the productivity of agricultural crops and have a direct impact on product quality. It should be noted that the melioration of lands is directly related to natural and climatic conditions and has a direct and indirect impact on the level of use of all major factors. Indeed, whether or not to implement melioration measures on agricultural lands requires taking into account the impact of climatic factors [18-19].

In general, on the basis of the studied scientific-theoretical and methodological-practical developments, the effectiveness of land melioration measures to maintain and increase soil fertility in agriculture, and most importantly to increase crop yields, improve product quality and increase the income of economic entities In our view, the role of the base is primarily bioclimatic potential, phyto-active radiation levels, and photosynthetic processes, which are directly related to each other, and therefore we believe that the relationship between them can be reflected in Figure 1 below.

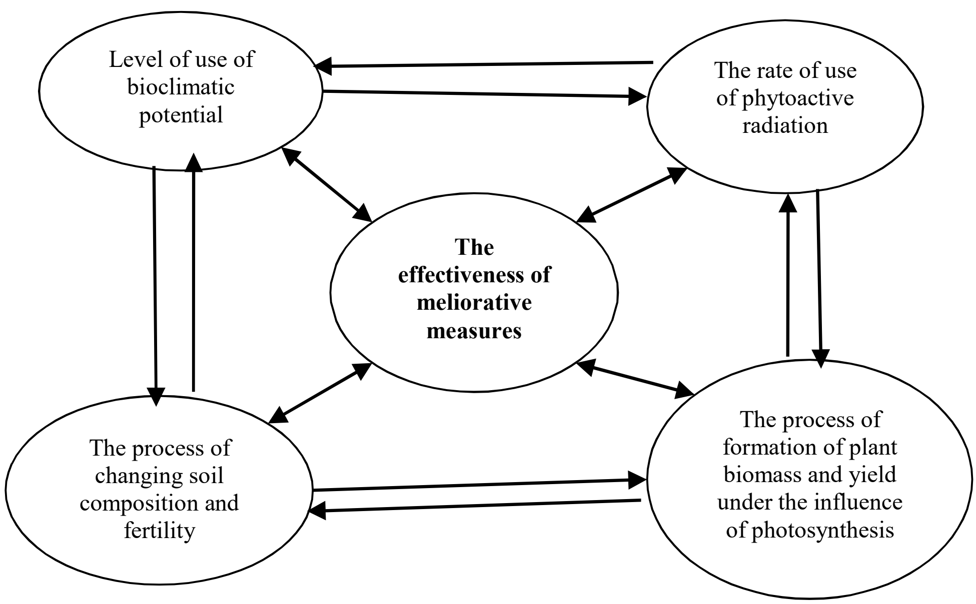

Fig 1. Interrelation and directions of influence between efficiency of amelioration measures in agriculture and natural-climatic factors influencing it.

It is known that one of the main natural factors influencing the melioration condition of lands and the efficiency of their cultivation is water resources. Their level of availability and quality plays an important role not only in the use of arable land but also in increasing the effectiveness of melioration measures. In particular, the fact that the country is located in an arid (irrigated) region and agricultural production is mainly based on irrigated agriculture, further enhances the priority of this factor [20]. Due to the fact that the main object of melioration works is the mechanical composition and properties of the fertile soil,

i.e., the degree of salinity, leaching, and rock mixing in the regions, it is necessary to form a system of melioration measures. Therefore, in practice, in order to prevent a decrease in soil fertility, it is advisable to look for resources to maintain its natural and economic fertility through proper management of nutrients, air, heat, and water factors.
In general, it is expedient to divide the factors that directly affect the melioration of lands into the following groups (Figure 2).

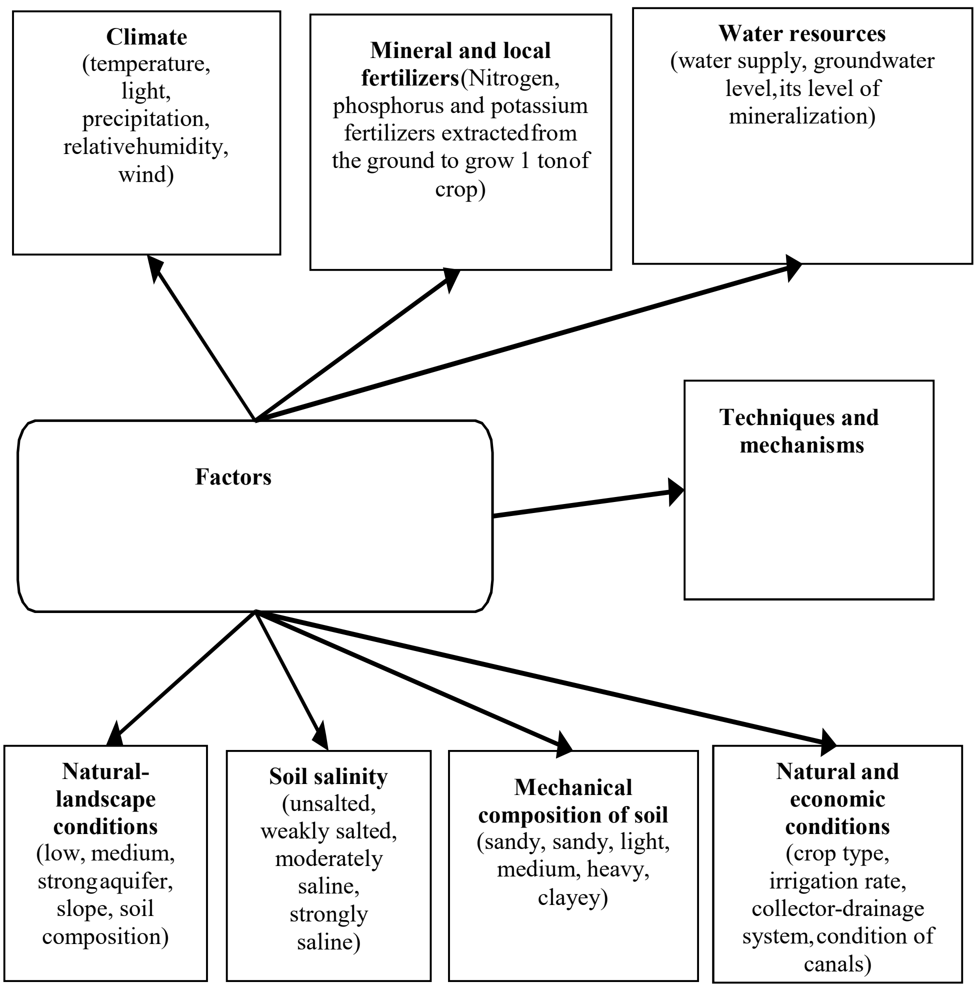

Fig 2. Factors directly affecting the change of land melioration.

Due to the breadth of factors affecting soil fertility and the need for their organic and balanced development, the issue of selection of arable lands for melioration, primarily related to their complex or individual implementation, as well as the nature of specific features makes it difficult to evaluate their application and effectiveness.

2 Materials and methods

There are various opinions, suggestions, and recommendations on the criteria and indicators for determining the economic efficiency of the use of land and water resources, as well as the use of melioration measures to increase soil fertility. In determining the efficiency of land valuation and use, as well as in determining the economic efficiency, it is advisable to take into account methods that allow comparing the quality indicators of a particular plot of land and even field contours. As a criterion for assessing the land, it is advisable to take into account, first of all, its melioration status, which determines its production capacity, in particular, the biological, mechanical, and agrochemical composition of the soil [21].

In order to determine the level of efficiency (Smti) of all melioration measures, our recommendation is, firstly, to subtract melioration costs from the total costs incurred in one cycle of production and secondly, the result obtained on the basis of this type of melioration measures it is expedient to express the effect by means of an indicator calculated as a result of addition.

$$Smti = Ign - Igh + (Samt + Sgmt + Sutm + Skm + Smtm) \quad (1)$$

Smti - economic efficiency indicator of melioration measures, UZS;
Ign - production result (in value terms);
Igh - production costs, UZS;
Samt - economic efficiency indicator of agro-technical melioration measures, UZS;
Sgmt - economic efficiency indicator of hydrotechnical melioration measures, UZS;
Sutm - economic efficiency indicator of forest and technical melioration measures, UZS;
Skm - economic efficiency indicator of chemical melioration measures, UZS;
Smtm - economic efficiency of cultural and technical melioration measures, UZS;

Therefore, it is expedient to express the generalized, ie integrated indicator of economic efficiency from land melioration as follows.

$$Smtium = Ign - Igh + (Samt + Sgmt + Sutm + Skm + Smtm)/Igh + \sum_{i=1}^{n}(T + Mk/Kki) \quad (2)$$

where: *Smtium* - the only generalizing indicator of economic efficiency of melioration measures;
n - the number of melioration measures to be taken; i - types of melioration measures;
T - cost of melioration measures;
Mk - normative coefficient of efficiency of capital investment;
Kki - specific capital investment in the implementation of melioration measures.

It can be said that the complex implementation of melioration measures covers all economic activities in the agroecological system [22]. Such an approach will allow, firstly, to meet the requirements of the laws of development of society and nature, firstly, to provide the population with sustainable agricultural products by increasing the volume of agricultural production, and secondly, to ensure agro-landscape security based on melioration measures.

3 Results and discussion

It is known that any level of salinization of lands causes threefold damage to farms that grow agricultural products. Firstly, it leads to a decrease in crop yields, on the other hand, it reduces product quality, and thirdly, it increases the material and capital costs spent on restoring and increasing soil fertility [23]. For example, in practice, one of the most important melioration measures is the leaching of crop fields. However, the ability to implement these measures in many areas is limited due to the scarcity of water resources. In particular, in 2020, a total of 40 hectares of cotton were planted on the farm "Roman Boshlik" in the Kegeyli district, of which 32 hectares were washed away, i.e., after the implementation of the necessary agro-technical measures and the remaining area due to water shortages. As a result, a total of 65.28 tons of cotton was harvested from 20.4 quintals per hectare of saline-washed area, and 12.88 tons from 16.1 quintals of cotton per hectare of unwashed saline area (Table 1).

Table 1. Economic and ecological efficiency achieved in the fields of the Republic of Karakalpakstan "Roman Boshlik" in the fields of washed and unwashed cotton fields (2020) At the expense of one hectare.

№	Indicators	In the area where the salt is not washed	In the area where the salt is washed	Difference + more - few
1	Productivity, ts/ha	16.1	20.4	+4.3
2	Gross product, tons	1.61	2.04	+0.43
3	All expenses for salt washing,thousand UZS	0	49.2	+49.2
4	Expenses for mechanization and electricity in salt washing, thousand UZS	0	28.3	+28.3
5	wages of workers involved in salt washing (including deductions), thousand UZS	0	20.9	+20.9
6	Cost per hectare, thousand UZS	5727	6179.0	+452
7	Gross product value, thousandUZS	4991.0	6426.0	+1435.0
8	Profit +, loss -, thousand UZS	-736	247	x
9	Profitable, %	-12.8	4.8	x

The economic significance of irrigation land melioration status, in particular, the level of salinity, is that "if 15 percent of the product is lost in poorly saline areas on irrigated land, then this indicator can be used, respectively, up to 40 percent in moderately saline areas, up to 60 percent in strongly saline areas, and up to 70 percent in extremely saline areas". To date, no single method has been developed to determine the number of losses that can be seen in the process of using natural resources and their scale. Therefore, this issue is approached in different ways.

Based on the research, a methodological approach was proposed to determine the extent of the damage seen as a result of the link between land melioration status and productivity, as well as the deterioration of land melioration, taking into account the market price of the cultivated agricultural product. It is desirable to carry out this methodological approach in the following sequence: the result achieved in conditions in which the melioration condition of the territory is good, that is, the received crop is perceived as a base, and the lost product is determined depending on the degree of deterioration of the melioration condition. Of course, in this process, the melioration state of the soils as a criterion of "bad" or "good" can be selected such key indicators as the salinity of the soils, the depth of the underground waters, as well as the degree of their salinity.

Accordingly, the amount of the lost crop, that is, the melioration condition can be determined by subtracting the yield from the average yield obtained from the well-counted crop area by subtracting the yield obtained from the crop area whose meliorative status is poor. The value of this lost gross product can be found on the basis of an increase in the average purchase price of the product or in the prices of the world market. Summarizing this series of notes, it is possible to express the following formula:

$$Q = (Yg\text{-}Yb)^{*}\ \Omega bms\ {}^{*}N1(N2) \quad (3)$$

where, Q – the value of the lost gross yield, thousand UZS;

Yg – melioration status average yield from well-counted crop area, TS/ha;

Yb – average yield from a crop area with poor melioration status, TS/ha;

Ωbms – the area of the crop, whose melioration status is worse, thousand ha

N1 – average purchase price of the product; thousand UZS;
N2 – the average price of cotton poppy in the world market is one thousand US dollars.

In the Republic of Karakalpakstan on the basis of this methodological approach, monographic studies have been carried out in 2007, 79.9 thousand hectares of 114.24 thousand hectares of a cotton field, that is, about 70 percent of them were not saline, while the remaining 34,272 thousand hectares were saline to a different extent, the loss of productivity in lands with product left undelivered. As a result of this, the farmer farms average 4.1 bln. soum, the average price of 1 ton of cotton fiber in the world market is 1500 dollars, while the average in the Republic this year is 5.6 million. It can be considered that a dollar product is left without cultivation (Table 2).

Table 2. The cost of losses as a result of the salinity of cotton fields in the Republic of Karakalpakstan.

Years	Total cotton field,thousand hectares	that:		Average yield in unfertilizedareas, TS/ha	Average yield in saline areas,TS/ha	The difference in the yield offields of salinity and salinity, TS/Ga	The amount of lost harvest,thousand tons	Lost yield value, billion UZS	Lost yield value*, million USdollars
		Total area of undilutedcotton, thousand ha	Total saline cotton field,thousand ha						
2007	114,24	79,95	34,27	22,5	19,2	3,3	11,3	4,1	5,6
2010	94,7	51,13	43,56	21,6	18,4	3,2	13,9	7,1	7,0
2013	94,7	70,07	24,62	23,9	22,4	1,5	3,7	2,6	1,8
2015	94,7	66,29	28,41	25,6	22,1	3,5	9,9	9,3	5,0
2017	94,7	75,76	18,94	26,7	20,4	6,3	11,9	13,3	6,0
2020	92,1	78,28	13,81	24,1	20,4	3,7	5,1	9,2	2,56

Note: the cost of 1 ton of cotton fiber in the world market is estimated to be 1500 US dollars on average.

The introduction of a methodical approach to determining the amount of these damages into practice will in turn improve the land melioration situation and economic incentives based on clear criteria, otherwise, create opportunities for fine measures.

4 Conclusions

In the Republic of Karakalpakstan, where monographic research was conducted on the basis of this methodological approach, in 2007 farms lost an average of 4.1 billion UZS due to the loss of productivity on lands with poor melioration conditions. UZS, and 5.6 mln. UZS per year as fiber. USD, and in 2017 it was 9.2 bln. UZS or 2.56 million UZS as fiber. dollars were not produced. Therefore, in our opinion, in solving the environmental problems of agricultural production of the republic, along with the radical change and implementation of the system of crop rotation, instead of organic (mineral) fertilizers and chemical means of plant protection, organic substances and it is advisable to prioritize measures for wider use of bioresources.

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