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INCREASING LAND USE EFFICIENCY THROUGH IMPROVING AGRICULTURAL SPECIALIZATION

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Qdirbaeva G.U Ingreasing land use efficiency through improving agricultural specialization. Monograph-2025, 104 pages

The monograph examines scientific proposals and practical recommendations for increasing land use efficiency as a result of improving agricultural economics. The monograph is intended primarily for professors, specialists, researchers, and graduate students interested in improving land use efficiency by improving agricultural specialization in the Aral Sea region and compiling cartograms of the dynamics of changes in the land fund of the Aral Sea region over the years, the degree of influence of factors underlying and influencing the processes of land degradation in the region, the current quality state of various types of irrigated soils, salinity and humus supply. intended for students.

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INTRODUCTION

Land degradation is currently affecting people and ecosystems across the planet, contributing to climate change and being a consequence of global change. According to current estimates, by the beginning of the 21st century, approximately 24% of the land area was degraded, directly affecting the well-being of more than 1.5 billion people, and the pressure on ecosystems and land resources is only increasing from year to year. Due to anthropogenic impact, agricultural land degradation has reached 34% (1660 million ha).

Desertification, land degradation, soil erosion and water scarcity are causing tensions and crises in social development. In this context, land degradation can be considered a risk factor, especially in cases where land use is gradually decreasing, which negatively affects food production, water storage or other vital ecosystem services.

The world's agriculture is diverse in content and has great potential for developing the economies of the countries of the region by increasing the productivity and overall efficiency of food, feed and technical crops. In this sense, research and development work is being carried out in priority areas aimed at fulfilling a large-scale task of sustainable intensification of production systems in the region, which is soil-protective and resource-saving. In this regard, special attention is paid to research aimed at developing various approaches and mechanisms for the use of degraded lands widespread in the Aral Sea region, as well as to improving the mechanism for assessing the ecological state of saline lands and organizing their effective use based on research with a specific scientific solution.

THEORETICAL BASIS OF THE EFFICIENT USE OF THE ARAL REGION LAND THROUGH SPECIALIZATION IN AGRICULTURE AND ITS IMPROVEMENT

1.1. Theoretical foundations of effective use and improvement of land and water

As is known, in the current market economy, the rational and effective use of land resources, including irrigated and salt-marsh lands, and their protection are the most urgent issues of the day in our country. Irrigated lands currently remain the main source of agricultural production. However, due to the rapid growth of the population, the use of low-yielding, saline lands of varying degrees of salinity is becoming increasingly important. Therefore, the study of the properties of salt-marsh soils is one of the most urgent tasks of the day.

The annual decrease in irrigation water and the need to pump as much water as possible into the Aral Sea require some changes to the agro-industrial complex in the Republic of Karakalpakstan. As a result of the ecological instability that has been occurring in recent years, the cotton sector is also not producing the expected results. Over the past 10-15 years, its average yield has been 18.0-22.0 centners per hectare. Such yields, naturally, do not justify themselves due to the extremely high cost. In 2017, the President of the Republic of Uzbekistan Sh.M.Mirziyoyev also paid special attention to this issue during his visits to the Republic of Karakalpakstan [1.8].

According to world experts, by the 2030s, Uzbekistan's water deficit could reach 7 billion cubic meters. Being an agrarian country, our republic is one of the countries in Central Asia that consumes the most water. While Kazakhstan uses 33% of its water and Kyrgyzstan uses 50% of its water, the Republic of Uzbekistan uses 169% of its water reserves.

As is known, in the current market economy, land resources in our country, including irrigated agricultural lands, are currently the main source of agricultural production. In the conditions of Karakalpakstan, soil salinization, a shortage of irrigation water, which is accompanied by global climate change, the need to improve agricultural lands and, as a result, rational and effective use of irrigated lands, their protection is the most urgent issue of the day.

The need for specialization in agriculture and the continuity of this process, the arming of labor with a unique and increasingly complex system of techniques and technologies, the formation of specialties and specialists with special knowledge and skills in the effective use of land, and the improvement of their qualifications are necessary. It also requires the implementation of measures aimed at ensuring the effective movement of products from production to the final consumer in the market in modern separate areas, the implementation of measures aimed at introducing the results achieved by world science and practice in the field of advertising and offering products to the market.

In recent years, the increasing influence of the anthropogenic factor has led to a radical change in nature and the environment, and such negative processes reached their peak at the end of the 20th and beginning of the 21st centuries. This situation is reflected in the current ecological instability in certain regions of the world, as S.A. Avezbaev.[2.10, 158 b], A. Babazhanov.[2.16; 625-633 b]., and others have also recognized in due time. The Republic of Karakalpakstan and the Khorezm region, which are considered the northern regions of our country, are experiencing such a crisis today.

When we studied the distribution of agricultural land in the Republic of Karakalpakstan by main land types from 2014 to 2023, there were no changes in the total land area of the Republic. Of this, the area of arable land or the area of land that is irrigated and cultivated annually changed from 418,864 hectares to 420,460 hectares, i.e. an increase of 1,596 hectares.

The area of perennial irrigated forests was 8,876 hectares, but by 2023 it had decreased to 7,961 hectares, a decrease of 915 hectares. The main reason for this is that perennial forests have decreased by 915 hectares in 10 years due to lack of water and aging and death.

Due to the activities of land users, agroclusters and other land users and the re-use of land through reclamation, the area of brownfields in the Republic increased from 10,186 hectares in 2014 to 14,211 hectares in 2023, 10 years later, an increase of 4,025 hectares. The area of existing hayfields and pastures in our Republic was 5,275,172 hectares, but by 2023 it had decreased to 5,265,348 hectares, or 9,824 hectares. The main reason for this is the lack of water in hayfields and pastures, the lack of natural moisture in the soil, the lack of water, and the destruction of hayfields and pastures due to irregular grazing of livestock, which decreased by 915 hectares over 10 years.

The total area of agricultural land in our republic was 5,712,898 hectares in 2014, and by 2023 it will decrease to 5,707,980 hectares, and the area will decrease by 4,918 hectares.

The Republic of Karakalpakstan alone accounts for 37.0 percent of the country's single land fund, 48.5 percent of natural forage areas, and 20.0 percent of irrigated arable land. All this data indicates that there are great opportunities for the future development of agricultural production in the region. However, the large volume of water from the Amu Darya for irrigation in its upper and middle reaches is an obstacle to the rapid development of the economic sectors of the Republic of Karakalpakstan, including agriculture. As a result of ecological instability in the region, large areas of irrigated arable land have become secondary salinized, which has led to a fundamental deterioration in the land reclamation situation and a sharp decrease in agricultural crop yields. The official data obtained show that over the past 20-25 years, cotton yield in the region has decreased from 28.0 to 18.0 tons per hectare, wheat yield from 41.0 to 34.0 tons, rice yield from 52.0 to 38.4 tons, and vegetable yield from 52.0 to 38.4 tons. Despite the large number of improved horizontal collector-drainage networks, as well as the availability of sufficient agricultural machinery and labor resources, and other necessary opportunities, the fact that cotton yields decreased from 34.0 to 26.2 tons per hectare in the Republic of Karakalpakstan and Khorezm region, which are part of the Aral Sea region, from 56.0 to 38.4 tons per hectare, and vegetable and melon yields from 146.0 to 122.0 tons per hectare (6) once again confirms our opinion.

The area of other lands in the republic was 10,946,197 hectares in 2014, and by 2023 it reached 10,951,115 hectares, that is, it increased by 4,918 hectares. We can see the changes in the main types of agricultural land in the Republic of Karakalpakstan over the 10 years starting from 2014, that is, in 2023, in Table 1.1.1.

Based on the data obtained, it can be concluded that, taking into account the pace of farming in our republic, the amount of harvested crops, the preservation of land in the land use system, the amount of water limit allocated annually, and water shortages, it is necessary to expand the areas of crops that require less water - sesame, millet, mung beans, beans, alfalfa, spring wheat and sorghum - in addition to the main crops in the republic.

1.1.1- table

Distribution of agricultural land areas of the Republic of Karakalpakstan by main land types

№	Main land types	2014 y		2023 y		change, ± A thousand
		A thousand	%	A thousand	%	
1	Total land area of the republic	16659095	100	16659095	100	00
2	Cropland, total of which: irrigated	418864	2,5	420460	2,5	+1 596
3	Perennial tree lantations total: irrigated	8876	0,05	7961	0,05	-915
4	Gray areas	10186	0,08	14211	0,09	+4 025
5	Hayfields and pastures	5275172	31,7	5265348	31,6	-9 824
6	Total agricultural land types	5712898	34,4	5707980	34,3	-4 918
7	Other places	10 946 197	65,6	10 951 115	65,7	+4 918

** The table is based on data from the Cadastral Agency of the Republic of Karakalpakstan.*

As a result of improving agricultural specialization, more efficient land use requires the establishment of economic relations related to the procurement of material and technical resources, which are specific to farms producing commodity products and perform specific tasks.

The works of researchers S.A. Avezbaev and S.N. Volkov present the issues of organizing the effective use of land resources on the basis of scientifically based land management projects. The main principles of organizing the rational use of land in areas with a deteriorated ecological situation are identified. The role of land management in organizing the rational use of land and creating artificial (anthropogenic) ecological systems is shown.

In the textbook "Economics of Land Management" by S. Avezbaev and S.N. Volkov, it is stated that the optimal area of land allocated for the organization of new agricultural enterprises and the reorganization of existing ones is of great importance. Practice shows that the determination of optimal areas is based on the requirements for rational organization and management of the economy, without which it is impossible to properly organize production and territory.

The socio-economic significance of land is manifested in its use for certain economic or collective purposes; ownership and use of land are among the objective conditions of the activity of society. Methods of economic management, forms of ownership, the procedure for using and owning land are constantly changing. The most noticeable changes occur during a radical reform of production methods and social relations.

According to A.S. Altiev, the aim is to identify and reveal the essence of the existing problems of land use diversification in order to meet the needs of society and the economy in land resources, to substantiate approaches aimed at ensuring the full and efficient use of land through the distribution and redistribution of land resources.

A. Babazhanov's article "The Importance of Inventorying Cropland in Returning It to Agricultural Turnover" presents the role of inventorying cropland in returning it to agriculture and restoring it, as well as the work being carried out in our republic to date and the existing experience of developed foreign countries.

In the scientific research work of A.B. Mambetnazarov, a microhydromodule zoning was developed based on the area of crops and water distribution of farms in irrigated lands belonging to a specific melioration region, changes in the level of seepage water, and the rate of moisture rise through soil tubes. The mechanism of groundwater use through the root system, depending on the mechanical composition of the soil, its morphological structure by genetic layers, the size of macro- and microaggregates, the salinity-irrigation-nutrient regime, and the biological properties of cotton varieties, was determined. An optimal irrigation regime for medium-fiber cotton varieties "Chimboy-5018" and "Dostlik-2" was developed and introduced on a total area of 19.1 thousand hectares in the Tortkul, Chimboy, Takhtkopir and Karaozak districts of the Republic of Karakalpakstan.

S. Sherimbetov studied the molecular-biological and ecological characteristics of plants in the Aral Sea drylands, and found that 220 higher plant species (130 of them for the first time) grow in the South Aral Sea region and proved that the plants of this region appeared in the background of the Irano-Turonian flora.

Z.A. Bakhodirov, Sh.M. Bobomurodov, G.T. Parpiyev, N.Yu. Abdurakhmonov s desertification processes also affected the mineralization of groundwater, and the mineralization of groundwater in the Aral Sea region changed from 80-100 mg/l to 200-300 mg/l, increasing from the southern regions to the northern Aral Sea. Transformation processes in soils are a very complex process, in which all the signs formed in one soil change over time, as a result of which they occur gradually. Transformation processes in soils are explained as changes in soil formation factors and conditions (including climate warming, water shortage, etc.). As a result of a sharp decrease in groundwater in the regions, hydromorphic and semi-hydromorphic soils are converted into automorphic and semi-automorphic soils. In order to prevent desertification, it is necessary to increase the number of plants suitable for the climate of the region (Kandym, Circassian, Turangi, Saxaul), to organize mulberry and jade forests around each irrigated area, and to apply other forest reclamation measures.

In order to ensure the implementation of the Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2019 "On approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030", to increase the production of high value-added products in the fruit and vegetable and viticulture sectors, to increase exports, to develop unused and fallow lands, to increase the planting of export-oriented agricultural crops on areas reduced from cotton and grain, as well as to establish effective use of the potential of gardens, vineyards and greenhouses, in accordance with the Resolution of the President of the Republic of Uzbekistan No. PQ-4239 dated March 14, 2019 "On measures to develop agricultural cooperation in the fruit and vegetable sector", a total of 41 agricultural cooperatives were established in 8 districts of Jizzakh, Samarkand, Tashkent and Fergana regions. Agricultural associations for fruit and vegetable growing have been established.

The maintenance of buildings and structures of scientific centers, as well as the financing of staff salaries, is carried out at the expense of the cotton-textile clusters, within which scientific centers are organized;

Land and water resources are the primary factor in the location of agricultural production enterprises, especially the farming sector. In areas rich in water resources, crops such as rice, cotton, and vegetables, which require a lot of water, are grown. This is the case in some parts of Central Asia, half of Southeast Asia, Natural conditions and agro-climatic resources have a strong impact on the location of not only farming, but also livestock farming. The cultivation of fodder crops for livestock and their provision with pastures, the system of feeding purebred and productive livestock, livestock complexes and farms, and their values \u200b\u200bdepend on natural conditions.

1.2. Analysis of foreign sources on the regulation of agricultural specialization.

The main directions, goals and results of land inventory work in the United States of America, as well as information on the organizations responsible for this work, are presented, and specific proposals are made on the use of the experience gained in this work in our republic.

The level of support for agriculture in developed countries is several times higher than in developing countries. For example, the amount of subsidies and compensations allocated, taking into account the inflation rate and the selling prices of agricultural products, is 82% of the investment in the USA, 75% in Norway, 74% in Japan, and 44% in Austria. A similar situation can be seen in other developed countries. In addition, developed countries are distinguished by high import duties to protect their food markets. These are the import duties imposed on agricultural products, which average 18.8 percent in developing countries, 40.6 percent in China, 13.4 percent in countries with economies in transition, 10.5 percent in Russia, and an average of 43.3 percent in economically highly developed countries.[1]

The article by Khalina Khreshchuk, “Efficiency of land management provision of sustainable land use of agricultural land”, is devoted to the substantiation of theoretical and methodological approaches to assessing efficiency. According to the integral indicator, four groups of clusters are formed according to the efficiency of land resource provision: the first group - the most efficient management; the second group - the efficiency level above the average; the third group - the efficiency level below the average; the fourth group - ineffective management.

When characterizing the quality of the main agricultural land types, special attention is paid to the salinity levels of the soils. Depending on the degree of salinity, soils are divided into the following: unsaline or washed, low, medium and

[1] Иззатов Қ.И. Совершенствование системы государственной поддержки сельского хозяйства в условия рынка. Автореферат. Диссертация к.э.н. Душанбе, 2016 г. Ст 7.

high salinity. In addition, when characterizing the quality of the lands, it is necessary to pay attention to the susceptibility of the soils to water and wind erosion. The levels of salinity and erosion of the soils are determined in the field and supplemented according to the results of laboratory analyses..

Sufficient soil phosphorus (P) is important for achieving optimal productivity, but excessive phosphorus levels in the soil can lead to phosphorus loss and the associated risk of eutrophication of surface waters. The Olsen-P critical soil level for crop productivity was determined using the linear plateau model.

The United States ranks first in the world in terms of agricultural efficiency, with only 2 percent of the country's workforce employed in this sector. Agriculture in the United States uses many innovative solutions that allow farmers to produce more products at a lower cost. For example, specialization according to soil and climatic conditions, the use of genetically modified seeds and direct sowing reduce farmers' costs for the use of machinery, fuel and pesticides.

In the Netherlands, only 2% of the country's employed population works in agriculture. In Israel, less than 20% of the land is suitable for agriculture, but farmers provide 95% of the population's food needs. In Israel, taking into account the acute shortage of irrigation water, drip irrigation technology has been developed. At the same time,. The main components of the smart farming approach are software, irrigation systems, innovative harvesting equipment, which are cheaper due to the subsidy system. Thanks to this approach, a high rate of introduction of new technologies into the agro-industrial complex has been maintained, thanks to close cooperation between the state, private and scientific sectors. The phenomenon of Israeli agriculture is that the low natural potential is compensated by the high intensity and efficiency of the introduction of new technologies. Qishloq xo‘jaligida an’anaviy yondoshuvlar deyarli qo‘llanilmaydi, innovasiyalarning yuqori darajasi minimal resurs harajatlari bilan sohaning maksimal mahsuldorligiga erishishga yordam beradi.

High-tech development in agriculture in the Republic of Korea. In the Republic of Korea, the experience of agricultural development has been found to be low, and in developing countries, it is possible to use the innovation in shaping the agrarian system to ensure food security. In 2018, the Ministry of Agriculture of the Republic of Korea announced that it intends to increase the amount of land allocated for the development of "digital" farms across the country from the current 4.01 hectares to 7 thousand hectares.

In Taiwan, the government has invested up to $100 million over the past 5-10 years to develop and implement innovations, including the creation of research centers, the development of software and mobile applications, and a large-scale training program for farmers. To eliminate as many middlemen as possible and increase the profitability of farmers, processors, and retail chains, the government has ordered the creation of Internet portals where farmers can maintain their own pages and thus promote themselves in the market.

Argentina is implementing a state-level system for monitoring crop conditions, monitoring soil conditions, collecting and analyzing data. Satellite data is constantly being acquired, analytical data is obtained from weather stations, enterprises, research centers, laboratories located on a common Internet portal, and they serve as a service for farmers to obtain data in their fields.

India is focusing on improving farmer knowledge, in particular, on the introduction of Agri Value Added Services mobile applications that provide farmers with information about the weather, product prices, the best technologies for growing crops, and more. Agricultural innovation and research centers have been established in each region.

Labor productivity in agriculture in Russia is currently three times lower than in Germany, and wages are 2.5-3 times lower than in Germany and the United States. The main aspects of the use of digital technologies in agriculture in Russia are increasing agricultural productivity and reducing losses, with little attention paid to overall labor productivity. Improving the use of water resources in transboundary rivers requires close cooperation between neighboring countries. Therefore, cooperation and integration between neighboring riparian countries play an important role in ensuring sustainable management of water resources for future generations (FAO, 2012). Integration of water use at the regional level and in transboundary river basins requires coordinated relations between basin countries. Close cooperation is needed in all areas of water resources management and protection (Global Water Partnership, 2005; 2006; 2014). The total average annual flow of all rivers into the Aral Sea basin is 115.6 km3. This volume includes 78.46 km3. The Amu Darya drainage is 37.14 km3 and the Syr Darya flow, according to the probability distribution of the flow at 5% (wet year) and 95% (dry year), the annual flow for the Amu Darya varies from 109.9 to 58.6 km3 and for the Syr Darya from 51.1 to 23.6 km3, respectively (Table 1.2.1, Table 1.2.2, Figure 1.2.1).

1.2.1. table

Surface water resources of the Aral Sea basin. Average annual flow, km3/year.

Country	River basin		Total by pool	
	Syr Darya	Amuda ryo	km 3	%
Kazakhstan	4.5	-	4.5	3.89
Kyrgyzstan	27.4	1.9	29.3	25.3 5
Tajikistan	1.1	62.9	64,0	55.36
Turkmenistan (with Iran)	-	2.78	2.78	2.4
Uzbekistan	4.14	4.7	8.84	7.65
Afghanistan	-	6.18	6.18	5.35
Pool total	37.14	78.46	115.6	100

1.2.2. table

. Interstate water distribution in the Aral Sea basin (Aral Sea Basin Issues 2018)

Country	Amudaryo		Sirdaryo		Jami	
	km3	%	km3	%	km3	%
Kazakhstan	-	-	15.29	31	15.29	11.44
Kyrgyzstan	0,42	0,5	4.88	9.89	5.3	3.97
Tajikistan	10.63	12 607	3.66	7.42	14.29	10.69
Turkmenistan (with Iran)	27.07	32.1	-	-	27.07	20.26
Uzbekistan	46.2	54.79	25.49	51.68	71.69	53.64
Total:	84.32	100	49.32	100	133.64	100

Currently, the most important task of the Central Asian region is to solve the problem of maintaining the current level of the Aral Sea. Scientists offer various options for solving this problem. According to scientists, the widespread use of water-saving irrigation and micro-irrigation technologies allows saving irrigation water and contributing to a partial solution to the Aral Sea problem. Thus, the introduction of water-saving technologies and irrigation equipment is an important condition for saving water. Therefore, first of all, it is necessary to gradually transition to the use of water-saving irrigation technologies in farmers' and peasant farms, attracting foreign investors.

Currently, the use of digital technologies in almost all areas of human activity is growing rapidly on a global scale. In recent years, a number of presidential decrees and resolutions have been adopted in the field of developing the digital economy.

ANALYSIS OF THE GENERAL DESCRIPTION OF THE NATURAL CONDITIONS OF THE ARAL RIVER REGION.

2.1. Geographic location of the research site.

The total area of the Republic of Karakalpakstan is 166.6 thousand square kilometers, which ranks first among the territorial units of the Republic of Uzbekistan in terms of area. The total area is

16,659,095 hectares, including irrigated pastures and groves - 5,265,348 hectares.

The Aral Sea and the Aral Sea basin are administratively located on the territory of Uzbekistan (Karakalpakstan) and Kazakhstan. More than half of the Aral Sea belongs to the territory of Uzbekistan.

The Aral Sea includes the Amu Darya tributary, which is more than 500 km long, in the Caspian lowland. The Republic of Karakalpakstan is geographically located between 40° 58S - 45° 39S north latitude and 56° 00S - 62° 33S east longitude.

It borders the Republic of Kazakhstan to the north and northeast, Turkmenistan to the south, and Bukhara and Khorezm regions to the east and southeast. It is surrounded by Kyzylkum to the east and Karakum to the southwest. Its area extends from north to south for 420 km and from east to west for 550 km. According to N.V. Kimberg, it covers an area of 167 thousand km2.

The arable land area in the Republic of Karakalpakstan is about 2 million hectares, of which 500 thousand hectares are currently irrigated. Due to the decline in the Aral Sea level, about 0.7 million hectares of land have been opened up for cultivation in these areas.

2.2. Soil formation and development conditions

The Republic of Karakalpakstan is located in the northwestern part of Uzbekistan, bordering the Republic of Kazakhstan to the north, northwest and west, Navoi region to the east, Bukhara region to the southeast, Khorezm region to the south and the Republic of Turkmenistan to the southwest. The Republic of

Karakalpakstan is located on the foothills of the Amu Darya River and the southern coast of the Aral Sea, adjacent to the large Karakum and Kyzylkum sands. The territory of the Republic of Karakalpakstan occupies the northwestern part of the Kyzylkum desert, the southeastern part of the Ustyurt plateau, the Amu Darya River delta, and the southern part of the Aral Sea. The ridge sloping towards the Aral Sea consists of vast flat plains covered with dune sand dunes.

The climate and natural conditions of the Republic of Karakalpakstan, as well as the processes of soil formation, are unique. The climate is sharply variable. Sharp changes in climate and low humidity lead to high evaporation. The wind blows more often in the northeast direction throughout the year. Strong winds carry soils and salt marshes from the Amu Darya River basin, high temperatures, low humus content, soil salinity and carbonation levels negatively affect the productivity of agricultural crops. Depending on the wind speed, the Republic of Karakalpakstan is divided into four regions: weak wind (5 m/s), partially active wind (5-10 m/s), active wind (10-15 m/s), and very active wind (above 15 m/s). The Republic of Karakalpakstan is located in a partially active region, with an average annual wind speed of 5.2 m/s. Soil fertility is declining due to the rapid development of the Aral Sea desertification process and the sharp increase in climate.

Relative humidity is one of the climatic elements and depends mainly on local conditions, including the number and order of irrigation, the condition of collector-drainage systems, lakes, swamps, water surfaces, irrigated fields, the location of groundwater and other factors. In the lower reaches of the Amu Darya, the highest relative humidity is observed in the daytime in the winter months (December-January), when it is maintained at 74-79%. In the summer months, it decreases to 46-51%. The relative humidity of the air in the summer is 22-28% at 1300.

The predominantly flat structure of the territory allows for intensive formation of wind activity. In the spring-autumn months, the wind speed reaches

10-15 m/sec. Winds from the north and northeast directions prevail. The most frequent strong winds occur in March-May. The maximum number of dusty days in the Republic of Karakalpakstan is 37 days in Jaslyk, 94 days in Muyinok, and 28 days in Nukus. The maximum number of thunderstorm days is 35 days in Jaslyk, 26 days in Muyinok, and 27 days in Nukus. The maximum number of foggy days is 52 days in Jaslyk, 51 days in Muyinok, and 30 days in Nukus. During periods of dust-salt storms, strong winds bring a large amount of salt and sand from the dried-up bottom of the sea to the oasis area (irrigated areas), further exacerbating the ecological situation.

Currently, there is a tendency for desertification processes to increase in the Republic of Karakalpakstan, especially in the delta of the Amu Darya and the Aral Sea regions. The continentality of the climate is increasing, and the frequency of strong winds is increasing, and soil fertility is deteriorating. As a result, the productivity of natural pastures and agricultural crops is decreasing. The prevailing direction of spring winds in this region is considered to be the northern and northeastern directions, which negatively affects spring field work, and the germination of planted seeds is at risk. In order to obtain stable and stable yields from agricultural crops, it is necessary to develop and implement measures to combat defoliation processes. Thus, the natural conditions of the described area are unfavorable for both soil formation processes and agricultural production.

2.3. Geomorphology, soil-forming rocks and groundwater

The relief and soil-forming parent rocks of the Republic of Karakalpakstan are extremely complex, and the variety of lithological and geomorphological conditions of its soils affects its reclamation status and soil quality indicators. The territory of the Republic of Karakalpakstan consists of the Ustyurt Plateau, the plain between the Karakum and Kyzylkum deserts, relatively low-lying lands from a geomorphological point of view, located in the ancient and modern deltas of the Amu Darya. According to its geological structure, 4 types are distinguished in the region: ancient crystalline rocks, Cretaceous-limestone deposits, Tertiary and late

Quaternary deposits. Sandstones with a height of 2-3 to 6 meters, gray-gray and reddish low-high and shale-like sands are found throughout the territory.

The ancient and modern delta areas of the Amu Darya consist mainly of a flat surface with a very slight slope (0.0001-0.0002°), relatively uniform flat lands, uplift strips lying along the currently active and defunct riverbeds, and inter-river lowlands, which have led to a general flat appearance with a number of complex relief features. The height of the "walls" (uplifts) along the riverbeds, depending on the size of the riverbeds and their location in the delta area, is 4-6 meters in the upper part of the delta and 1-2 meters in the lower part.

In the history of its formation, the Amu Darya has formed several independent deltas, including the South Khorezm, Akchadarya, Sarikamysh and Aral Sea deltas. The Aral Sea delta is an alluvial plain formed by conditional river deposits, which is clearly separated from the Ustyurt plateau in the west and the Karakum and Kyzylkum geomorphological regions in the south and east. The alluvial plain area includes the northern part of the Amu Darya Aral Sea delta, vast areas within the non-irrigated and undeveloped areas. Over time and with the changing hydrogeological regime of the Amu Darya, the boundaries of the delta and the location of the lakes in the delta have changed. The formation of the relief and geomorphological structure of the lower reaches of the Amu Darya is primarily associated with the activity of the river of this name. The deposits formed in the Amu Darya delta vary in both age and lithological structure, and deposits of three different ages can be distinguished in this area: the youngest, current deposits associated with the activity of the ancient Daudan River. Irrigation of the soils of the ancient and modern deltas of the Amu Darya with turbid waters for many centuries had a great influence on the processes of soil formation, agroirrigation horizons of different thickness and mechanical composition (lithological structure) were formed on the soil surface, as a result of which the thickness of the humus layer increased, nutrient elements were evenly distributed, and differentiation occurred in the mechanical, petrographic, mineralogical and general chemical composition of the soils. The current (modern) valley of the Amu Darya, which is considered the youngest of alluvial deposits, stretches from several meters to 8-10 km. along the left bank of the Amu Darya. They are mainly composed of light (sand, loam, sometimes loam-sandy) mechanical composition, sometimes covered with light, medium and, rarely, small layers of heavy loams. Here, it is possible to conditionally distinguish between terraces of lowland lands that are frequently flooded (with strong wetting) and terraces above the lowland, which are used for irrigated agriculture (especially rice and melon crops).

The relief and soil-forming rocks of the Republic of Karakalpakstan are extremely complex and diverse, determining the main, main characteristics of soil covers. This indicates the deltaic structure of the territory. The deltaic structure of the territory and low elevations have caused poor drainage. The specific features of lithological and geomorphological conditions lead to sharp differences in the land-reclamation state of the soil, their agro-production indicators and quality assessment. In this regard, the best soils are considered to be highland areas, average soils are considered to be medium-altitude, and poor soils are considered to be lowland-basin soils. In this sequence, the salinity of soils, water physical and technological properties change from negative to negative.

The complex geological and geomorphological structure of the territory of Karakalpakstan has created extremely diverse hydrogeological conditions. In areas of different age and geomorphological structure, groundwater has different sources of nutrition, depth of occurrence and salinity chemistry, as well as salinity levels. The change in the hydrogeological regime of the Amu Darya delta and the Aral Sea is completely and integrally associated with the flows of two rivers - the Amu Darya and the Syr Darya. Atmospheric precipitation does not play a practical role in the formation of underground and surface flows in this region. Only in recent years, during the development of new lands, especially in large areas, have cases of irrigation water returning to collectors been observed. By their quality, these waters are perfectly suitable for irrigating (filling) pastures and delta lakes, however, experience with the use of collector waters shows that in years of water scarcity, due to their increased mineralization (up to 6-8 g/l), these waters are unsuitable for flooding lakes. Long-term use of collector waters causes salinization of soils and waters, which leads to a loss of productivity of such water bodies (artificial ponds).

From the point of view of the influence of the hydrogeological conditions of the Amu Darya delta, including the irrigated lands of Karakalpakstan, on the processes of soil formation, transformation and evolution of soil covers, and salinization, a systematic and planned study of the hydrogeological conditions of the region dates back to the beginning of the 20th century, the studies were mainly related to the implementation of design work on irrigation structures in the lower reaches of the Amu Darya. According to the analysis of many years of data, in recent years, the quality of the Amu Darya water has been deteriorating. The main reason for this is the discharge of large amounts of collector waters into the river, and on the other hand, the river's own water supply is sharply decreasing. The first factor, namely the discharge of collector waters into the river, is the main reason for the increase in the mineralization of the Amu Darya water. The second factor is the reduction in the inflow of river waters into the region, that is, its significant decrease in recent years. As a result, the mineralization of the Amu Darya water is increasing both in time and along the entire length of the river.

The maximum high level of mineralization of river water falls on the period of transition of the river from groundwater to recharge - March, April.

In certain periods, its mineralization level reaches

2000-2400 mg / l. In recent years, due to the decrease in the inflow of the river flow into the delta, a reduction in the area of \u200b\u200bwater basins has been observed. At the same time, basins have appeared in the areas of irrigated areas that accumulate large volumes of collector-sewage water.

The main part of the return waters formed in the territory of irrigated lands is discharged into the delta's inland and coastal lakes, currently these wastewaters do not reach the Aral Sea, but are absorbed in lowlands and swamps. Of the total volume of collector waters formed in the irrigated areas of the Republic of Karakalpakstan, 70-73% of the waters fall on the lands of the northern region, that is, they are formed from the system of Suenli and Kyzketgan canals.

The Amu Darya delta, like other dry regions of the desert region, is a natural salt accumulation area, river waters are considered the main sources of salts.

The formation and regime of groundwater in the described area are determined by the lithological and geomorphological characteristics of the area, climate and surface water regimes. Due to the very weak slope of the area, the high dustiness of the soil, its sharp stratification, and the fact that they form a certain "layered screen", the general groundwater flow is extremely difficult, rising close to the surface, and the speed of groundwater flow is several tens of centimeters per year.

The generally known rules on the relationship of the relief with lithological and hydrogeological conditions in the Amu Darya delta are that the soils in the elevated elements of the relief (basin banks) have relatively good water permeability due to their light mechanical composition, and the flow of groundwater is ensured to a certain extent. In the lowlands (interbasin lowlands), soils with a sharply layered structure dominated by clay layers have poor water permeability and are characterized by the lack of local flow of groundwater. According to the dynamics of groundwater level fluctuations, 3 main regimes of groundwater are established in the Amu Darya delta: hydrogeological, irrigation and climatic-irrigation. Atmospheric precipitation is a secondary factor in the formation of groundwater, its amount in the oasis does not exceed 80-100 mm. The main sources of groundwater are rivers and irrigation water.

The type of hydrogeological regime of groundwater is distributed in a narrow strip along the current bed of the Amu Darya. The lower sandy, layers consist of clean fine and medium-grained sands and create favorable conditions for underground flows. The majority of areas are covered with not very thick (1.0-1.5

m.) loam and sandy loam layers, and the layer of agroirrigation deposits is up to 0.8 m. The main source of groundwater recharge is filtered water from the Amu Darya. The groundwater regime in the current valley of the Amu Darya is clearly observed at a distance of 1.5-2.0 km from water sources. The highest groundwater level in the region falls on the summer months (July-August), when the Amu Darya water level is at its maximum. In some years, high groundwater levels are observed in winter (January-February), which is associated with a rise in the water level in the river due to ice jamming in the river.

2.4 Description of the main soils common in irrigated areas

The specific natural conditions of the Republic of Karakalpakstan: relief, geomorphological and lithological structure (Kyzylkum, Ustyurt, Supatog relic plateau, Sultan Uvays lowlands, foothill plains, Quaternary marine deposits), hydrogeological and soil-climatic conditions, genesis of soil-forming rocks, plant world (cover) and human and economic activity have formed various types of soil cover specific to this region.

The territory of the Republic of Karakalpakstan includes the very ancient, ancient and relatively young modern delta of the Amu Darya River, as well as part of the Kyzylkum, the Ustyurt plateau and the Aral Sea. The great diversity of natural and geomorphological conditions in these areas is due to the fact that, along with typical desert automorphic soils, hydromorphic - amintakal soils are also widely developed. Among them, one can distinguish brown, sandy desert, barren soils and barren, residual-hydromorphic, meadow and swamp-meadow soils, as well as continental and coastal saline soils.

All alluvial layers are characterized by frequent and sharp changes in their mechanical composition. The hydrogeological and melioration conditions of the described area are extremely unfavorable, which is due to the extreme difficulty of the general groundwater flow, which is facilitated by the weak slope (slope) of the delta, the composition of soil-forming rocks, high dustiness of particles and the complex structure of the soil-soil layer, which is characterized by the absence of a well-drained layer. Therefore, the depth and regime of groundwater here are determined by the ratio of their inflow and outflow. Soils used in irrigated agriculture are located within the alluvial-delta plains. As a result of genetic evolutionary changes, the following irrigated soils have been formed in the irrigated region of the Republic of Karakalpakstan: meadow-barren, barren-meadow and meadow soils. In very rare cases, swamp-meadow soils are found in small areas.

Irrigated meadow-barren soils developed under conditions of weak moisture supply by seepage waters. They are distributed in the form of small areas among the remaining protected lands and serve as a “dry ditch” that holds seepage waters at a depth of 3-5 m in irrigated areas. The recent development and weak influence of agricultural culture determine that their soil profile is close to the protected state. The arable layer is 25-30 cm. thick, and according to its mechanical composition it is more common in heavy, medium and light loamy. Beneath it is a brownish-gray or dark-gray humus layer up to 40-45 cm. thick. The lower layers consist of a complex of alternating clay, loam, sandy loam and sandy layers. In this, the remains of reed roots and signs of hydromorphism in the recent past are observed - rusty and bluish-green gardens. The humus content in the arable layer of meadow-barren soils is 0.9-1.0%, nitrogen - 0.04-0.05%, depending on the lower layers, humus decreases to 0.5-0.7%. Carbonates are 7.0-8.0%, gypsum - 0.1-0.8%, in some strongly saline horizons up to 1.5-4.6%. Soils are mainly moderately and strongly saline.

Irrigated barren-meadow soils, which in ancient times underwent the process of desertification, are distributed in small areas on the ancient surface of the Amu Darya delta in the remote parts of the oases of the Kungirat, Chimboy, Takhtkopir and Qonlikul districts. Groundwater fluctuates within 2-3 m., creating a semi-hydromorphic water regime of soil moisture in the soil. Barren soils previously passed the hydromorphic stage during evolutionary development, and residual signs of hydromorphism are still preserved in them, and this process is currently developing rapidly. Oxidation-reduction processes are activated in the lower part of the section.

The soils are distinguished by their stratification and mechanical composition, ranging from heavy loams and clays to sandy loams.

The arable layer, consisting of a layer of 27-30 cm, consists of heavy and medium loams, and rarely light loams and sandy loams. In soils with a heavy loamy mechanical composition, an 8-15 cm thick compacted sub-soil horizon is formed. This is not observed in light soils. In the lower part of the section, rusty-brown spots of ancient and growing hydromorphism are found. Humus in barren-meadow soils increases from light loams (0.4-0.6%) to heavy loams (up to 0.7-1.0%). Towards the lower horizons, it decreases to 0.2-0.4%. The total nitrogen in these soils is 0.03-0.07%, and carbonates (SO2) fluctuate between 6.6 - 8.1%. The soils are weakly and moderately saline.

Irrigated meadow alluvial soils are widespread in all districts of the Republic of Karakalpakstan. By their origin, meadow soils have a long history, and in some parts of the territory they were formed in recent decades as a result of the re-formation of barren and barren-meadow soils. Groundwater is located at a depth of 1.0-2.5 m. Their highest level corresponds to the period of salt leaching and vegetative irrigation. The high level of mineralized groundwater creates conditions for the development of secondary salinization of soils. The optimal melioration state of this type of soil should be maintained using a well-functioning collector-drainage system.

Irrigated meadow soils are one of the most common soils in the irrigated land fund of the republic. In the morphological section of these soils, a 28-32 cm. plow layer is distinguished. According to their mechanical composition, they are found in various forms - from heavy loams to sandy loams. The subsoil layer is formed only on old irrigated lands, sometimes on newly irrigated meadow soils with a heavy mechanical composition.

2.5. Reclamation status of irrigated soils distributed in the districts of the Republic of Karakalpakstan

Various soils are distributed in the Republic of Karakalpakstan, and their specific conditions of formation were reviewed above. Irrigated soils in all 15 districts of the Republic of Karakalpakstan are saline to varying degrees, and even in some districts, all irrigated soils are completely saline (Table 2.5.1).

2.5.1- table

Salinity status and description of irrigated soils of the Republic of Karakalpakstan

№	Name of districts	Irrigated land area, to.	Saline lands		Including medium, strong, and very strong salt		
					Relative to total irrigated area		Relative to total saline areas
			to.	%	to	%	%
1	Amu Darya	33979,0	27739,0	81,6	13766,8	40,5	49,6
2	Beruni	29645,0	29645,0	100,0	24457,1	82,5	82,5
3	Nukus	27263,0	25065,6	91,9	14114,1	51,8	56,3
4	Kungarat	38592,0	36289,4	94,0	22266,5	57,7	61,4
5	Kanlikol	33512,0	30367,0	90,6	18268,2	54,5	60,2
6	Qaraozak	32704,0	32566,0	99,6	23677,3	72,4	72,7
7	Kegeyli	50666,0	46206,5	91,2	29911,8	59,0	64,7
8	Tortkul	26556,0	22662,6	85,3	10404,2	39,2	45,9
9	Khojaly	26271,0	23845,8	90,8	12267,1	46,7	51,4
10	Chimboy	46910,0	41576,8	88,6	26211,5	55,9	63,0
11	Ellikkal'a	29708,0	20685,3	69,6	10023,1	33,7	48,5
12	Shumanay	26604,0	26603,9	100,0	21064,8	79,2	79,2
13	Nukus.sh	189,0	189,0	100,0	137,4	72,7	72,7
14	Takhtakopir	32767,0	32443,6	99,0	26730,4	81,6	82,4
15	Muynaq	25073,0	25073,0	100,0	25073,0	100,0	100,0
total		460439,0	420958,4	91,4	278373,1	60,5	66,1

** This table is based on data from the Cadastral Agency of the Republic of Karakalpakstan..*

The total area of irrigated land in the Republic of Karakalpakstan is

460439.0 hectares, of which 420958.4 hectares (91.4%) are saline to varying degrees (Table 2, Appendix 1). Soil salinity varies depending on its salinity level, salt chemistry, depth of the saline horizon, and depth of groundwater. Non-saline soils account for 39480.9 hectares of irrigated land in the Republic of Karakalpakstan, or 8.6%. Weakly saline soils account for 142585.0 hectares of irrigated land, or 31.0%.

Weakly saline soils are distributed in almost all regions. Moderately saline soils are 139,499.1 hectares. This accounts for 30.3% of the irrigated lands of the republic. The salinity type is mainly chloride-sulfate and sulfate. Moderately saline soils are distributed in all districts of the republic. Strongly saline soils are 69,385.7 hectares. This accounts for 15.0% of the irrigated lands of the republic. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are distributed in all districts of the republic. Very strongly saline soils are 69,488.6 hectares. This accounts for 15.1% of the irrigated lands of the republic. The salinity type is mainly chloride-sulfate and sulfate. Very strongly saline soils are also widespread in all regions of the republic.

Nukus district. The total area of irrigated land in the district is 27,263.0 hectares, of which 25,065.6 hectares (91.9%) are saline to varying degrees. Non-saline soils account for 2,197.4 hectares, or 8.1% of the district's irrigated land (Table 2.5.1).

The area of weakly saline soils is 10951.5 hectares, which is 40.2% of the irrigated land of the district. The salinity type of weakly saline soils in the district is chloride-sulfate and sulfate. The area of moderately saline soils is 6894.9 hectares, which is

25.3% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are 2962.2 hectares.

This is 10.8% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are more common in the regions of "Kerder", "Shortanboy", "Boyantomir", "Kizil Uy", "Darsan" and "Nukus". The area of highly saline soils is 4257.0 hectares, which is 15.6% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. Highly saline soils are most common in the areas of "Kerder", "Shortanboy", "Boyantomir", "Kizil Uy", "Darsan", "Kotankul" and "Aqterek".

Khojaly district. The total area of irrigated land in the district is 26271.0 hectares, of which 23845.8 hectares (90.8%) are saline to varying degrees. Non-saline soils account for 2425.3 hectares, which is 9.2% of the irrigated land of the district (Table 2.5.1).

Weakly saline soils account for 11578.62 hectares, which is 44.1% of the irrigated land of the district. The salinity type of weakly saline soils in the district is chloride-sulfate and sulfate. Weakly saline soils are distributed in almost all regions. The average area of saline soils is 6867.17 hectares, which is 26.1% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. The area of highly saline soils is 2,650.9 hectares. This accounts for 10.1% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are distributed in all regions except for the "Khojaly massif", "Taxiatash poultry farm" and "Forestry farms". The area of very strongly saline soils is 2749.1 hectares, which is 10.5% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are distributed in all regions except for the "Taxiatash poultry farm".

Muynak district. The total area of irrigated land in the district is 25073.0 hectares, which are completely (100%) saline to varying degrees. Also, there are no weakly saline soils among the salinity levels (Table 2.5.1).

The area of moderately saline soils is 8112.1 hectares, which is 32.4%. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are 11996.8 hectares, which is 47.8% of the irrigated land of the district. The salinity type is mainly chloride-sulfate and sulfate. The area of very strongly saline soils is 4964.1 hectares, which is 19.8%. The salinity type is mainly chloride-sulfate and sulfate.

Takhtkopir district. The total area of irrigated land in the district is 32,767.0 hectares, of which 32,443.6 hectares (99.0%) are saline to varying degrees. Non-saline soils account for 323.4 hectares, or 1% (Table 3). The area of weakly saline soils is 5,713.2 hectares, which is 17.4% of the irrigated land in the district. The salinity type of weakly saline soils in the district is chloride-sulfate and sulfate. The area of moderately saline soils is 10,372.4 hectares, which is 31.7% of the irrigated land in the district. The salinity type is mainly chloride-sulfate and sulfate. Strongly saline soils are 15,271.3 hectares. This accounts for 46.6% of the irrigated land in the district. The area of highly saline soils is 1086.7 hectares, which is 3.3% of the irrigated lands of the district. The type of salinity is mainly chloride-sulfate and sulfate. Almost all irrigated soils in this district are completely saline, which shows that reclamation activities in the Republic of Karakalpakstan should be carried out on the basis of a special approach and control..

2.6. Climatic conditions

Since precipitation from the atmosphere is very low (90-120 mm per year), it does not have a significant impact on the formation and flow of runoff.

The flow of runoff varies in direct connection with the level of river water. For example, when the river water rises, the flow of runoff water in areas near it rises by 1.2-1.6 meters, and in areas near the sandbanks - by 2.0-2.5 meters. It should also be noted that in the conditions of the Aral Sea, the flow of runoff water can be reduced mainly by evaporation and transpiration, only a part of this water is collected in collectors and ditches in areas with a heavy mechanical composition and is collected in special evaporation lakes and is directly related to the reduction in water consumption in their branches. Therefore, the flow of runoff water varies in direct connection with the level of river water. In the northern part of the Aral Sea, the average annual temperature is around 10.5°C, in winter the temperature here is on average -6, -7°C (January) and from -22°C to 26°C in early February, and in summer the temperature is on average around 26°C

2.6.1-table

Weather indicators throughout the year in the Republic of Karakalpakstan

Indicators	Regions	
	North	South
Average temperature: (°C)	-7,6° C, 26° C, 10,5° C	-4,5° C, 28° C, 12,5° C
-January -July -annual	2200 - 4000	3000 - 4500
Useful temperature sum during the growing season, s	180-190	200

The conditions of the Aral Sea are also characterized by low rainfall compared to other regions of our Republic, with precipitation falling mainly in the winter months, and in the spring months, precipitation falls only in the form of rain. The snow that falls in the Republic of Karakalpakstan is not very thick, and in its northern regions it remains on the surface for 25-30 days, and in the southern regions for 15-20 days. The autumn months, like all oases, are mild and are considered a favorable season for harvesting agricultural crops. In the southern regions, 85-87 mm of precipitation falls, and in the Aral Sea region - about 110 mm. The end of cold days in the Aral Sea in spring falls on April 5-12, and the beginning of late autumn falls on the end of October and November..

Under the influence of the winds blowing in these places (deflation), 125-140 million tons of sand and salt particles are brought to the irrigated fields every year in the sand and salt massifs of the Aral Sea and its drained waters.

2.6.2-table

Interdistrict weather indicators throughout the year in the Republic of Karakalpakstan

Name of weather stations	Duration of cold days						Average period of days
	Spring			Autumn			
	Average	The beginning	The end	Average	The beginning	The end	
Nukus	9.04	28.03	24.04	11.10	25.09	30.10	184
Qo‘ng‘irot	12.04	26.03	26.04	13.10	19.09	30.10	183
Mo‘ynoq	5.04	10.03	18.04	5.11	13.10	25.11	213

Due to the high air temperature, low atmospheric precipitation and, finally, low air humidity, evaporation always prevails in these areas (1200-2000 mm per year). This indicator is approximately 15-20 times higher than the average annual precipitation. In the Amu Darya, 11 billion m3 of water is consumed annually for evaporation, or 22.5% of the total river water, which leads to the conclusion that the several-fold increase in the amount of input elements over the output elements leads to soil salinization.

V.N. Kovda showed that if 1500-2000 mm of moisture evaporates per year in the tributaries of the Amu Darya and Syr Darya and the mineralization of river water is at a minimum of 0.1 g/l, an average of 1-2 tons of salt accumulates per hectare of land per year. Since the soil formation process in the lower reaches of the Amu Darya is directly related to the water of the Amu Darya, there are non-washable water regimes for automorphic soils and sweat regimes for hydromorphic soils, which, as a result, creates conditions for salinization, carbonation and gypsum formation of soils, which has been scientifically proven. In the summer months, the temperature in the surface layer of the soil rises from 42°C to 56°C in June-August, resulting in positive heat retention in the 0-20 cm layer of the soil throughout the year..

INCREASING LAND USE EFFICIENCY THROUGH IMPROVING AGRICULTURAL SPECIALIZATION IN WATER CHARACTERISTICS

3.1 Problems that negatively affect the efficient use of land through agricultural specialization in the Aral Sea region

Uzbekistan is studying how water scarcity will affect the agricultural sector in arid regions. By 2030, the country may experience a water shortage of 7 billion cubic meters. As a result, Uzbekistan is likely to fall into the group of 33 countries with water shortages. In conditions of water scarcity, that is, in the event of insufficient water quantity or insufficiency of water resources, various problems arise. In these conditions, there is a significant impact on the ecosystem, human health and economic development. Causes of water scarcity: Climate change: changes reduce the amount of water; Population growth: increased demand for water; Economic activity: inefficient use of water, for example, consuming more water than is needed; Agro-industry: water-intensive cultivation methods. The use of modern methods in agricultural production is important for the efficient use of resources and increasing cultivation efficiency.

It is reported that by 2030, the country will experience a water deficit of 7 billion cubic meters, and as a result, Uzbekistan will be among the 33 water-scarce countries in the world. "In such conditions, the agricultural sector, which consumes the most water (90 percent of the total water) in the regions located in the lower reaches of the Amu Darya and Syrdarya basins, will suffer greatly. Therefore, it is advisable to develop measures to gradually replace water-intensive crops with less water-intensive crops in the Republic of Karakalpakstan and Jizzakh, Syrdarya and Khorezm regions," the institute's press service said. The study also studied the level of water consumption of drought-resistant crops in order to mitigate the impact of water shortages.

"In particular, 500 cubic meters of water are used to grow 1 ton of capers, which require little water, 700 cubic meters to grow desert sorghum (helictotrichon desertorum, fodder), and up to 1,500 cubic meters to produce 1 ton of mutton and goat meat. This means that they consume 10 times less water than the above-mentioned water-intensive crops. It is also advisable to plant drought-resistant legumes such as mung beans, beans, peas, and red beans.".

In recent years, the world community has been concerned about problems such as drought, water scarcity, soil degradation and desertification. As a result of climate change, by 2050, it is expected that up to 30-50% of the total glaciers in the Tien Shan and Pamir mountain ranges will melt, and the demand for water in the countries of Central Asia will increase by up to 50%. As a result, water shortages in Uzbekistan may reach an average of 15-25%, and the level of desertification may reach 123 million square meters. The increase in water scarcity means that it is necessary to widely introduce water-saving technologies. In countries such as Germany, Japan, and China, various non-traditional water-saving technologies are being introduced in plant care.

For example, in Japan, a hydrogel was created that changes shape depending on the air temperature. It is flexible, expands when it absorbs water and releases moisture to the plant roots. Then it returns to its previous state and begins to accumulate moisture again. Therefore, it is very useful for watering plants in desert areas.

In China, a grove of trees and green cover was built along a 450-km highway passing through a desert area. Hydrogel absorbs moisture from rain and snow in winter or from irrigation water in summer, stores it for a long time and provides moisture to the roots of plants. It can absorb 400-500 times its own weight in rainwater and 200-400 times its own weight in soil moisture.

By using 35-50 kg of hydrogel per hectare, approximately 120-140 cubic meters of water can be saved. For plants grown in the greenhouse, 50-80 percent of water can be saved, and for agricultural crops, 20-40 percent. In field conditions, hydrogel does not lose its properties for 2-3 years. The remains of the old hydrogel do not spoil the soil composition and are absorbed by plants as nitrogen fertilizer.

The problems of the Aral Sea region that negatively affect the effective use of land through agricultural specialization are;

1. Ecological crisis in the Aral Sea;
2. Deterioration and withdrawal of land resources;
3. Reduction of water and biological resources;
4. Sharp decrease in water supply;
5. Lack of control over water use;
6. Increasing salinization of land;
7. Inadequate areas of currently cultivated cotton, rice and other water-intensive crops in the face of water shortages;
8. The negative impact of the lack of scientific research on improving specialization for effective use of land in the face of water shortages on effective land use.

In cases of high groundwater levels in the regions, this leads to an increase in salt transport through water, which in turn activates salt accumulation processes in the soil. Fifthly, adverse weather conditions (unstable snow cover, deep freezing of the ground, late spring and early autumn frosts, high and low temperatures, heavy rainfall, hail, hailstorms, dust storms, etc.) lead to variability in crop yields. Sixthly, the area of cultivated land will decrease due to erosion, salinization, sand and salt migration. Seventhly, the area of water-loving plants will decrease, leading to losses in the nutrient base. Eighthly, a complete change in the composition of crops suitable for cultivation in agriculture is expected. Ninthly - there will be losses in fishing, muskrat farming and livestock farming, and tenthly - irreversible changes in nature will occur due to desertification of the river delta and deterioration of the pastures.

The increase in the number of days with extremely high temperatures (above 39˚C), irrigation deficit, droughts, land degradation, increased water and wind erosion, soil salinization, reduced humus content, and deterioration of the feed base lead to a decrease in productivity in livestock farming. Climate change processes worsen the ability of pastures to regenerate, reduce water supplies, and cause large numbers of animals to gather around water sources. Due to the excessive number of cattle herds owned by farmers on pastures, the grazing period on one land is extended, which eliminates the possibility of over-exploited pastures to regenerate.

Another factor affecting the rational use and protection of land and water resources in the development of agriculture and ensuring food security is climate change. This threat is becoming even more acute due to climate change. 80 percent of the Aral Sea basin consists of deserts and semi-deserts, ecological systems that are highly vulnerable to climate change and anthropogenic factors. As a result of climate change, the amount of temperature and precipitation is changing, which is leading to an increase in the negative environmental consequences. In this regard, it is also necessary to introduce measures to adapt to climate change and mitigate its negative consequences. In this regard, measures such as the introduction of resource-saving technologies in agriculture, increasing the efficiency of irrigation systems, combating desertification and desertification, soil salinization and soil erosion are among them.

3.2. Results of crop production in the Republic of Karakalpakstan under water scarcity conditions.

Currently, the average soil quality score of the Republic of Karakalpakstan is 41.3 points. Maintaining and improving it in line with the requirements of the times will greatly contribute to the development of agriculture and ensuring food security in the face of climate change and will determine the future prospects. When comparing the economic efficiency of crops that require a lot of water and low water requirements for the 2022 harvest in the agricultural conditions of the Republic of Karakalpakstan at the current prices as of January 1, 2023, the yield of cotton from 1 ha of water-intensive crops was 22.3 t / ha, i.e. the yield of grain was 2.23 tons, the average selling price of cotton was 6200 soums per kilogram. The total expected income was

13 million 861 thousand soums and the profitability rate was 10.47%.

Of the currently cultivated crops that require a lot of water, rice, based on the calculated planting area of 1 ha, has a grain yield of 25 centners/ha, a gross yield of 2.5 tons of grain, a total expected income of 20 million soums, and a profitability rate of 36.2%..

3.2.1- table

Results of crop production in the Republic of Karakalpakstan under water scarcity conditions.

(Account books and estimates as of January 1, 2023)

Serial number	Crop type	Main crop (grain, seed or cotton), s/ha	Proceeds from sales, thousand soums	Fodder yield, t/ha	Proceeds from sales, thousand soums	Total profit from sales, thousand soums	All expenses, Thousands of soums	Including irrigation water consumption in m3 and price, soums		Sof foyda, so‘ m	Rentabellik, %
								1 gektarni sug‘orish suvi sarfi, ming m^3	Narxi, ming so‘m		
1	Cotton	22,3	13380	7	35	13861	12518	9,5	950	1343	10,7
2	Rice	25,0	15000	11	5000	20000	14681	24,6	2 460	5319	36,2
3	Wheat	38,8	15520	10	4400	19920	13891	7,7	770	6029	43,4
4	Sesame	13,3	19950	3	600	20550	13436	4,2	420	7114	52,9
5	Millet	14,9	5960	10	4000	9960	7214	3,6	360	2746	37,8
6	Mung Beans	12,2	12200	2	400	12600	7986	3,4	340	4614	57,7
7	Alfalfa	9,9	11880	2	400	12280	7993	3,4	340	4287	53,6
8	Oats	1,5	7500	9,54	11448	18948	13525	5,6	560	5423	40,1
9	Corn	46,3	16205	9,12	12768	28973	18396	5,4	540	10577	57,4
10	Wheat	37,6	13160	9,07	11791	24951	18427	7,3	730	6524	35,4

** This table contains data from the results of the dissertation research paper.*

Among the crops with low water requirements, alfalfa was planted on an area of 1 hectare, with a grain yield of 1.5 t/ha and a stalk yield of 9.54 t/ha, the total expected income was 18 million 948 thousand soums, and the profitability rate was 40.1%.

Among the crops with low water requirements, sesame was planted on an area of 1 hectare, with a grain yield of 13.3 t/ha and an additional crop of dry stalks of tons, and the total expected income when sold at current prices was 20 million 550 million soums, and the profitability rate was 52.9%.

In our calculations, among the crops with low water requirements, millet was planted on an area of 1 hectare, with a grain yield of 14.9 t/ha and a stalk mass of 10 tons. The total expected revenue was 9 million 960 thousand soums and the profitability rate was 37.8%..

When planting mung beans in Karakalpakstan, an average of

12.2 centners of grain yield and 2 tons of stem mass were obtained per hectare, and the income was 12 million 600 thousand soums, and the profitability rate reached 57.7%.

When planting beans in the conditions of water shortage in our republic, an average of 9.9 centners of grain yield and 2 tons of dry stem mass were obtained per hectare. The total yield was 12 million 280 thousand soums, and the profitability rate was 53.6%.

When planting corn in order to strengthen the grain and fodder base of the republic, an average of 46.3 centners of grain yield and 9.07 tons of dry stem mass were obtained per hectare. The total income was 24 million 951 thousand soums, and the profitability rate was 35.4%..

When we calculated the water standards required for crop production in Karakalpakstan, when there is currently a water shortage, we found that cotton requires 9.5 thousand cubic meters, wheat 7.7 thousand cubic meters, rice 24.6 thousand cubic meters, and vegetables and melons 12.5 thousand cubic meters for tomatoes, while crops that require less water - 5.4 thousand cubic meters for corn, 5.6 thousand cubic meters for alfalfa, 4.2 thousand cubic meters for sesame, and 3.6 thousand cubic meters for millet. In other words, it was calculated that 7 hectares of millet, or 6 hectares of sesame, or 4.4 hectares of alfalfa, or 4.6 hectares of corn can be grown with the water used to grow 1 hectare of rice. When all agrotechnical measures were carried out in full and in accordance with the established procedure, the average yield was 22.3 quintals, and the total income was 13 million 861 thousand soums. 9 thousand 500 cubic meters of water were used per hectare to harvest cotton.

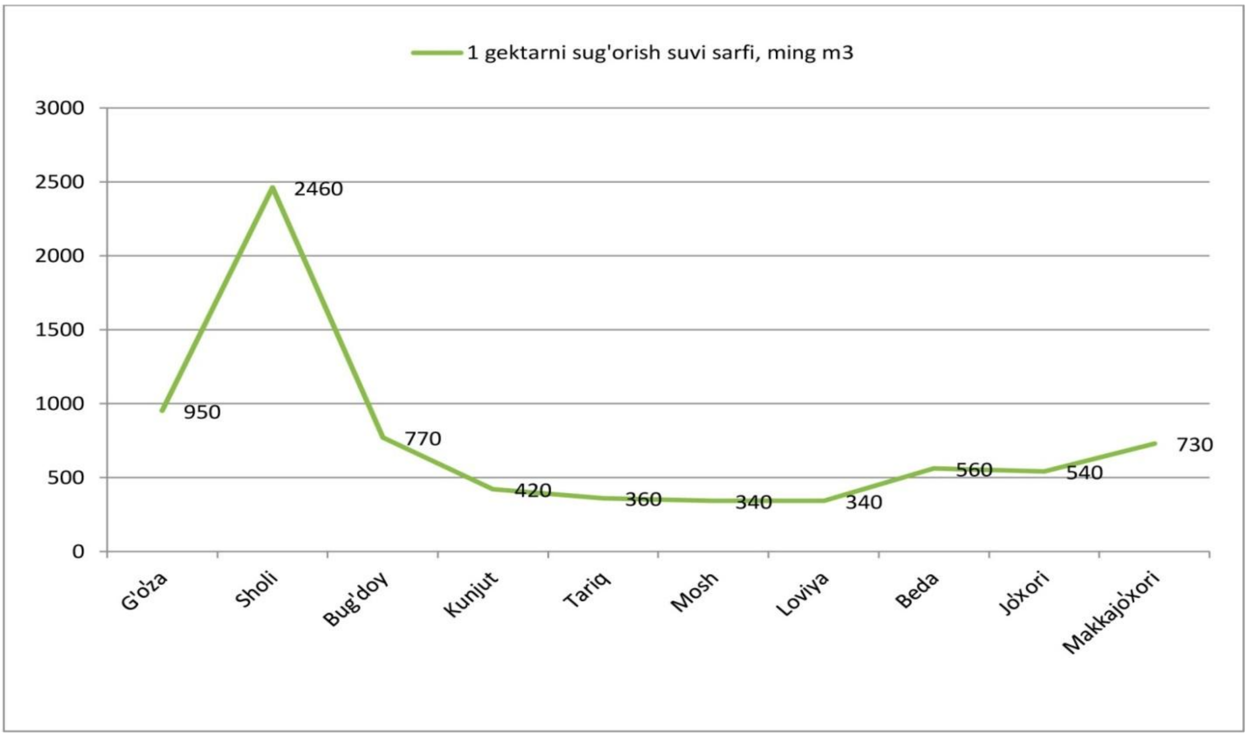


Figure 3.2.2. Cost of irrigation water used per hectare by crop type, in soums

It has been scientifically proven that when growing sorghum, which requires little water, under drought conditions, an income of 28 million 973 thousand soums was obtained per hectare, that is, an additional profit of 15 million 112 thousand soums was obtained compared to growing cotton, 5 million 087 thousand soums was obtained from growing alfalfa, 6 million 689 thousand soums was obtained from growing sesame, and 11 million 90 thousand soums was obtained from growing corn.

The cost of products includes the resources used in the production process, raw materials, materials, services, fuel, energy, main tools used, labor resources, as well as current prices for the production of the same product, other additional factors of product production and sales activities, in other words, the monetary expression of all expenses incurred in production costs constituted the cost of the product.

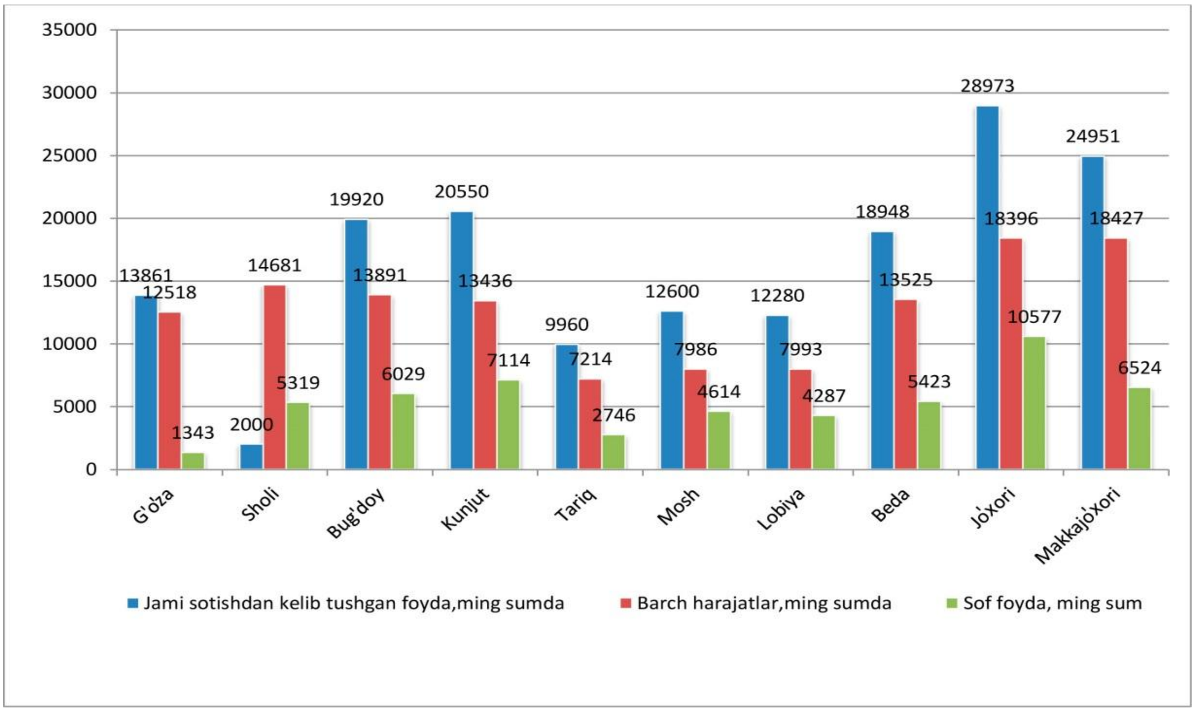
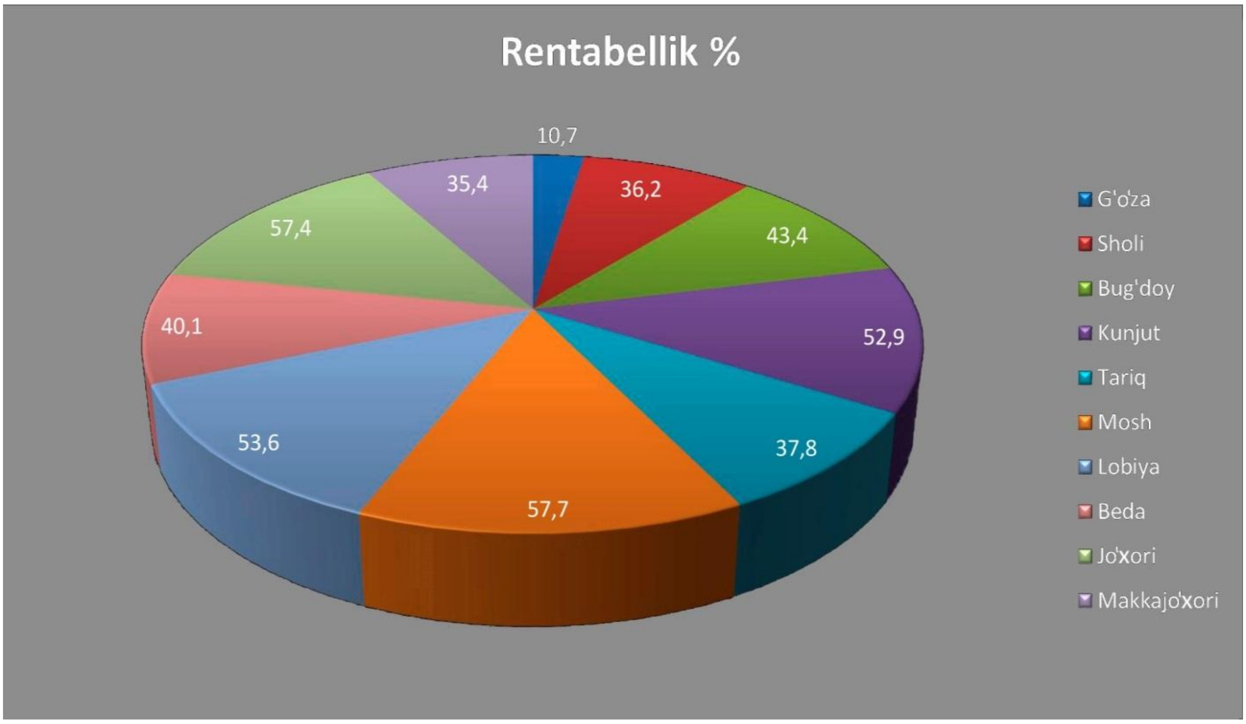


Figure 3.2.3. Economic efficiency of various agricultural crops, thousand soums.

If the total income from planting 4 different crops - cotton, wheat, rice and melons, which were previously planted under the program, amounted to 32 million 890 thousand soums, and the total amount of irrigation water used for them was 41.8 thousand cubic meters, including 6.9 thousand cubic meters of water for salt leaching and 34.9 thousand cubic meters of water for irrigation during the crop maintenance period, then mathematical and statistical calculations determined that, along with these crops, the income from growing sorghum, sesame, millet and alfalfa amounted to 62 million 50 thousand soums, and the total amount of irrigation water used for them was 18.8 thousand cubic meters, including 4.6 thousand cubic meters of water for salt leaching and 14.2 thousand cubic meters of water for irrigation during the crop maintenance period. Therefore, our research calculations have shown that during times of water scarcity, 23,000 cubic meters of water is saved by growing crops that require less water than by growing crops that require more water, and 29 million 160 thousand soums more income is generated by growing crops that require less water than by growing crops that require more water.

In order to improve specialization in the Republic of Karakalpakstan, it has been proven through dissertation research that planting sesame, millet, mung beans, beans, sorghum, and alfalfa, which require less water, along with the currently planted water-intensive crops, is economically beneficial and will generate an additional profit of 91 million 435 thousand soums..



Due to the water shortage observed in the Republic of Karakalpakstan in recent years, the planned harvest of agricultural crops is not being obtained. For example, in 2000-2001, when the water supply was 39-40%, the yield of one of the main crops - cotton - was 12-13 centners / ha, which did not even cover its costs. That is why, at the initiative of our President, the area of cotton cultivation in Karakalpakstan was reduced by 30 thousand hectares, and 4 districts were specialized for animal husbandry and fodder crops. Due to the inclusion of low-water-demanding crops - millet, sesame, sunflower, alfalfa and sorghum, and medium-water-demanding crops - winter and spring wheat, alfalfa, fruit and vegetable crops and water grass in the planting plan to some extent, and sufficient water for livestock farming, the area of arable land (green landscape) in the Republic has increased. Cotton plantings have been reduced in accordance with water shortages, and after water became sufficiently available, cotton yield has increased from 17.5 to 22.3 centners.

Limited water availability and a short growing season are the main factors limiting crop production in the region. Due to the arid climate, crop production is dependent on irrigation. Due to the lack of seeds for legumes and oilseeds, farmers widely practice monoculture of cereal crops. However, wheat yields are generally low due to the low productivity of the varieties grown and the ineffectiveness of agricultural techniques. Table 3.2.2 provides a summary of the most important field crops:

3.2.2- table

Advanced agrotechnical practices in crop cultivation.

Agricultural practice	Comments on agricultural practices	Initial conditions
Soil-conserving and resource-saving agriculture	Optimizing the growing season (adjusting planting times to inter-row or over the main crop) Testing crop compatibility (planting times and crop combinations)	Planting times tested Adapted small mechanization tools available Crop compatibility and planting times tested (to provide nutrients to the main crop)
Contour technology of agriculture	-	-
Planting windbreak crops	-	-
Controlled grazing of livestock	Limiting the intervals between fertilization and/or supplementing with additional feeding	Forage available

Diversification of crop rotation	Optimizing the growing season (Planting times are adjusted to be planted between rows or on top of the main crop)	Quality seed material of adapted crop varieties has been tested. Sowing times have been tested. Adapted small mechanization tools are available (seeders, combine harvesters)
Intensification of crop rotation	-	-
Improved nutrient supply to plants (more intensive and efficient)	Optimizing the growing season (planting times adjusted to inter-row or over the main crop) Testing crop compatibility (planting times and crop combinations)	Fertilizers are available Crop compatibility and planting times (tested to provide nutrients to the main crop)
Integrated plant protection	Farmers' awareness of the importance of integrated pest management methods and their methodology (e.g., biological control methods, beneficial insects)	Pesticides are available Improved seed material for cereals, legumes and broadleaf crops is available Adapted small-scale mechanization is available(p)

3.2.3- table

Comparison of permanent cropping with tillage and sprinkler irrigation in soil conservation and resource-saving agriculture.

Indicator	Persistent pink	Comparative advantage
Water use efficiency	30% higher	Narrower slopes have a higher yield potential than wider slopes..
Productivity	Same or higher	
Access to land	Easier, allows for the following:	Increasing the efficiency of fertilizer use, as they can be applied to plants at a specific place and time. For example, when planting grain, the technique can apply nitrogen

		fertilizers in a band method at the branching or stemming stages, or in a face method at a later time, without compacting the crop. Reducing the amount of herbicide application due to mechanized inter-row cultivation. Facilitating seed germination and improving their quality due to planting in rows.
Farmer's income	Higher because:	Operational costs per unit area are saved by an average of 25%, as well as fuel consumption is reduced (up to 60 liters per hectare per year).

Soil-ecological assessment is an assessment of climatic indicators and other characteristics of certain regions based on soil properties. Soil-ecological indices are calculated according to the following basic formula::

$$PEI=12{,}5\cdot(2-V)\cdot P \frac{\sum t>10^{\circ}\times(КУ-Р)\times А}{КК+100}$$

where V – soil density g / cm3 (average per meter layer);

2-maximum density of soils at maximum compaction, g / cm3; P-useable volume of soil (per meter layer); Ds - additionally soil properties are taken into account; $\sum t > 10^{c}$ v – 10° average annual sum of temperatures above ; KU - humidity coefficient (R - correction for this coefficient); KK - continentality coefficient; A - agrochemical properties of soils (for example, NPK content in the arable horizon). Therefore, morphological and physical properties were determined for all selected soil samples: soil structure, granulometric composition, natural density and moisture, dry soil density (bulk density), specific surface area, hydrological constants, soil filtration coefficient.

3.2.table

Soil ecological index

№ section	Average soil density, g/cm3	12,5·(2–V)·P	$\frac{\sum t > 10° \times (КУ - Р)}{КК + 100}$	PEI
1	1,16	7,140	7,56	54,0
2	1,35	5,525	6,05	33,4

In conclusion, it is advisable to adhere to the following main conclusions and principles for adapting agriculture to climate change and mitigating its negative consequences in the Aral Sea basin:

Rational use of available water resources, effective use of land through specialization in agriculture, use of modern economical techniques and technologies for irrigation of agricultural crops;

Increasing soil fertility and rational use and protection of land in the context of climate change;

Harmonizing specialization in agriculture with issues of animal husbandry and water supply in the region;

3.2.5-table

Indicators of physical properties of soils

Section number	Depth, cm	Bulk density, g/cm3	Field soil moisture, % abs. dry. soil mass	Bulk density of soil, g/cm3	Density of the solid phase, g/cm3	Soil porosity, %	Specific surface area of soils So, m2/g-1	GV-hygroscopic soil moisture%.	Kgv - conversion coefficient to absolutely dry soil suspension	MG - maximum hygroscopic soil moisture;	SK - stable turbidity moisture of plants	NV - the lowest field moisture capacity of soils	PV – total moisture capacity of soils;	DAV - active moisture range.
1	0-25 25-33	0,90 1,42	28,8 8,6	1,15 1,54	2,53 2,65	66 46	30,0 8,4	1,51 0,42	0,985 0,996	7,50 2,10	30,6 4,4	41,9 26,8	63,6 43,5	11,3 22,4
2	0-24 24-37	1,17 1,49	34,9 25,2	1,58 1,86	2,51 2,65	53 44	28,3 16,3	1,42 0,82	0,986 0,992	7,06 4,08	37,8 19,8	43,3 32,3	51,4 41,8	5,5 12,5

G-hygroscopic soil moisture; Kg - coefficient of conversion of absolutely dry soil into a suspension; MG - maximum hygroscopic soil moisture; SK - wilting coefficient of plants; NV - lowest field moisture capacity of soils; PV - total moisture capacity of soils; DAV - active moisture range.

3.2.6- table

Results of sorghum cultivation in the Republic of Karakalpakstan.

(Account books and estimates as of January 1, 2022)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from planting corn				
1	Area sown	Ga	1	
2	Yield per grain	s/ga	46,3	
3	Gross yield per grain	Tonna	4,63	
4	Purchase price of grain	soums /kg	3500,0	
5	Yield per stalk	s/ga	912	
6	Gross yield per stalk	Tonna	9,12	
7	Purchase price per stalk	soums /kg	600,00	
8	Expected income	thousand soums	28973,0	
Used water				
1	Average annual water requirement	ming kub	5,40	100%
2	Including brine washing	ming kub	1,60	29,6
3	Irrigation during the growing season	ming kub	3,80	70,4
Total expected costs for corn in 2023				
1	Total expected costs for 2023	thousand soums	18396	100,0
Shundan :				
1	Total payroll with ESP 12% calculation	thousand soums	2560,6	28,88
2	YoMM	Kg	193,9	
	By price (8600 sum/kg)	thousand soums	1667,4	18,81
3	The seed (60 kg/ga)	Kg	20,0	

	Price estimate (average 4200 soums/kg)	thousand soums	130,0	1,47
4	General mineral fertilizers	Kg	1094	
	total amount	thousand soums	2850,8	32,16
a	V.T.Ch N nitrogenous (in physical form)	Kg	666	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorous (physical)	Kg	248	
	Amount (3577 thousand soums)	thousand soums	886,8	
v	K potassium (in physical form)	Kg	180	
	Amount (2050 thousand soums)	thousand soums	369,9	
G	Organic fertilizer	thousand soums	224,0	
D	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	630,00	8,75
7	SIU Water Management Service	thousand soums	36,7	0,57
8	Electricity service	thousand soums	38,4	0,49
9	Taxes	thousand soums	507,10	2,23
10	Water tax (100 soums/cubic meter)	thousand soums	540,00	3,91
11	Other expenses	thousand soums	46,03	0,52
12	Unexpected expenses	thousand soums	173,13	1,95
	Cost of 1 ton of product	thousand soums	3500	
	Net profit (loss)	thousand soums	10577	
	Profitability	%	57,4	

3.2.7- table

Results of alfalfa cultivation in the conditions of the Republic of Karakalpakstan.

(Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Expected income from alfalfa for hay in the first year of planting				
1	Area sown	Ga	1	
	Grain yield	s/ga	1,5	
	Average grain selling price	thousand soums /kg	50	
	Hay yield	t/ga	9,54	
	Average selling price	soums /kg	12	
5	Total expected revenue	thousand soums	18948,0	
	Average annual water requirement	thousand kub	5,60	100,0
	Total salt leaching	thousand kub	1,40	25,0
	Irrigation during the growing season	thousand kub	4,20	75,0
Expected first year alfalfa hay costs for planting for the 2023 crop				
	Total expected costs for 2023	thousand soums	13525	100,0
Shundan :				
1	General wage fund with ESP 12% calculation	thousand soums	1261,8	15,66
2	GWP	Kg	164,0	
	By price (8600 soums/kg)	thousand soums	1410,0	17,50
3	Seeds (60 kg/ha)	Kg	200,0	
	By price (average 4200 soums/kg)	thousand soums	1040,0	12,91
4	General mineral fertilizers	Kg	1124	

	General account	thousand soums	2800,4	34,76
a	V.T.Ch N nitrogenous (in physical form)	Kg	666	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	Kg	248	
	Amount (3577 thousand soums)	thousand soums	886,8	
v	K potassium (in physical form)	Kg	211	
	Amount (2050 thousand soums)	thousand soums	431,5	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemical cartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	690,00	8,56
7	SIU Water Management Service	thousand soums	68,4	0,85
8	Electricity Service	thousand soums	41,6	0,52
9	Taxes	thousand soums	330,00	4,10
10	Water Tax (100 soums/cubic meter)	thousand soums	560,00	2,78
11	Other Expenses	thousand	46,03	0,57

		soums		
12	Unexpected Expenses	thousand soums	134,58	1,67
13	Cost of 1 ton of product	thousand soums	1074,2	
14	Net profit (loss)	thousand soums	5423	
15	Profitability	%	40,1	

Strengthening the material and technical base of agriculture and water management.

Smart Farming: Technologies such as IoT (Internet of Things), sensors and drones enable monitoring and control of the growing process.

Nanotechnology: Using microscopic materials to enhance, protect and protect crops from toxins.

Agroecological methods: Efficient use of water and conservation of natural resources, such as water recycling and proper linkages between agronomic crops.

Hydroponics and aeroponics: Methods of growing in water or in air that accelerate crop growth and allow for efficient use of water.

Continuous monitoring and analytics: Optimizing the growing process through data collection and analysis.

Priority farming: Helping local farmers use modern technologies through dialogue and community projects.

Implementing these methods is essential to increasing the efficiency of agricultural production and protecting water resources.

Planting low-water crops is a good way to use water resources efficiently and reduce scarcity. These crops generally do not require a lot of water and are adapted to drought conditions.

1. This allows for crop production, balancing and transforming water resources in agricultural production.
2. Various decisions and strategies need to be implemented to reduce water stress and address these issues.

3. The following methods and proposals are important in addressing water scarcity issues
4. Water resource restoration: Developing renewable sources for efficient water use, such as recycling contaminated water.
5. Water storage systems: Implementing water storage and storage systems in severe drought situations, which will help manage water more effectively.
6. Agroecological methods: Applying priority cultivation methods, such as proper breeding and increasing crop efficiency.
7. Information technologies in water management: Optimizing water resources through priority monitoring and analysis.
8. Collaboration with local communities: Taking into account the views of local communities on water conservation and reforms.
9. Legislation and Policy: Implement effective laws and policies for the protection and management of water resources.
10. Public Education: Implement water conservation, resource efficiency, and environmental education.

EFFECTIVE ORGANIZATION OF LAND USE BASED ON SPECIALIZATION AND IMPROVEMENT OF ECOLOGICALLY SUITABLE AGRICULTURE

4.1. Practical recommendations for shifting agriculture to crops that require less water and for establishing livestock farms and agroclusters in this direction

In recent years, the agrocluster method of agricultural production has been established in our Republic, and as a result of the consistent reforms carried out in the last 3-4 years to develop, improve, modernize and diversify agricultural production, and develop the product processing industry on the spot in the conditions of the Aral Sea, a new system of activity in the agricultural sector is being introduced - the cluster method. The resolution of the Cabinet of Ministers of the Republic of Uzbekistan on additional measures to ensure high productivity through the phased introduction of the cluster system widely states that in recent years, consistent reforms have been implemented aimed at the rapid development of agriculture, one of the important sectors of the country's economy.

Based on the existing water supply account book, 63 agroclusters operating using the latest modern methods have been formed in the Republic of Karakalpakstan, of which 12 agroclusters are operating in the cotton-textile sector, 30 in grain clusters,

10 in rice clusters,

13 in fruit and vegetable clusters and others.

193,113 tons of raw cotton were purchased from 69,381 hectares of land allocated to 11 cotton-textile clusters in 14 districts of the Republic of Karakalpakstan. In addition,

43,164 tons of raw cotton were grown from 14,750 hectares of land allocated to 11 cotton-textile clusters. Clusters are carrying out a number of works to further develop the agricultural sector, maintain and increase productivity and soil fertility, as well as create an added value chain. 8 of the clusters have fiber processing enterprises with a capacity of 102.9 thousand tons, 6 have fiber yarn production enterprises with a capacity of 47 thousand tons, 3 have yarn fabric production enterprises with a capacity of 16 thousand tons, 2 have fabric dyeing enterprises with a capacity of 13 thousand tons, and 4 have factories and infrastructure for the production of finished products with a capacity of 12.2 thousand tons.

The volume of agricultural land allocated to clusters by crop type is 62% in cotton and textiles, 8% in livestock farming, and 7.5% in fruit and vegetable growing. Also, the introduction of modern resource-saving technologies allows agricultural producers to effectively use land, water, and material and technical resources, process the grown raw materials and deliver them to the consumer in the form of finished products. As a result, this year, an average of 60 quintals per hectare was harvested in grain cultivation, the gross production volume amounted to more than 7 million tons, and 3 million 552 thousand tons of grain were transferred to the state, which is an increase of 140% compared to the previous year. At the same time, the lack of effective market mechanisms for state support of agriculture does not allow increasing the competitiveness of the sector.

It is necessary to carry out comprehensive measures to produce and export finished products with high added value, expand the activities of cotton and textile clusters, and widely introduce digital technologies into these processes. It is necessary to organize marketing research in the domestic and foreign markets, participate in the development and implementation of medium- and long-term programs for the development of the industry, as well as widely introduce market mechanisms into the industry. It is necessary to identify and eliminate systemic problems that hinder the rapid development and sustainable operation of cotton and textile production, as well as further improve the legislation on the industry.

There are also 30 grain clusters in Karakalpakstan, including the Tortkul Non Limited Liability Company (LLC) in Tortkul, the Beruniy Bugdoy Cluster Limited Liability Company in Beruni, the Guldursin Grain Cluster Limited Liability Company in Ellikkal, the Agroklass Cluster Limited Liability Company in Ellikkal, the Amu Darya Amu Rich Harvest Limited Liability Company and the Kipchak Grain Cluster Limited Liability Company, the Khojaly Limited Liability Company, the Bekhruz Jahangir Cluster Limited Liability Company, the Bahrom Ilgor Cluster Limited Liability Company, and the Wi Cluster Shomanay Limited Liability Companies, the Abdi-Esen Farm Agrocluster in Chimboy, From Kegely, "Xalkabad Grain Cluster", "Aktuba Grain Cluster", and "Darsan Agro Grain Cluster" Limited Liability Companies, from Takhiatash, "Taqiatas Tex Cluster" UK, from Kungirot "Kungirot Cotton Cluster" LLC, and "CHILI ASIA KUNGIROT" Limited Liability Companies, from Nukus, "Akmangit Grain Cluster", "Aqmangit Grain cluster", "Aqmangit Cluster" and "Aqmangit Altin Cluster Limited Liability Companies", from Qonlik, "Khabibulla Radjabboy" farm, "Ubaydullaev Batirbay" farm, "Shakhnoz Asel" farm and "Agro eco complex" limited liability companies, from Karaozak, "Agro invest expo cluster" and "Qaraozek galle cluster" limited liability companies, in Takhtakopir the

"Takhtakopir expo cluster", "Takhta invest cluster" and "Takhtakopir galle cluster" limited liability grain-growing agro-clusters are operating. Land for grain-growing clusters is allocated on the basis of a written agreement between the Council of Ministers of the Republic of Karakalpakstan, regional khokimiyats and initiators in agreement with the Cabinet of Ministers. Grain-growing clusters in which foreign investors participate The land for the cluster will be allocated by the Cabinet of Ministers after signing an investment agreement with the Ministry of Agriculture of the Republic of Uzbekistan.

Also, in order to increase rice production in the Republic, rationally use land and water resources, radically improve the management system in the field of rice procurement, storage and processing, sustainably supply the domestic consumer market with rice products, and increase export potential, the Cabinet of Ministers has made the following resolutions:

The proposal of the Ministry of Agriculture of the Republic of Uzbekistan, the Ministry of Economy and Industry, the Council of Farmers, Dehkan Farms and Homestead Owners of Uzbekistan, the Council of Ministers of the Republic of Karakalpakstan, and regional khokimiyats on the establishment of rice clusters starting from the 2020 harvest is approved, and the establishment and operation of rice clusters should be carried out on the basis of the following conditions. A rice cluster should be established by potential local investors who are economically stable, have the necessary infrastructure facilities, as well as property and other means, and are able to grow rice or purchase it under a contract, sort, store, process it, and supply finished products to the domestic and foreign markets, using modern innovative production technologies, In accordance with the requirements of the "Land Code of the Republic of Uzbekistan", land for the rice growing cluster is allocated from agricultural lands, reserve lands, and land areas for restoration and use that are not allocated to legal entities and individuals for a period of up to fifty years, but not less than thirty years, in accordance with the established procedure.

When analyzing the existing and newly established rice clusters in the districts of the Republic of Karakalpakstan, there are already 10 rice clusters, including the "Khusaynov Javlonbek" farm in Khojaly, the "Zhuzbasi" farm in Chimboy, the "Sholichilik Cluster" Limited Liability Company in Qonlikol, the "Sholichilik Cluster" Limited Liability Company in Shomanoy, the "Shomanay Rice Cluster" Limited Liability Company in Kungirot, the "Kungrad Rice Cluster" in Bozotov, the "Buzatov Rice Cluster" in Tortkol, the "Besh Khoroz" Limited Liability Company in Beruniy, the "Ubaydullaev Batirbay" farm in Qonlikol, and the "Agro eco complex" limited liability company agroclusters are operating to fulfill the requirements of the food program on site. The republic's Khojaly, Shomanoy, Seven new rice-growing clusters have been established in Qonlikol, Kungirot and Chimboy districts, and 31,136 hectares of land have been allocated to these cluster enterprises, of which 13,290 hectares are owned by 157 farms, and the cluster's own land area is 17,846 hectares. The existing infrastructure in these clusters includes indoor and outdoor warehouses for receiving 11,000 tons of rice.

The cluster enterprises have a total of 113 agricultural machinery and units, including 14 tractors, 8 plows, 15 chipper tractors, 12 grain seeders, 12 grain harvesters, 9 laser levelers, 16 units and 33 other equipment. The clusters have planned 4 new projects in 2022-2023 and financed new projects worth a total of 29 billion. 959 million soums, and in fact 15 billion. 130 million soums.

Transfer all arable land in districts with low profitability of cotton and grain areas above 50% to clusters organizing full processing of cotton and grain, with the condition of construction and reconstruction of irrigation and land reclamation networks.

Also, in order to fulfill the requirements of the food program in our Republic, 30 fruit and vegetable clusters are operating in 16 districts of the Republic, including fruit and vegetable clusters in Karakalpakstan and other agroclusters. In particular, clusters: A total of 22 fruit and vegetable clusters have been newly established in 12 districts, including 2 in Takhiatash district, 2 in Shomonay district, 1 in Khojaly district, 2 in Kungirot district, 1 in Qonlikol district, 3 in Nukus district, 2 in Kegeyli district, 1 in Bozatov district, 2 in Chimboy district, 2 in Karaozak district, 2 in Takhtkopir district and 2 in Moynaq district. These clusters produced 62.3 thousand tons of fruit and vegetable products in 2022, of which 60.5 thousand tons were for domestic consumption, 0.7 thousand tons were for processing, and 1.2 thousand tons were for export. A total of 13.2 thousand hectares of fruit and vegetable growing land and 1,258 farms were assigned to the fruit and vegetable clusters.

II. Regarding the existing infrastructure in the clusters, currently 2 of the clusters have enterprises for processing, packaging and drying products with a capacity of 1200 tons, and 6 have refrigeration infrastructures with a capacity of 1950 tons.

III. Regarding investment projects implemented by the clusters.

20 new projects were planned by the clusters in 2022 with a total value of 42 billion. 461 million soums, 4 billion. 198 million soums were actually financed and 3 projects were launched.

In particular, in Tortkol, the limited liability companies "Tortkol kunjuti", "Tortkol tuprogi" and "Star agro servis"; in Beruni, the "Sarkopli Khalimaxon farm agrocluster" and "Likoroots" limited liability companies; in Nukus, the "Agroexport RK group", "Biogumus" farm and "Ekoeksport servis" limited liability companies; in Ellikkal, the "Agro Eksim gold", "Boston Agrosanoatsavdo" and "Ellikkal'a Sakhovati" limited liability companies; in Amudarya, the "Mangit omad savdo" limited liability company and the "Orlando cluster" limited liability company in Shumanoy operate in the form of agroclusters, farms and agroclusters in fruit and vegetable growing and other areas, and they provide land plots to legal entities and individuals in accordance with the requirements of the "Land Code of the Republic of Uzbekistan" Land allocated from unallocated agricultural lands, reserve lands, and land areas to be restored and put into use is allocated in accordance with the established procedure for a period of up to fifty years, but not less than thirty years.

When assessing the effectiveness of agrocluster management, the organizational and production efficiency indicator is based on the relationship between the management practices of the business entity and the volume of product production. In this case, the use of material resources, including fixed assets, in the management of production processes is analyzed and the following indicators are used: - growth coefficient of the level of profitability of fixed assets; - growth coefficient of cost profitability; - growth coefficient of production volume; - growth coefficient of profitability of sales of manufactured products; - profitability coefficient of agrocluster activities, etc.

The adoption of a separate regulatory legal act is not required to organize the activities of agroclusters, with the exception of the grain cluster, in which foreign investors participate. In accordance with the procedure for state support of the grain-growing cluster: the grain-growing cluster that has put land into use is provided with a subsidy for the purchase of renewable energy sources, energy-efficient gas-burning devices and boilers, as well as other energy-efficient equipment, in accordance with the Decree of the President of the Republic of Uzbekistan No. PF-5742 dated June 17, 2019 "On measures for the effective use of land and water resources in agriculture"; in accordance with the Resolution of the President of the Republic of Uzbekistan No. PQ-4422 dated August 22, 2019 "On additional measures for the timely provision of the agrarian sector with agricultural machinery"; The benefits provided for in Resolution No. PQ-4268 of April 4, 2019 will be applied. Experts in the field believe that by 2030, due to digital transformations, the overall productivity of agriculture should increase by about 60%, so that there is no food shortage. In connection with these trends and innovations in the field of digital agrotechnologies, a draft concept for the implementation of "Smart Agriculture" in the agricultural sector of Uzbekistan was published on the portal of regulatory legal documents of the Cabinet of Ministers of the Republic of Uzbekistan for general consideration and discussion. The main purpose of this concept is to increase the productivity of agricultural crops, increase the productivity of livestock, protect crops and land from pests and various insects, eliminate the impact of external crops on the productivity of various crops, as well as introduce modern agricultural methods and increase the culture of production. Particular attention is paid to the introduction of high technologies and digital management methods in the agriculture of the Republic of Uzbekistan.

In general, the socio-economic efficiency indicators of agrocluster management consist of the following: - labor productivity growth coefficient; - growth coefficient of income per capita per worker; - growth coefficient of average monthly salary of workers; - efficiency of personnel management activities; - growth coefficient of labor profitability.

Taking into account all the conditions such as water shortage in Karakalpakstan, global climate change, soil salinity, and others, we recommend the specialties and their land areas recommended for the future in our Republic.

In our Republic, 2,478 farms are currently operating in production in the current cotton-grain direction, with a total land area of 346,746 hectares and a land use coefficient of 62.13%. The area of unused land is 131,287 hectares, of which 37.86% needs to be brought into use. In this direction, each farm has 139.9 hectares..

The total land area occupied by the cotton-grain sector is 9.75% of the total land area occupied by all specializations.

Currently, 714 farms are operating in the vegetable-bean sector, with a total land area of 10,678 hectares and a land use coefficient of 79.8%. The area of unused land is 2,147 hectares, and 20.36% of the total area needs to be put into use.

Each farm operating in the vegetable-bean sector has

14.9 hectares. The total land area occupied by the vegetable-bean sector is 3.0% of the total land area occupied by all specializations.

Currently, 214 farms are operating in the grain sector, with a total land area of 23,507 hectares and a land utilization ratio of 60.76%. The area of unused land is 9,222 hectares, and 39.23% of the total area needs to be put into use. Each farm in this sector has 109.8 hectares.

The total land area occupied by grain farming is 6.61% of the total land area occupied by all specialties.

Currently, 176 farms are operating in the rice farming sector, which is an important branch of grain farming, with a total land area of 10,296 hectares and a land use coefficient of 65.36%. The area of unused land is 3,568 hectares, and 34.65% of the total area needs to be put into use. Each farm in this sector has 58.5 hectares.

The total land area occupied by rice farming is 2.89% of the total land area occupied by all specialties.

1113 farms are engaged in livestock production, their total land area is 2,520,005 hectares and the land use coefficient is 13.59%. The area of unused land is 2,485,758 hectares, and 20.36% of the total area needs to be put into use. Each farm in this direction has 2264.1 hectares. The total land area occupied by livestock farming is 70.86% of the total land area occupied by all specialties..

There were no farms operating in the livestock-grain sector.

498 farms operated in the horticulture-viticulture sector, with a total land area of 14,692 hectares and a land use coefficient of 34.15%. The area of unused land is 9,674 hectares, and 65.84% of the total area needs to be brought into use. Each farm in this sector has 29.5 hectares.

The types of specializations currently operating in our Republic, the number of farms operating in the specializations, their total land area (ha), including actively used and inactive land areas (ha), and the average land area per farm (ha) are shown in table 4.1.1. The types of specializations operating in the Republic, the number of farms operating in the specializations, their total land area (ha), including actively used and inactive land areas (ha), and the average land area per farm (hectares).

The total land area occupied by livestock farming is 1.4% of the total land area occupied by all specialties.

In other specialties, 2,054 farms are engaged in production, the total land area of which is 640,448 hectares, and the land use coefficient is 34.15%. The area of unused land is 581,220 hectares, and 65.84% of the total area needs to be put into use. In this direction, each farm has an average of 311.8 hectares.

The total land area occupied by other specialties is 18% of the total land area occupied by all specialties.

4.1.1- table

Recommended specializations for the future, number of farms, total attached land, including land in active use and their land area, hectares.

№	Specialties	Number of households	Actively used cropland, hectares	Other places. hectares	Total attached lands	T.r
1	Cotton and grain growing	2478	215 459	131 287	346 746	139,9
2	Vegetable and melon growing	714	8531	2 147	10678	14,9
3	Grain growing	214	14 285	9 222	23507	109,8
	including rice growing	176	6728	3568	10296	58,5
4	Animal husbandry	1113	34 247	2 485 758	2 520 005	2 264,1
5	Animal husbandry and grain farming	-	-	-		
6	Horticulture and viticulture	498	5018	9 674	14 692	29,5
7	Other specialties	2054	59 228	581 220,0	640 448	311,8
	Total	7071	336 768	3 219 308	3 556 076	502,9

A total of 7071 farms were engaged in production in all directions of our republic, their total land area was 3,556,076 hectares, and the land use coefficient was 9.47%. The area of unused land was 3,219,308 hectares, and 90.53% of the total area should be put into use.

In all directions of our republic, each farm had an average of 502.9 hectares.

The specialties recommended for the future, the number of farms, the total attached land, including land in active use, and their land areas are shown in Table 4.1.2.

If in the previous specializations of farming, including other specializations, 7 different specializations were worked on, then as a result of our scientific research, the number of specializations recommended for the future is 9. In this regard, 1735 farms are currently operating in the promising cotton-grain direction, with a total land area of 242722 hectares and a land use coefficient of 95.8%. That is, the land use coefficient will increase by another 33.67%..

The area of unused land is 10,000 hectares, and there is also a possibility of re-use of 4.11% of the area. In this direction, each farm accounted for 139.8 hectares.

The total land area occupied by the cotton-grain direction is 5.93% of the total land area occupied by all specialties. That is, the total land area occupied by cotton will decrease by 3.18%.

In the vegetable-bean direction, there are currently 823 farms, which will increase by 109. The total land area occupied by the vegetable-bean direction is 12,345, and the land area will increase by approximately 2 thousand hectares. The land use coefficient will be 69.1%. The reason for the decrease in the land use coefficient is that the clean, waste lands allocated for vegetable and melon growing were cleared from fertile lands with thickets and sweet potatoes, which is expected to change for the better soon. The area of unused lands is 2147 hectares, and 17.39% of the total area needs to be brought into further use.

Each farm operating in the vegetable and melon growing direction had 15 hectares.

The total occupied land area in the vegetable and legume growing direction is 3.0% of the total land area occupied by all specialties.

It is planned to operate 328 farms in the grain growing direction. The total occupied land area is 39,360 hectares and the land use coefficient is 61.39%. The area of unused land is 15,039 hectares, and 38.20% of the total area needs to be put into use. Each farm in this direction has 120 hectares.

The total occupied land area in the grain growing direction is 0.096% of the total land area occupied by all specialties.

Currently, 130 farms are engaged in rice production, with a total land area of 5,483 hectares and a land use efficiency of 69.39%, with an increase of 4%. The area of unused land is 1,678 hectares, which is 34.65-30.60% of the total area, and 4.05% of the land is put into active use. In this direction, each farm has 42.17 hectares..

The total land area occupied by rice cultivation accounted for 1.3% of the total land area occupied by all specializations.

In the future planned livestock farming direction, 1,354 livestock farms are operating in production, which is 241 more than the previous number of livestock farms, their total land area is 2,941,234 hectares, which is 421,229 hectares more than the previous situation, and the land use coefficient is 13.42%. The area of unused land is 2,546,367.0 hectares, and 86.57% of the total area can be put into use. Each farm in this direction will have 2,172.2 hectares.

The total land area occupied by livestock farming is 71.87% of the total land area occupied by all specializations.

If there are no farms operating in the livestock-grain direction in our republic, then 32 farms will be created as a pilot project in the specialization intended for the future and a total of 13,600 hectares of land will be allocated to them. Of the allocated lands, 9,600 hectares will be lands in active circulation, and 4,000 hectares will be taken from the reserve. Each farm operating in the livestock-grain direction will have 425 hectares of land.

One of the promising areas of specialization is horticulture and viticulture, in which 562 farms are engaged in production, which is an increase of 64 farms compared to the previous year. The total land area is 19,670 hectares, an increase of 4,978 hectares. The land use coefficient reaches 46.77. The land use coefficient increases by 12.62%. The area of unused land is 10,470 hectares, and 53.22% of the total area needs to be brought into use again. Each farm in this area accounts for 35 hectares.

The number of farms in our republic that have not previously operated, and are engaged in the cultivation and maintenance of new forage and oilseed crops and grain and leguminous crops, is 128, and their total land area is 8,151 hectares. Of these, 3,366 hectares are in active use, which is 41.29% of the total area. The area of unused land is 4,785 hectares, which is 58.70% of the total allocated area..

The average hectares allocated to farms engaged in the cultivation and maintenance of fodder, oilseed and grain crops and legumes is 63.7 hectares.

Also, 50 farms have been established as a pilot in the previously non-operating livestock-farmer cooperation direction, with a total allocated land area of 70 thousand hectares and actively used land areas of 40 thousand hectares. The land use coefficient is 57.14%. There are still 30 thousand hectares of land that are not actively used, which is 42.85% of the total area. The average farm established in the new system is

1,400 hectares.

The total land area occupied in the directions of other specialties is 18% of the total land area occupied by all specialties.

In the future, the types of specializations operating in our Republic, including other areas, will be 9 types, which is 3 more than the previous types of specializations. The total number of farms operating in the specializations is 7,317, and their total land area is 4,092,065 hectares, which is 535,989 hectares more than the previous situation (3,556,076 hectares)..

Compared to the previously operating specialties, the number of specialties recommended for the future will increase to 3 (Livestock and grain farming, fodder and oilseed crops and grain legumes, and livestock and farmer-cooperatives). In the newly established livestock and grain farming, fodder and oilseed crops and grain legumes, and livestock and farmer-cooperatives specialties, +422,038 hectares of land will be added to active turnover, and water and land saved as a result of specialization changes will be used to irrigate them..

4.1.2 - table

Proposed specializations, number of farms, total attached land, including land in active use, and their land area, hectares

T.r	Specialties	Number o farms	Actively use cropland, hectares	Other places. hectares	Total land acquired, hectares	Average land area per farm, hectares
1	Cotton-grain growing	1735	232 722	10 000	242 722	139,8
2	Vegetable-meat growing	823	8531,0	2 147,0	12 345	15
3	Grain growing	328	24 311	15049	39 360	120
	including rice growing	130	3 805	1678	5 483	42,17
4	Livestock farming	1354	394 867,0	2546367,0	2941234	2172,2
5	Livestock-grain growing	32	9600	4000	13 600	425
6	Horticulture-viticulture	562	9200	10470	19 670	35
7	Fodder-oil crops and grain legumes	128	3366,0	4785	8 151	63,7
8	Livestock-farmer-cooperative	50	40 000	30 000	70 000	1400
9	Other specialties	2175	72 930	666 570	739 500	340
	Total	7317	758 806	3 315 739	4 092 065	559,25
		+246	+422 038	+96 431	+535 989	+56,35

4.2. Specialization in livestock farming and organization of territories

In accordance with the Resolution of the President of the Republic of Uzbekistan No. PQ-4512 dated November 7, 2019 "On measures for the accelerated development of the livestock sector in the Republic of Karakalpakstan", the Bozatov, Muynak, Takhtkopir, and Kungir districts of the Republic of Karakalpakstan were transformed into districts specialized in livestock breeding. In these districts, the Republican Commission has allocated a total of 6,621 hectares of arable land and 17,711 hectares of pasture land to a total of 135 business entities that are project initiators for the implementation of projects for industrial breeding of large and small horned livestock, as well as grazing on pastures and hayfields, production of feed for livestock, and processing of livestock products. In fact, a total of 128 business entities have been allocated 10,443 hectares of arable land and 15,700 hectares of pasture land by decisions of district khokims.

During the specialization period, the State Fund for the Support of Entrepreneurship will provide guarantees for up to 50 percent of loans allocated by commercial banks to small business entities, but not exceeding 2 billion soums, as well as a part of the interest expenses on loans allocated by the State Fund to these areas up to 8 billion soums in the form of compensation.

In order to timely fulfill the main tasks of the Commission for the Accelerated Development of Livestock Breeding, the following measures were taken, including the adoption of Resolution No. 362 of the Council of Ministers of November 8, 2019. By this resolution, a program of measures for the development of livestock breeding in the Republic of Karakalpakstan was developed and a special headquarters was established under the leadership of the Chairman of the Council of Ministers. Every Friday, livestock issues will be discussed by the “Commission for the Accelerated Development of Livestock Breeding”.

The minutes of the meetings of the Commission on the development of business initiatives for livestock farming and the wide involvement of the population in the livestock farming sector, the rapid development of livestock farming No. 49 dated November 15, 2019, No. 51 dated November 22, No. 58 dated December 30, No. 32 dated December 17, 2020, No. 20 dated May 22, and No. 19 dated July 31, 2021, provided clear instructions. On December 13-14, 2019, the Ambassador Extraordinary and Plenipotentiary of the Hungarian State Santo Pete and the Advisor for Foreign Economic Affairs Vnik Janosha visited the Takhtakopir and Bozatov districts, which specialize in livestock farming..

As of January 1, 2020, the number of all types of cattle in the Republic of Karakalpakstan, calculated by farms of all categories, was 1 million 095 thousand 338 heads in 2019, and increased by 1 million 109 thousand 625 by 2020. The growth rate is 101.3%, an increase of 14 thousand 287 heads. Including: in farms, the number was 50 thousand 834 heads in 2019, an increase of 52 thousand 294 by 2020. The growth rate is 102.9%, an increase of 1 thousand 460 heads. The number of dehkan (private subsidiary) farms in 2019 was 1 million 035 thousand 874 heads, increasing to 1 million 048 thousand 331 heads by 2020. The growth rate was 101.2%, an increase of 12 thousand 457 heads. The number of organizations carrying out agricultural activities was 8 thousand 630 heads in 2019, an increase of 9 thousand heads by 2020. The growth rate was 104.3%, an increase of 370 heads.

In particular, the number of cows in all categories of farms in the Republic of Karakalpakstan was 302,943 heads in 2018, and by 2019 it increased to 315,346 heads, that is, the growth rate was 104.1%. The number of cows increased by 12,403. In particular: the number of cows in farms was 14,624 heads in 2018, and in 2019 it was 15,607 heads, that is, the growth rate was 106.7%. The number of cows increased by 983 heads. The number of cows in dehkan (private subsidiary) farms was 285,770 heads in 2018, and by 2019 it had increased to 297,100 heads. The growth rate was 104.0%, and the number of cows increased by 11,330 heads.. The number of cows in agricultural organizations was 2,549 in 2018, and by 2019 it increased to 2,639, with a growth rate of 103.5%, an increase of 100 cows. In our republic, the number of cows in all categories of farms was 316,857 in 2019, and by 2020 it increased to 321,047, with a growth rate of 101.3%, an increase of 4,190 cows. Including: in farms, there were 16,729 in 2019, and by 2020, there were 18,114 heads, a growth rate of 108.3%, an increase of 1,385 heads. In dehkan (personal assistant) farms, there were 297,550 heads in 2019, and by 2020, there were 299,991 heads. The growth rate was 100.8%, an increase of 2,441 heads. The number of organizations engaged in agricultural activities in 2019 was 2,578, and by 2020 it had increased to 2,942, an increase of 114.1%, an increase of 364..

The number of sheep and goats in our republic in all categories of farms was 1 million 031 thousand 788 in 2018, and by 2019 it increased by 1 million 087 thousand 106 heads, an increase of 105.4%, an increase of 55 thousand 318 heads.

Including: the number of sheep and goats in farms was

84 thousand 144 in 2018, and by 2019 it increased by 108 thousand 327 heads, an increase of 128.7%, an increase of 24 thousand 183 heads. The number of dehkan (personal assistant) farms was 936,385 in 2018, and increased by 962,856 in 2019, that is, the growth rate was 102.8%, or 26,471 heads. The number of sheep and goats in organizations carrying out agricultural activities was 11,259 in 2018, and increased by 15,923 in 2019. The growth rate was 141.4%, or 4,664.

The number of sheep and goats in the Republic of Karakalpakstan in all categories of farms in 2019 was 1 million 089 thousand 776 heads, and by 2020 it increased to 1 million 135 thousand 088 heads. The growth rate was 104.2%, an increase of 45 thousand 312 heads. Including: in farms

In 2019, there were 112 thousand 094 heads, and in 2020 it increased to 121 thousand 992 heads. The growth rate was 108.8%, and the number of sheep and goats increased by

9 thousand 898 heads. The number of dehkan (personal assistant) farms in 2019 was 963,243 heads, and by 2020 it had increased to 996,611 heads. The growth rate was 103.5%, and increased to 33,368 heads. The number of organizations carrying out agricultural activities in 2019 was 14,439 heads, and by 2020 it had reached 16,485 heads. The growth rate was 114.2%, and increased to 2,46 heads.

The number of horses in the Republic of Karakalpakstan In 2018, the number of horses in all categories of farms in the Republic of Karakalpakstan was 22,052 heads, and by 2019 it increased to 23,394, and the growth rate was 106.1%, to 1,342 heads. Including: in farms, the number was 3,180 in 2018, and by 2019 it was 3,959, and the growth rate was 124.5%, and the number of horses increased by 779 heads.

The number of horses in the Republic of Karakalpakstan in all categories of farms was 23,809 in 2019, and increased to 24,465 in 2020. The growth rate was 102.8%. In farms, there were 4,371 in 2019, and increased to 4,894 in 2020. The growth rate was 112.0% and increased to 523. The number of dehkan (personal assistant) farms in 2019 was 19,072 heads, and by 2020 it had increased to 19,176 heads, a growth rate of 100.5%, an increase of 104 heads. In organizations engaged in agricultural activities, there were 366 heads in 2019, and by 2020, it increased to 395 heads. The growth rate was 107.9%, and the number of heads increased by 29. In dehkan (personal assistant) farms, there were 18,583 heads in 2018, and by 2019, there were 19,070 heads. The growth rate of the number of horses increased by 102.6%, and by 487 heads. In addition, the number of horses in organizations engaged in agricultural activities increased from 289 heads in 2018 to 365 heads in 2019. The growth rate was 126.3%, an increase of 76 heads.

The number of all types of poultry in the Republic of Karakalpakstan in all categories of farms in 2018 was 3 million 871 thousand 369 heads, and by 2019 it increased to 4 million 165 thousand 570 heads. The growth rate was 107.6%, and the number of poultry increased by 294 thousand 201 heads. Including: the number of all types of poultry in farms was 234 thousand 176 heads in 2018, and by 2019 it increased to 236 thousand 348 heads. The growth rate was 100.9%, and the number of heads increased by 2 thousand 172 heads. In 2018, there were 3 million 496 thousand 562 dehkan (personal assistant) farms, and in 2019 there were 3 million 725 thousand 055. The growth rate was 106.5%, an increase of 228 thousand 493 heads. In organizations carrying out agricultural activities, there were

140 thousand 631 in 2018, and by 2019 there were 204 thousand 167 heads. The growth rate was 145.2%, an increase of 63 thousand 536 heads.

Today, in the Kungirot district, the construction of 7 livestock complexes, each designed for 100 heads of pedigree cattle, two-story model houses for 9 workers and 1 silo site has been completed in the livestock cooperative, and now 62 heads of Simmental and Swiss cattle have been brought to Andijan Kungirot Chorvasi LLC and 62 heads of Andijan Nukus Chorvasi LLC for breeding. In parallel, the construction of livestock complexes has been carried out by the societies Agrobiznes Bozatov in Bozatov district, Seit Chorva in Takhtakopir district, Moynaq Kelajagi Bunyodkorlari in Moynaq district, and Gofur Gulom Chorva in Khojaly district.

Collection of information on suppliers of pedigree livestock and technologies, effective communication between project initiators and them was established. In particular, a special group called "Karakalpak breeders" was created on the social network "Telegram". Currently, there are 323 members, of which about 300 are breeders.

In the livestock sector, projects have been formed for the implementation of 236 projects worth a total of 513 billion 38 million soums in 2020 (of which 353 billion 913 million soums are from commercial bank loans).

As of November 1, 2021, 186 projects worth a total of 342 billion 264 million soums (of which 237 billion 479 million soums were fully launched. As a result of the implemented projects, 7,531 heads of cattle, 3,808 heads of sheep and goats, 30 camels, 5,000 poultry, 960 rabbits, and 91 bee colonies were raised, and 977 new jobs were created.

Today, out of 60 projects worth a total of 194 billion 206 million soums scheduled for implementation in 2021, 34 projects worth 101 billion 758 million soums have been implemented. The intensive development of the livestock sector was organized in cooperation with state bodies and public organizations.

By order No. 10 of the State Enterprise "Center for the Development of Seed Production" under the Ministry of Agriculture of the Republic of Uzbekistan dated

October 15, 2019, "Takhtakopir Forage Crops Elite Seed Farm" LLC was established. By the relevant resolution of the Takhtakopir district khokimiyat, this farm was allocated 218.5 hectares of sown land; 200 hectares of pasture land were allocated to the "Bukhara Steppe Pasture Seed Production Scientific and Production Center".

In particular, in 2006-2019, 3,769 heads of pedigree cattle were imported to our republic from foreign countries, while in 2020 alone, 5,643 heads of pedigree cattle and 2,458 heads of sheep were imported from foreign countries and put into breeding. As an example of the continuation of these works, this year a total of 4,137 heads of livestock, of which 2,186 heads of pedigree cattle and 1,951 heads of sheep and goats, were imported from foreign countries. As a result of the import of pedigree livestock from foreign countries, large livestock complexes are being established in each district. This, in turn, creates an environment that arouses the interest of our entrepreneurs operating in the livestock sector.

4.3. Improving the mechanism for organizing pasture areas for livestock

The main source of feed for steppe-pasture livestock is natural pastures, which are used almost all year round. The area of such pastures in Uzbekistan is 20 million ha. Depending on the vegetation cover, soil and climatic conditions, the pastures of Uzbekistan are mainly divided into 3 types: sandy, gypsum steppe pastures and hills. As a result of the continuous use of pastures, a pasture crisis has now occurred in large areas. As a result of the crisis, the vegetation cover of pastures is becoming sparse, and the productivity and nutritional value of pasture fodder are decreasing. To date, the productivity of 9 million ha of pastures has decreased by 20%, 5 million ha of pastures by 30%, and 2 million ha of pastures by 30%. ha pasture decreased by 40% or more

More than 1,200 living gene pools of valuable forage plant species such as izen, teresken, kuyrovuk, camphorosma, chogon, arkato'ot, white and black saxaul are being preserved, and as a result of comparative studies of their ecological, biological, and economic characteristics, selection work is being carried out to create a number of local varieties adapted to growth and high yields in various soil and climatic conditions of the deserts of Uzbekistan.

Pastures are the main source of feed for steppe livestock in our country, and they can be used all year round. However, the current state of Karakul pastures does not meet the requirements for sustainable development of the sector. Because pastures have low productivity, not exceeding 1.5-3.0 centners per hectare in dry mass. Many years of observations show that every ten years there are 3 productive years, 4 average productive years, and 3 low productive years [5]. Pasture productivity and feed quality vary dramatically not only from year to year, but also from season to season. For example, the amount of feed in pastures decreases by 2.5 times by the winter season. The protein content in the feed decreases from 20% to 5.0%, and the protein content from 13% to 4.0% [6]. If 100 kg of pasture feed contains 80-90 feed units in spring, then in winter this figure does not exceed 18.3.

The vast majority of the desert pastures of our country (9-10 million ha) are sandy deserts. The Kyzylkum desert has great potential for the development of karakul, goat and camel breeding, and has a unique soil-climate and vegetation cover. Ephemeral, ephemeroid, semi-shrub, and shrub plants are widespread in the sandy desert. The richness of the plant world compared to other desert pastures, the availability of feed in the pasture at any time of the year further increases the importance of sandy desert pastures. The excellent moisture absorption of sand and the low physical evaporation create favorable conditions for plants. Therefore, the productivity of sandy desert pastures is more stable than that of other types of desert pastures, that is, the mass of dry pasture feed in different years is 1.7-2.4 t / ha. In the sandy steppe pastures, valuable forage species such as ilok, chitir, and tolaqizgaldok, as well as coarse-stemmed herbaceous species such as astragalus, yantoq, shrubs such as aq and qaraksovul, kandim, and cherkez, and forage shrubs such as chogan and singren are abundant. The pastures of the Republic of Navoi, Bukhara, Jizzakh, Khorezm, and Karakalpakstan are mainly located in the Kyzylkum desert.

Assessment of the ecological state of pastures of the Republic of Karakalpakstan The current ecological stability of pastures in the research object was assessed in 7 stages based on 10 indicators.

As a result of studying the natural and climatic conditions of the district, it is recommended to use natural pastures in the district during the following periods of spring, summer and autumn. Taking into account the average air temperature in the district by season, livestock is not grazed on pastures in early spring, late autumn and winter.

In the methodological manual used in practice (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 689 dated 19.08.2019), a feed unit was also taken. Here, these indicators seem to complement each other. However, these indicators differ sharply from each other. Taking into account these aspects, we calculated the grazing duration of the studied pastures by region and determined the grazing capacity for each pasture type in the massifs. The following improved formula is recommended:.

$$N = \frac{(SxFu)x(Dg)x85\%}{m\,x\,n}$$

Here, N - grazing rate of livestock on pasture, s.b.; S - pasture area, ha; F, - feed unit, s/ha; D, - duration of use in the season, %; m - daily feed unit requirement of one conditional head, s.b.; n - duration of grazing in the season, days; 85% is the percentage of pasture feed reserves, with 15% left as an insurance fund for the possibility of deterioration of weather conditions and trampling of the pasture by livestock.

For example, the pasture capacity of the pasture type "165-kovulli-ko‘izukuluqli-rangli" belonging to the 25th pasture type, which occupies an area of 574 ha in the studied district, was determined for the spring, summer and autumn seasons. Here: area (S) - 574 ha; feed unit (Fu) - 2.3 s/ha (in spring), 1.5 s/ha (in summer), 1.3 s/ha (in autumn); duration of use in the season (Dg) - 83.7% (in spring), 100% (in summer), 100% (in autumn); duration of livestock grazing in the season (n) (according to Table 4) 77 days (in spring), 92 days (in summer), 91 days (in autumn).

According to calculations, according to the current formula: 574 ha 165. In the kuvulli-kozikuluogli-color pasture, 1975.8 conditional heads can be grazed in the spring season, 1767.7 conditional heads in the summer season, and 1576.9 conditional heads in the autumn season.

According to the proposed formula: 574 ha 165. In the kuvulli-kozikuluogli-color pasture, 1195.8 conditional heads can be grazed in the spring season, 779.9 conditional heads in the summer season, and 683.3 conditional heads in the autumn season.

Here, according to the difference in productivity and feed unit, calculated according to the current formula, it was found that in spring - 780, in summer - 987.8, in autumn - 893.6 conditional head of cattle is higher than that calculated by the proposed formula.

Therefore, in the scientific organization of the pasture rotation system, determining the livestock capacity per feed unit and organizing the pasture area will have positive effects.

In the lower tier of the adir region of the studied district, there are 12,506.1 ha of pastures, and in the upper tier of the adir region there are 48,196.3 ha of pastures. In the lower tier of the mountain region, 6,730.0 ha of natural pastures are spread, and in the upper tier - 11,291.9 ha. Taking into account the fact that the feed unit and duration of use of pastures in each tier are different in terms of seasons, a pasture rotation scheme was developed for each tier. We will consider the scheme and schedule of rotation (intensive use) using the example of the lower tier of the adir region. A draft of a pasture rotation field for 11 years, divided into 12 plots, was developed for pastures located in the lower tier of the adir region (Figure 2).

It was proposed to carry out land development and design work by dividing one pasture plot into 12 plots in the lower pasture tier of the hilly region and 10 plots in the upper tier, as well as 9 plots in the lower tier of the mountain region and 8 plots in the upper tier..

Calculations show that, on average, each pasture should be designed for 24 hectares. When the pastures have a rectangular shape, the pastures will be grazed evenly by livestock and the field roads and other pasture infrastructure designed for livestock movement on the pasture site will be optimally located. Based on the terrain of the area, the pastures should be designed to be 300 m wide and 800 m long.

Based on the results obtained, an annual grazing schedule for the lower foothill region was drawn up.

The division of the grazing area into 12 pastures is carried out so that each pasture in the lower foothill region is grazed by livestock 5 times in 260 days, depending on the intensity of pasture use. Studies have shown that it takes at least 40 days for the grass cover of pastures to recover for the next period.

The first grazing cycle ends in 63 days and the livestock is returned to the first pasture for grazing. Each pasture is then grazed in the same order. During this time, the grazed areas restore their grass cover. In this way, the livestock goes around each pasture 5 times during the entire season, with each pasture being grazed for a total of 25-28 days during the year.

According to calculations, when using wire mesh to fence 1 pasture plot, a total of 95,462,800 soums are spent, and when using electric wire fences, a total of 78,200,000 soums are spent. Thus, electric wire fences are 17,262,500 soums (18%) cheaper than wire mesh, convenient to use, and durable as a protective device. It is recommended to use them as fencing material for pasture rotation plots in the district. For example, it has been proven that when livestock is fed traditionally, the required pasture area per 1 head of livestock is 2.0, while in rotational grazing, it is 0.4 due to the increased pasture use cycle. In rotational grazing, the utilization of the total potential of the pasture is also high, namely 70-90%. In unsystematic use, a separate pasture area is not allocated for reserves and rest, while in rotational grazing, 20% of the pasture area is allocated for reserves every year and is not used partially or at all. Thus, it has been proven that pasture capacity can be grazed 4 times more than in the traditional method with rotational grazing.

Improved mechanism for organizing pasture areas. Of the 2 main types of pasture use, namely extensive and intensive use, the extensive (volniy vipas) type is widely used in practice in our republic. When designing pastures for extensive use of pasture lands, pasture capacity is determined based on the productivity index, and since the entire productivity of the pasture is taken into account, the risk of degradation processes in the pasture increases.

The prediction of soil types and properties in digital mapping is based on the interaction of soil, factors and soil formation processes, and these are included as variable factors in the general equation for developing digital maps.

The RTX logic is based on this equation[128; 10-25 p.]:

$$\boldsymbol{S}a[x,y,\sim t] \text{ yoki } \boldsymbol{S}c[x,y,\sim t]=f(\boldsymbol{s}[x,y,\sim t], \boldsymbol{c}[x,y,\sim t], \boldsymbol{o}[x,y,\sim t], \boldsymbol{r}[x,y,\sim t], \boldsymbol{p}[x,y,\sim t], \boldsymbol{a}[x,y,\sim t], \boldsymbol{n}) \quad (1.1)$$

whereSa - quantitative soil properties,

Sc - soil taxonomic unit,

s - soil properties at a given point,

c - climate (local climatic conditions),

o - organisms, including human activity,

r - relief, including morphometric features,

r - soil-forming body, lithological structure,

a - time factor,

n - spatial location,

t - time.

Spatial analyses based on the geographic information system were carried out using the ArcGIS 10 program from ESRI. The Geostatistical Analyst, 3D Analyst, Surface Analyst and Model Builder modules and add-ons of this program were used..

CONCLUSION

1. The hydrogeological and reclamation conditions of the soils of the Aral Sea region are not satisfactory. This situation is due to the extreme difficulty of the general groundwater flow, which is facilitated by the weak slope of the delta, the composition of the soil-forming rocks, the complex structure of the soil-soil layer.
2. In the Aral Sea region, it is necessary to take into account the ecological environment of the region when improving the efficiency of land use by improving the specialization of agriculture. The newly studied areas are the salinity of the soils of Takhta-kupir, Bozatov, Nukus-Khojaly, Takhiatash and Muynak districts, and the use of modern innovative technologies and the study of foreign experience in conducting reclamation measures..

3. When comparing the economic efficiency of water-intensive and water-poor crops grown in the agricultural conditions of the Aral Sea region, the yield of water-intensive crops from 1 hectare of cotton was 22.3 t/ha, i.e., the grain yield was 2.23 tons, the profitability rate was 10.47%. Also, the yield of rice was 25 t/ha for grain, the gross yield was 2.5 tons for grain, the profitability rate was 36.2%. For wheat, these indicators were 38.8 t/ha for grain, the gross yield was 3.8 tons for grain, and the profitability rate was 43.4%.

4. It has been scientifically proven that when sorghum, which requires little water, was grown in drought conditions, 28 million 973 thousand soums of income were obtained from 1 hectare, that is, 15 million 112 thousand soums of additional profit was obtained compared to cotton cultivation, 5 million 087 thousand soums of additional profit was obtained from alfalfa cultivation, 6 million 689 thousand soums of additional profit was obtained from sesame cultivation, and 11 million 90 thousand soums of additional profit was obtained from corn cultivation.

5. In conditions of water scarcity, it was proven through calculations in our research that 23 thousand cubic meters of water is saved from crops that require less water compared to crops that require more water, and 29 million 160 thousand soums more income is obtained from crops that require less water compared to crops that require more water.

6. In the planned future direction of livestock farming, 1354 livestock farms are operating in production, which is 241 more than the previous number of livestock farms, their total land area is 2,941,234 hectares, which is 421 thousand 229 hectares more than the previous situation, and the land use coefficient is 13.42%. The area of unused land is 2,546,367.0 hectares, and 86.57% of the total area can be put into use. In this direction, each farm has 2,172.2 hectares..

7. The total income from the main crops grown in the republic - cotton, wheat, rice - amounted to 12 million 691 thousand soums of net profit, and from crops that require little water - corn, sesame, millet, mung beans or beans and alfalfa - 34 million 761 thousand soums of income. The profitability level was 10.7% for cotton and 36.2% for rice, while for mung beans (57.7%), corn (57.4%), beans (53.6%) and sesame (52.9%).

8. In the process of reviewing specialization for the effective use of land in the Republic of Karakalpakstan, it is recommended to further expand the areas of sesame, millet, mung beans, beans, alfalfa and sorghum by 12-15%, along with the main cultivated agricultural crops - cotton, rice, corn, vegetables and melons.

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APPLICATIONS

The results obtained when calculating the economic efficiency of cultivating millet, sesame, sorghum, alfalfa, mung beans, beans, corn, rice, wheat, and cotton on farms in the agricultural conditions of the Republic of Karakalpakstan under water shortage conditions are shown in the following appendices:.

1- app

Results of cotton cultivation in the Republic of Karakalpakstan. (Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from cotton cultivation				
1	Area planted	hectares	1	
2	Yield	centner/hectare	22,3	
3	Total yield	tons	2,23	
4	Average selling price	soum/kilogram	6200,0	
5	Total expected profit	thousand soums	13861,0	
	Average annual water requirement	thousand cubic meters	9,50	100%
	Total leaching	thousand cubic meters	2,50	26,3
	Irrigation during the growing season	thousand cubic meters	7,00	73,7
Total expected cotton expenditure in 2023				
	Total expected costs for 2023	thousand soums	12518	100,0
Including :				
1	Total payroll with ESP 12% calculation	thousand soums	6117,1	48,00
2	YoMM	Kg	238,4	
	By price (8600 soums/kg)	thousand soums	2050,0	16,09
3	Seeds (60 kg/ha)	Kg	60,0	
	Price by price	thousand	252,0	1,98

	(average 4200 soums/kg)	soums		
4	General mineral fertilizers	Kg	1048	
	General account	thousand soums	2599,0	20,39
a	V.T.Ch N nitrogenous (in physical form)	Kg	665,8	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	Kg	172,2	
	Amount (3577 thousand soums)	thousand soums	615,8	
v	K potassium (in physical form)	Kg	210,5	
	Amount (2050 thousand soums)	thousand soums	431,5	
g	Organic fertilizer	thousand soums	224,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	92,64	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	12,75	0,10
6	Mechanization service MTP, MMTP	thousand soums	617,00	4,84
7	SIU Water management service	thousand soums	45,0	0,35
8	Electricity service	thousand soums	51,2	0,40
9	Taxes	thousand soums	300,08	2,35
10	Water tax (100 soums/cubic meter)	thousand soums	950,00	2,98
11	Other expenses	thousand	58,60	0,46

		soums		
12	Unexpected expenses	thousand soums	260,61	2,05
	Price per ton of product	thousand soums	5792,4	
	Net profit (loss)	thousand soums	1343	
	Profitability	%	10,72	

2-app

Results of winter wheat cultivation in the Republic of Karakalpakstan (Accounts and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from wheat cultivation				
1	Area under cultivation	hectares	1	
2	Yield	centner/hectare	38,8	
3	Total yield	tons	3,88	
4	Average selling price	soum/kilogram	4000,0	
5	Expected sales revenue	thousand soums	19920,0	
	Average annual water requirement	thousand cubic meters	7,70	100
	Including salt washing	thousand cubic meters	1,82	23,6
	Watering during the growing season	thousand cubic meters	5,88	76,4
Total expected costs for wheat in 2023				
	Total expected expenditures for 2023	thousand soums	13891	100,0
Shundan :				
1	General wage fund with ESP 12% calculation	thousand soums	1947,4	24,69
2	GWP	Kg	189,5	
	By price (8600 soums/kg)	thousand soums	1630,1	20,67
3	Seeds (60 kg/ha)	Kg	220,0	

	By price (average 4200 soums/kg)	thousand soums	528,0	6,70
4	General mineral fertilizers	Kg	939	
	General account	thousand soums	2324,2	29,47
a	V.T.Ch N nitrogenous (in physical form)	Kg	592	
	Amount (1855 thousand soums)	thousand soums	1097,7	
b	F phosphorus (in physical form)	Kg	167	
	Amount (3577 thousand soums)	thousand soums	596,0	
v	K potassium (in physical form)	Kg	180	
	Amount (2050 thousand soums)	thousand soums	369,9	
g	Organic fertilizer	thousand soums	168,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	92,64	
5	Works and services Agrochemical cartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	690,00	8,75
7	SIU Water management service	thousand soums	45,0	0,57
8	Electricity service	thousand soums	38,4	0,49
9	Taxes	thousand soums	176,00	2,23
10	Water tax (100 soums/cubic meter)	thousand soums	770,00	3,91
11	Other expenses	thousand soums	46,03	0,58

12	Unexpected expenses	thousand soums	143,87	1,82
	Price per ton of product	thousand soums	4000	
	Profit (loss)	thousand soums	6029	
	Profitability	%	43,4	

3-app

Results of rice cultivation in the conditions of the Republic of Karakalpakstan (Accounts and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from rice cultivation				
1	Area planted	hectares	1	
2	Yield	centner/hectare	25,00	
3	Total yield	tons	2,50	
4	Average selling price	soum/kilogram	6000,0	
5	Expected income	thousand soums	15000,0	
	Average annual water requirement	thousand cubic meters	24,60	100,0
	Total leaching	thousand cubic meters	2,20	8,9
	Irrigation during the growing season	thousand cubic meters	22,40	91,1
Total expected expenditure for rice in 2023				
	Total expected expenditures for 2023	thousand soums	14681	100,0
including:				
1	Total payroll with ESP 12% calculation	thousand soums	1634,5	17,44
2	YoMM	Kg	172,4	
	By price (8600 sum/kg)	thousand	1482,8	15,82

		soums		
3	Seeds (60 kg/ha)	kg	200,0	
	Price by price (average 4200 sum/kg)	thousand soums	1040,0	11,09
4	General mineral fertilizers	kg	1124	
	General account	thousand soums	2800,4	29,87
a	V.T.Ch N nitrogenous (in physical form)	kg	666	
	Amount (1855 thousand sums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	kg	248	
	Amount (3577 thousand sums)	thousand soums	886,8	
v	K potassium (in physical form)	kg	211	
	Amount (2050 thousand sums)	thousand soums	431,5	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,10
6	Mechanization service MTP, MMTP	thousand soums	740,00	7,89
7	SIU Water Management Service	thousand soums	106,4	1,14
8	Electricity Service	thousand soums	137,6	1,47
9	Taxes	thousand soums	247,50	2,64
10	Water Tax (100 soums/cubic meter)	thousand soums	2460,00	10,50
11	Other Expenses	thousand soums	46,03	0,49
12	Unexpected Expenses	thousand	145,27	1,55

		soums		
	Cost of 1 ton of product	thousand soums	6000	
	Net profit (loss)	thousand soums	5319	
	Profitability	%	36,2	

4-app

Results of sorghum cultivation in the Republic of Karakalpakstan. (Account books and estimates as of January 1, 2022)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from planting corn				
1	Area sown	hectares	1	
2	Yield per grain	centner/hectare	46,3	
3	Gross yield per grain	tons	4,63	
4	Purchase price of grain	soum/kilogram	3500,0	
5	Yield per stalk	centner/hectare	912	
	Gross yield per stalk	tons	9,12	
	Purchase price per stalk	soum/kilogram	600,00	
	Expected income	thousand soums	28973,0	
Used water				
	Average annual water requirement	thousand cubic meters	5,40	100%
	Including brine washing	thousand cubic meters	1,60	29,6
	Irrigation during the growing season	thousand cubic meters	3,80	70,4
Total expected costs for corn in 2023				
	Total expected expenditures for 2023	thousand soums	18396	100,0
including:				
1	Total payroll with ESP	thousand	2560,6	28,88

	12% calculation	soums		
2	YoMM	kg	193,9	
	By price (8600 soums/kg)	thousand soums	1667,4	18,81
3	Seeds (60 kg/ha)	kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	130,0	1,47
4	General mineral fertilizers	kg	1094	
	General account	thousand soums	2850,8	32,16
a	V.T.Ch N nitrogenous (in physical form)	kg	666	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	kg	248	
	Amount (3577 thousand soums)	thousand soums	886,8	
v	K potassium (in physical form)	kg	180	
	Amount (2050 thousand soums)	ming so‘m	369,9	
g	Organic fertilizer	thousand soums	224,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	630,00	8,75
7	SIU Water management service	thousand soums	36,7	0,57
8	Electricity service	thousand soums	38,4	0,49
9	Taxes	thousand soums	507,10	2,23

10	Water tax (100 soums/cubic meter)	thousand soums	540,00	3,91
11	Other expenses	thousand soums	46,03	0,52
12	Unexpected expenses	thousand soums	173,13	1,95
	Cost of 1 ton of product	thousand soums	3500	
	Net profit (loss)	thousand soums	10577	
	Profitability	%	57,4	

5-app

Results of alfalfa cultivation in the conditions of the Republic of Karakalpakstan.

(Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Expected income from alfalfa for hay in the first year of planting				
1	Area sown	hectares	1	
2	Grain yield	centner/hectares	1,5	
	Average grain selling price	thousand soums/kilogram	50	
3	Hay yield	Tons/hectares	9,54	
	Average selling price	soums/kg	12	
4	Total expected revenue	thousand soums	18948,0	
	Average annual water requirement	thousand/cubic meter	5,60	100,0
5	Total salt leaching	thousand/cubic meter	1,40	25,0
	Irrigation during the growing season	thousand/cubic meter	4,20	75,0
Expected first year alfalfa hay costs for planting for the 2023 crop				

	Total expected spending for 2023	thousand soums	13525	100,0
Shundan :				
1	Total payroll with ESP 12% calculation	thousand soums	1261,8	15,66
2	YoMM	kg	164,0	
	By price (8600 soums/kg)	thousand soums	1410,0	17,50
3	Seeds (60 kg/ha)	kg	200,0	
	Price by price (average 4200 soums/kg)	thousand soums	1040,0	12,91
4	General mineral fertilizers	kg	1124	
	General account	thousand soums	2800,4	34,76
a	V.T.Ch N nitrogenous (in physical form)	kg	666	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	kg	248	
	Amount (3577 thousand soums)	thousand soums	886,8	
v	K potassium (in physical form)	kg	211	
	Amount (2050 thousand soums)	thousand soums	431,5	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemical cartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	690,00	8,56
7	SIU Water Management Service	thousand soums	68,4	0,85
8	Electricity Service	thousand soums	41,6	0,52

9	Taxes	thousand soums	330,00	4,10
10	Water Tax (100 soums/cubic meter)	thousand soums	560,00	2,78
11	Other Expenses	thousand soums	46,03	0,57
12	Unexpected Expenses	thousand soums	134,58	1,67
	Cost of 1 ton of product	thousand soums	1074,2	
	Net profit (loss)	thousand soums	5423	
	Profitability	%	40,1	

6-app

Results of sesame cultivation in the conditions of the Republic of Karakalpakstan.

(Accounts and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from planting sesame				
1	Area planted	hectares	1	
2	Yield	centner/hectares	13,3	
3	Total yield	tons	1,33	
4	Average selling price	Soum/ kilogram	15000,0	
5	Expected income	thousand soums	20550	
	Average annual water requirement	thousand cubic meters	4,20	100%
	Total leaching	thousand cubic meters	0,80	19,0
	Irrigation during the growing season	thousand cubic meters	3,40	81,0
Total expected expenditure for sesame in 2023				
	Total expected expenditures for 2023	thousand soums	13436	100,0
including:				

1	Total payroll with ESP 12% calculation	thousand soums	1921,9	26,54
2	YoMM	Kg	159,3	
	By price (8600 soums/kg)	thousand soums	1370,0	18,92
3	Seeds (60 kg/ha)	Kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	210,0	2,90
4	General mineral fertilizers	Kg	917	
	General account	thousand soums	2519,0	34,79
a	V.T.Ch N nitrogenous (in physical form)	Kg	444	
	Amount (1855 thousand soums)	thousand soums	823,3	
b	F phosphorus (in physical form)	Kg	372	
	Amount (3577 thousand soums)	thousand soums	1330,2	
v	K potassium (in physical form)	Kg	101	
	Amount (2050 thousand soums)	thousand soums	207,1	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	46,3	
5	Works and services Agrochemical cartogram (soil analysis)	thousand soums	9,4	0,13
6	Mechanization service MTP, MMTP	thousand soums	490,00	6,77
7	SIU Water Management Service	thousand soums	24,0	0,33
8	Electricity Service	thousand soums	28,8	0,40
9	Taxes	thousand soums	313,50	4,33
10	Water Tax (100	thousand soums	420,00	2,32

	soums/cubic meter)			
11	Other Expenses	thousand soums	46,03	0,64
12	Unexpected Expenses	thousand soums	140,57	1,94
	Cost of 1 ton of product	thousand soums	4827,4	
	Profit (loss)	thousand soums	7008,9	
	Profitability	%	96,8	

7-app

Results of corn cultivation in the conditions of the Republic of Karakalpakstan.
(Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measure ment	Costs used per hectare	Total %
1	2	3	4	5
Income from planting corn				
1	Area planted	hectares	1	
2	Yield per grain	centner/he ctares	37,6	
3	Gross yield per grain	tons	3,76	
4	Purchase price of grain	Soum/ kilogram	3,5	
5	Yield per stalk	centner/he ctares	907	
	Gross yield per stalk	tons	9,07	
	Purchase price per bushel of stalk	Soum/ kg	13	
	Total expected income	thousand soums	24951	
Used water				
	Average annual water requirement	thousand cubic meters	7,30	100%
	Including salt washing	thousand cubic meters	1,60	29,6
	Watering during the growing season	thousand cubic meters	5,70	70,4

Total expected costs for corn in 2023				
	Total expected spending for 2023	thousand soums	18427	100,0
Shundan :				
1	Total payroll with ESP 12% calculation	thousand soums	2780,6	28,88
2	YoMM	Kg	193,9	
	By price (8600 soums/kg)	thousand soums	1667,4	18,81
3	Seeds	Kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	130,0	1,47
4	General mineral fertilizers	Kg	1094	
	General account	thousand soums	2850,8	32,16
a	V.T.Ch N nitrogenous (in physical form)	Kg	666	
	Amount (1855 thousand soums)	thousand soums	1235,0	
b	F phosphorus (in physical form)	Kg	248	
	Amount (3577 thousand soums)	thousand soums	886,8	
v	K potassium (in physical form)	Kg	180	
	Amount (2050 thousand soums)	thousand soums	369,9	
g	Organic fertilizer	thousand soums	224,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	135,10	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,12
6	Mechanization service MTP, MMTP	thousand soums	630,00	8,75
7	SIU Water management service	thousand soums	36,7	0,57

8	Electricity service	thousand soums	38,4	0,49
9	Taxes	thousand soums	507,10	2,23
10	Water tax (100 soums/cubic meter)	thousand soums	730,00	3,91
11	Other expenses	thousand soums	46,03	0,52
12	Unexpected expenses	thousand soums	173,13	1,95
	Cost per ton of product	thousand soums	492,5	
	Net profit (loss)	thousand soums	6524	
	Profitability	%	35,4	

8-app

Results of millet cultivation in the Republic of Karakalpakstan. (Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from planting millet				
1	Area under cultivation	hectares	1	
2	Yield	centner/hectares	14,9	
3	Total yield	tons	1,49	
4	Average selling price	Soum/ kilogram	4000,0	
5	Total expected revenue	thousand soums	24951	
	Average annual water requirement	thousand cubic meters	3,60	100%
	Jumladan sho‘r yuvishga	thousand cubic meters	0,80	22,2
	Parvarishlash davridagi sug‘orish	thousand cubic meters	2,80	77,8
Total expected costs for millet production in 2023				
	Total expected spending for 2023	thousand soums	7214	100,0
including:				
1	Total payroll with ESP	thousand soums	1851,1	26,85

	12% calculation			
2	YoMM	kg	149,1	
	By price (8600 soums/kg)	thousand soums	1282,1	18,60
3	Seeds (60 kg/ha)	kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	250,0	3,63
4	General mineral fertilizers	kg	903	
	General account	thousand soums	2527,4	36,66
a	V.T.Ch N nitrogenous (in physical form)	kg	420	
	Amount (1855 thousand soums)	thousand soums	780,0	
b	F phosphorus (in physical form)	kg	393	
	Amount (3577 thousand soums)	thousand soums	1404,1	
v	K potassium (in physical form)	kg	90	
	Amount (2050 thousand soums)	thousand soums	184,9	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	46,3	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,14
6	Mechanization service MTP, MMTP	thousand soums	390,00	5,66
7	SIU Water management service	thousand soums	24,0	0,35
8	Electricity service	thousand soums	19,2	0,28
9	Taxes	thousand soums	214,50	3,11
10	Water tax (100 soums/cubic meter)	thousand soums	360,00	2,09
11	Other expenses	thousand soums	46,03	0,67
12	Unexpected expenses	thousand soums	136,97	1,99
	Cost of 1 ton of product	thousand soums	4596,4	
	Profitability	%	37,4	

9-app

Results of mung bean cultivation in the conditions of the Republic of Karakalpakstan.

(Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Income from planting mung beans				
1	Area planted	hectares	1	
2	Yield	centner/hectares	12,2	
3	Total yield	tons	1,22	
4	Average selling price	Soum/ kilogram	10000	
5	Total expected profit	thousand soums	12600	
	Average annual water requirement	thousand cubic meters	3,40	100%
	Total leaching	thousand cubic meters	0,80	22,2
	Irrigation during the growing season	thousand cubic meters	2,60	77,8
Total expected costs for mung bean cultivation in 2023				
	Total expected expenditures for 2023	ming so'm	7986	100,0
including:				
1	Total payroll with ESP 12% calculation	thousand soums	1851,1	26,85
2	YoMM	kg	149,1	
	By price (8600 soums/kg)	thousand soums	1282,1	18,60
3	Seeds (60 kg/ha)	kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	250,0	3,63
4	General mineral fertilizers	kg	903	
	General account	thousand soums	2527,4	36,66
a	V.T.Ch N nitrogenous (in physical form)	kg	420	
	Amount (1855 thousand soums)	thousand soums	780,0	

b	F phosphorus (in physical form)	kg	393	
	Amount (3577 thousand soums)	thousand soums	1404,1	
v	K potassium (in physical form)	kg	90	
	Amount (2050 thousand soums)	thousand soums	184,9	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	46,3	
5	Works and services Agrochemcartogram (soil analysis)	thousand soums	9,4	0,14
6	Mechanization service MTP, MMTP	thousand soums	390,00	5,66
7	SIU Water management service	thousand soums	24,0	0,35
8	Electricity service	thousand soums	19,2	0,28
9	Taxes	thousand soums	214,50	3,11
10	Water tax (100 soums/cubic meter)	thousand soums	340,00	2,09
11	Other expenses	thousand soums	46,03	0,67
12	Unexpected expenses	thousand soums	136,97	1,99
	Cost of 1 ton of product	thousand soums	4596,4	
	Net profit (loss)	thousand soums	4614	
	Profitability	%	57,7	

10-app

Results of bean cultivation in the conditions of the Republic of Karakalpakstan.

(Account books and estimates as of January 1, 2023)

№	Indicators	Unit of measurement	Costs used per hectare	Total %
1	2	3	4	5
Loviya ekishdan olinadigan daromad				
1	Area planted	hectares	1	
2	Yield	centner/hectares	9,9	
3	Total yield	tons	0,99	
4	Average selling price	Soum/ kilogram	1200	
5	Total expected profit	thousand soums	12280	
	Average annual water requirement	thousand cubic meters	3,40	100%
	Total leaching	thousand cubic meters	0,80	22,2
	Irrigation during the growing season	thousand cubic meters	2,60	77,8
Total expected costs for bean production in 2023				
	Total expected expenditures for 2023	thousand soums	7993	100,0
including:				
1	Total payroll with ESP 12% calculation	thousand soums	1851,1	26,85
2	YoMM	kg	149,1	
	By price (8600 soums/kg)	thousand soums	1282,1	18,60
3	Seeds (60 kg/ha)	kg	20,0	
	Price by price (average 4200 soums/kg)	thousand soums	250,0	3,63
4	General mineral fertilizers	kg	903	
	General calculation	thousand soums	2527,4	36,66
a	w.t.ch N nitrogenous (in physical form)	kg	420	
	Amount (1855	thousand soums	780,0	

	thousand soums)			
b	F phosphorus (in physical form)	kg	393	
	Amount (3577 thousand soums)	thousand soums	1404,1	
v	K potassium (in physical form)	kg	90	
	Amount (2050 thousand soums)	thousand soums	184,9	
g	Organic fertilizer	thousand soums	112,0	
d	Plant protection, defoliants, agrochemical laboratory services and their costs	thousand soums	46,3	
5	Works and services Agrochemical cartogram (with soil analysis)	thousand soums	9,4	0,14
6	Mechanization service MTP, MMTP	thousand soums	390,00	5,66
7	SIU Water management service	thousand soums	24,0	0,35
8	Electricity service	thousand soums	19,2	0,28
9	Taxes	thousand soums	214,50	3,11
10	Water tax (100 soums/cubic meter)	thousand soums	340,00	2,09
11	Other expenses	thousand soums	46,03	0,67
12	Unexpected expenses	thousand soums	136,97	1,99
	Cost of 1 ton of product	thousand soums	4596,4	
	Net profit (loss)	thousand soums	4287	
	Profitability	%	53,6	

1-table

Distribution of land fund by land categories in the Republic of Karakalpakstan, regions and the city of Tashkent, thousand hectares (as of 01.01.2023)

№	The name of the areas	Total land area	Shu jumladan							
			Land intended for agriculture	Locations of settlements	Land intended for industrial, transport, communications, defense, and other purposes	Land designated for nature conservation, health and recreation purposes	Places of historical and cultural significance	Forest fund lands	Water fund lands	Reserve lands
1	Republic of Karakalpakstan	16656,1	6242,6	33,5	56,3	2194,9	2,9	6462,6	81,1	1582,2
2	Andijan	430,3	360,8	12,0	20,7	0,6	0,1	11,0	19,0	6,1
3	Bukhara	4183,1	3440,7	7,7	87,0	18,0	0,5	562,7	66,4	0,1
4	Jizzakh	2117,9	1374,2	10,3	27,1	113,9	1,9	275,2	312,1	3,2
5	Kashkadarya	2856,8	2331,0	12,4	67,9	75,1	2,6	326,9	37,1	3,8
6	Navoi	10948,9	7067,1	16,0	61,4	739,3	0,8	2903,4	146,1	14,8
7	Namangan	743,3	488,9	17,6	58,2	0,3	2,5	152,4	23,4	-
8	Samarkand	1677,3	1474,7	19,1	86,6	0,1	0,4	56,3	28,3	11,8
9	Surkhandarya	2009,9	1360,9	11,5	111,8	24,0	0,5	299,1	24,0	178,1
10	Syrdarya	427,6	371,3	7,9	11,7	0,2	-	9,7	26,7	0,1
11	Tashkent	1520,4	748,4	46,0	83,9	25,1	1,9	580,1	17,9	17,1
12	Fergana	675,3	529,5	18,7	51,1	0,4	-	19,2	20,5	35,9
13	Khorezm	608,2	438,1	6,3	18,8	30,5	0,2	79,5	23,4	11,4
14	city of Tashkent	43,5	4,1	12,2	25,2	0,3	0,5	-	1,2	-
	Total	**44892,4**	**26232,3**	**225,8**	**767,7**	**3222,7**	**14,8**	**11738,1**	**827,2**	**1863,8**