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Optimal organization of dry lands in case study of Uzbekistan

S. Ruziboev*, *A.* Mukhumov, *Y.* Usmanov and *Sh.* Babakhulov

"Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National Research University, Tashkent, Uzbekistan

Abstract. The article showed that the internal land development projects, which include the organization of the territory, along with other measures, will give certain positive results in the rational organization of the use of dry land. Land planning projects developed based on land assessment data create an opportunity to optimize areas of arid lands and crops and justify the economic and technical-organizational aspects of the effective organization of agricultural production in these areas. The results of the conducted scientific research confirmed that in organizing the use of dry arable land in the plain region, first, it is of great importance to search for water sources in these areas, including the study of underground water sources and to positively solve the issues of water extraction by digging artesian wells. Using the data of soil monitoring in dry areas, the soil's natural fertility, its production characteristics, and the possibilities of its use in agriculture were considered to organize the agriculture of the region. Special agrotechnology for soils in dry areas was proposed. In this case, the use of secondary resources available in the republic (low-grade phosphorite, non-traditional agro-ores, various wastes) in field conditions on low-productivity lands (credit score below 40); it was recommended to obtain new organ mineral fertilizers by applying biotechnological methods on farmlands. Organ mineral fertilizers are prepared by composting based on manure and low-grade coal phosphorites in a ratio of 9:1 for 4 months. Other organ mineral fertilizers are made because of Angren low-grade coal and Central Kyzyl-Kum phosphorite flour. These fertilizers have been tested in farm conditions. The use of the proposed technology is resource efficient and solves environmental problems. When applying this technology, soil fertility is restored and improved, the amount of organic matter and organic matter in it increases year by year, the cost of mineral fertilizers is 30-40% and more, and the cost of organic fertilizer is 3-4 times allows to reduce. According to the research results, an additional harvest of 10-12 s/h was obtained from winter wheat.

1 Introduction

Optimal organization of dry lands will be important in increasing the efficiency of their use. At the same time, using soil fertility assessment data in the positive solution of these issues

*Corresponding author: ruziboyev@inbox.uz

can give certain results. In particular, the soil's quality determines the potential of arable land in the presence of sufficient moisture in the soil. Factors such as the ability of plants to easily absorb nutrients and the ability of soils to retain these nutrients are particularly important. In addition, the thickness of the soil layer has a major impact on plant roots' growth, while the subsoil's porosity provides the ability to deliver the oxygen needed for plant roots to grow. The soil composition is necessary to facilitate the growth of crops and is inextricably linked with the chemical composition of the soil and the agricultural practices adopted in the region [2]. Finally, the quality of soils is also affected by factors such as the slope of the relief, and the exposure (appearance) of the slope, because in dry areas, erosion processes occur when water flows from the slopes.

Research results and their discussion. Some issues related to the organization of agriculture in the dryland region can be resolved positively using the data of soil assessment in the drylands. In particular, the normative value of arable lands is determined based on soil assessment data. According to the current guidelines, the natural properties of soils and these properties can be justified as the impact on the growth of crop yields and normative net income. Therefore, arable lands are divided into 10 classes according to quality scores, considering their natural fertility, production characteristics, and agriculture use opportunities.

According to the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 235, the quality of soils is based on a 100-point scale, the value of which is 1 point, and this information is expressed in the cadastral calculation of grain yields [1].

Table 1. Cadastral calculation of grain and pea yields on quality scores, ts/ha

Bonitet points	10	20	40	50	60	80	90	100	1 point value, ts/ha
Cadastral calculation of grain and pea yields, ts/ha	2.5	5.0	10.0	12.5	15.0	20.0	22.5	25.0	0.25

2 Materials and methods

The amount of normative net income from lalmi arable land of different quality is found by the following equation:

$$SD_m = YA_m \cdot D_m / 100 \quad (1)$$

here: SD_m is the rate of net income per hectare of land,
YA_m is normative gross product per hectare of land,
D_m is the rate of income of agriculture generated on lands of different quality.
To determine the normative calculation of income in agricultural production, different quality of arable land can be found as a percentage by dividing it by the value of gross output that can be obtained from it (Table 2).

Table 2. Determine normative calculation of income in agricultural production

Bonitet points	Income ratio,%	Bonitet points	Income ratio,%
10	-	60	18
20	6	70	21
30	9	80	24
40	12	90	27
50	15	100	30

The nominal value of one hectare of arable land can be found using the following equation:

$$B_m = SD_m \cdot K_1 / P \cdot 100 \qquad (2)$$

here: SD_m is the normative net income from 1 hectare of arable land; P is interest rate on bank loans for capital, %, K_1 is coefficient of accounting for the level of intensity of management and agricultural production.

The level of intensity of agricultural production is set at 0.8 for the Kashkadarya region.

Of course, the materials for the assessment of arable lands can be used as a primary basis for the positive solution of some agricultural problems, the rational organization of the use of arable lands, and the optimization of the composition of soils and arable lands and taken as the basis in determining tax rates. Therefore, the more accurately the norm is determined, the more accurately the tax rate is determined.

It is necessary to determine the normative value of land as a production resource, considering the quality of agricultural land.

The normative value of agricultural arable land should be determined by the contours of each agricultural land.

To simplify the determination of the normative value of agricultural land, we consider it appropriate to use the following indicators:

- Quality indicators of agricultural land (results of assessment);
- average quality score of agricultural land;
- water supply coefficient;
-regional coefficient;
-crop loss coefficient.

Determining the normative value should consider the intensity of agricultural production on the contours of agricultural arable land, soil quality, the structure of arable land, and the method of drainage for irrigation (water by its own flow or machine method).

It is recommended to use the following formula when calculating the basic normative value of agricultural land:

$$Sn = BB \; x \; O'B \; x \; MK \; x \; SK \; x \; XN \qquad (2)$$

here: Sn is normative value of irrigated arable land (UZB soums); BB is land quality score (0-100); OB is the cost of 1 point based on calculations; MK is regional coefficient; SK is the water supply coefficient. XN is the crop loss calculation coefficient if agricultural crop fields are located in protected areas where chemicals are prohibited.

3 Study area

In the study of the Yakkabag district, which was selected as the object of scientific research, the dry lands are located in plains, hills, foothills, mountains, and high mountains (Fig. 1).

Of the 258.7 thousand hectares of arable land in the plains of the Kashkadarya region, 31.0 thousand hectares, or 12.0%, are located in these areas, and agricultural crops are planted in two periods: autumn and spring. It is known that cereals sown in autumn yield more than in spring, so 85-90% of crops are sown in autumn.

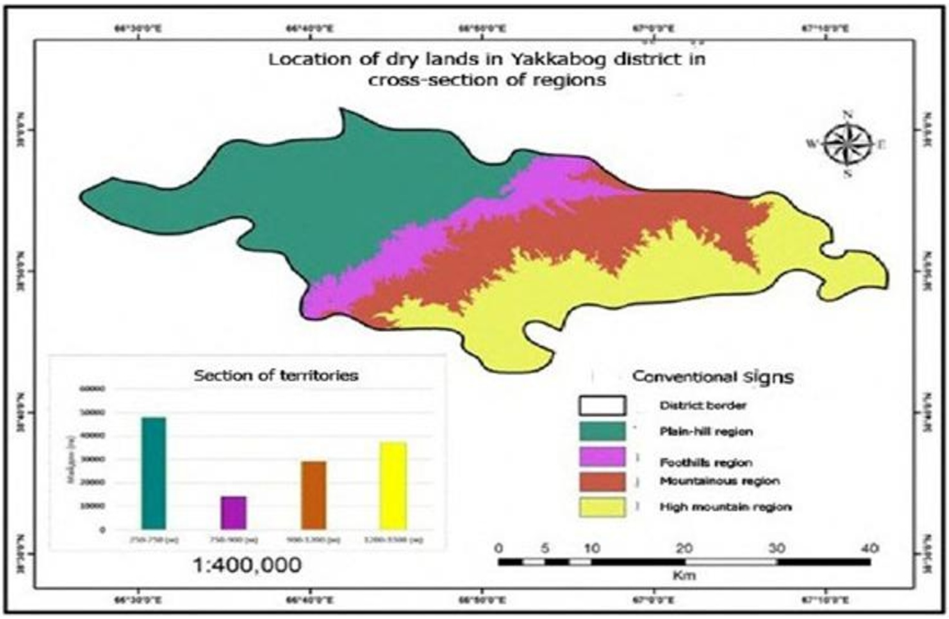

Fig. 1. Study area regional distribution of dry lands in Yakkabog district.

Some factors need to be considered in land management projects for dry land areas. One such factor is the state of land degradation.

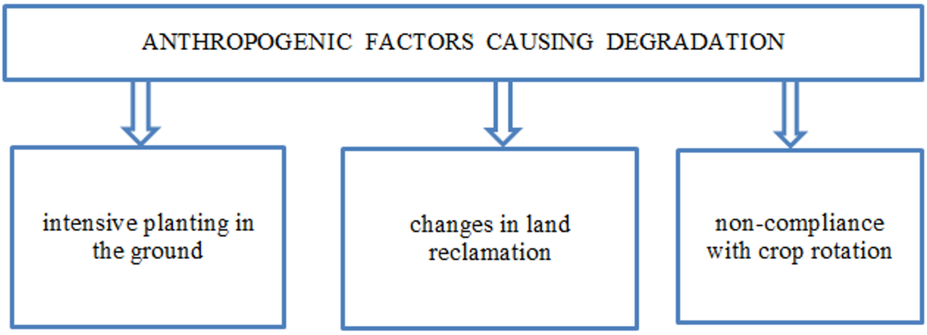

Fig. 2. Anthropogenic factors causing degradation in dry lands

Our research has shown that land degradation is more caused by the anthropogenic impacts shown in Figure 2 than by natural factors (precipitation, water and wind erosion, etc.).

4 Results and discussion

The results of scientific research show that in the organization of arable lands in the plains (not supplied with moisture), first of all, the search for water sources in these areas, including the study of groundwater sources and artesian wells, is of great importance. Calculations show that by digging one artesian well for every 20.0-22.0 hectares of arable land in these areas, it is necessary to create a source of irrigation water and to plant and cultivate dry wheat, peas, vegetables, and legumes in these areas can do. For example, the area of dry lands in the K. Ashurov massif is 340.4 hectares (Figure 1). By digging 10 artesian wells in this area, conditions for planting wheat on 100.2 hectares, vegetables on 57.5 hectares, melons on 65.5 hectares, and molasses on 117.2 hectares and growing agricultural products will be created. Data on the volume and total value of products imported from this region are given in Table 3.

Table 3. Calculation of volume and value of agricultural products

№	Agricultural crop	Area, ga	Productivity, ts/ha	yield, t	Price of 1 ton of product, thousand soums	Total cost, million soums
1	Wheat	100.2	7.0	70.1	2000	140200
2	Sesame	117.2	12.0	140.6	4000	562400
3	Vegetables	57.5	7.8	44.8	5000	224000
4	Melons	65.5	7.0	45.8	5000	22900
	total	**340.4**				**1155600**

From the data in Table 3, it can be seen that the total value of agricultural products is 1155,600 mln. soums.

In this case, first of all, assisting the farm in digging artesian wells will be necessary. Calculations show that the cost of building wells in the organization of crop production with the release of water to dry lands by digging artesian wells will be covered in 2 years and will begin to bring additional income. Most importantly, there will be an opportunity to increase land use efficiency, radically increase the volume of food production, and provide employment.

Using soil protection technologies significantly reduces soil tillage, crop rotation, mulching, protects the topsoil and reduces the rate of mineral fertilizers, and significantly improves soil quality through organic and organomineral fertilizers.

The main technical functions of this technology are: significantly reducing the number of tillage, protection-mulching of the topsoil, and adherence to crop rotation restores degraded lands.

In Lalmikor farming, winter wheat and legumes are grown using this technology.

Experts [3,4] point out that one of the technologies that protect the soil and retain moisture in the arid conditions of the region's dry lands is to plant crops directly without tillage, which is new for our agriculture but widely used worldwide. This technology is resource-efficient, increasing soil fertility. This method of sowing crops, especially wheat, moss, triticale, corn, sunflower, soybeans, sesame, and others, is effective and grows well-directed. The essence of resource-saving technology is to have minimal impact on the soil, to protect the topsoil through permanent vegetation or mulching, and to plant alternately.

Before applying resource-saving technology, farms should analyze the soil composition details of the selected area. The subsoil should be loosened with a deep softener when preparing the field. This improves the development of the root system of plants and allows the use of nutrients.

It is recommended to use special laser devices to level the top layer of soil, i.e., to level the field areas and create maps.

When using this technology, the seeds of cereal crops are sown using untreated or very poorly treated (up to planting depth) softened soil using a special seeder. This reduces the mechanical impact on the soil and its compaction. At the same time, the cost of energy materials and cocktails is reduced.

According to the data, the amount of organic matter in the country's main part of arable lands is low. There are currently several methods that improve the amount of soil organic matter. One of them is mulching, i.e., protecting the top layer of soil, legumes, and cereals, leaving plant residues on the soil surface.

It is known that intensive cropping without the use of crop rotation leads to the deterioration of soil performance [5,6,8,11]. This problem can be solved by implementing an acceptable method of crop rotation.

The following agrotechnologies are offered for arable and degraded soils: use of secondary resources available in the country in low-yielding lands (quality score below 40) in field conditions (low-grade phosphorites, non-traditional agro-ores, various wastes); obtaining new organomineral fertilizers through the application of biotechnological methods on farmlands. Organomineral fertilizers are prepared based on manure and low-grade coal phosphorites by composting in a ratio of 9: 1 for 4 months. Other organomineral fertilizers are prepared based on Angren low-grade idol and Central Kizilkum phosphorite flour. These fertilizers have been tested experimentally under farm conditions. The application of the proposed technology is resource-efficient and solves environmental problems. With the implementation of this technology, soil fertility is restored and improved, the amount of organic matter and nutrients in it increases from year to year, the cost of mineral fertilizers can be reduced by 30-40% or more, and organic fertilizer consumption by 3-4 times. According to the research results, 10-12 ts/ha of additional yield was obtained from winter wheat.

According to the results of a study conducted at the farm "Abdurazzakov Asliddin" Yakkabag district of Kashkadarya region, the actual economic effect of the introduction of resource-saving technologies for the cultivation of winter wheat (zero) has been identified. Primary accounting documents and normative-technological map data were used to calculate efficiency.

Top with cereals as a base for comparison, the traditional drive-based technology of the rish was selected. In zero technology, the seeds of cereals were sown using a special seed drill into the uncultivated or slightly loosened (at the level of sowing depth) soil. Using these combined aggregates reduces the mechanical impact on the soil and its compaction due to the harmonization of technological operations. This will reduce energy, material, and labor costs in growing cereals.

The agro-technical requirements for zero tillage require the creation of machines and equipment that meet the quality of its transfer in different soil-climatic conditions. In this case, the calculations were made considering using machine-technological complexes of the machine-tractor park in the study area. This park provides mechanization services for agro-technical activities.

Options for winter wheat cultivation technologies include basic and pre-sowing tillage and various fall sowing methods. Crop care, application of chemicals, grain harvesting, and processing of non-frost parts of the crop remain the same for all technologies. Technological operations required for the cultivation of winter wheat on the farm, the specifics of the local conditions of the units, as well as unified methods of growing and harvesting grain in the same type of work, increase productivity, reduce the harmful effects of harvesters on the soil and agricultural production in 2011-2016. taking into account the improvement of the technical level of the machine and technology system for complex mechanization. Operating costs are calculated to perform the technological processes using the main machines, which are shown in Table 4.

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Table 4. Operating costs of winter wheat cultivation (per 1 hectare)
(Calculated by the author based on 2019 prices)

№	Type of work	Technology			
		traditional		No-till	
		soum	%	soum	%
1	Basic tillage of the soil	50000	27.7	-	-
2	Pre-sowing work and planting	20000	11.1	20000	17.4
3	Crop care	30000	16.6	15000	13.0
4	Harvesting	80000	44.4	80000	69.5
	Total costs	180000	100	115000	100
5	Fuels and lubricants	177190		77978	
	Total operating costs	357190		192978	

The main document reflecting the technological operations of grain growing, resource, and labor costs are normative-technological maps. Based on these maps, operating costs are calculated, which are a complex item of the cost of growing cereals and account for 30-40% of the cost.

Operating costs for labor and fuel were calculated based on agreed prices for mechanized services of the district MTP, considering the implementation of all technological operations for cultivating winter wheat based on the technological map.

According to Table 4, the highest operating costs per hectare of arable land for cultivating and harvesting winter wheat were 357,190,000 soums using traditional technology and 192,978,000 soums with zero technology.

This was achieved due to a reduction in tillage operations, which accounted for 27.7 percent.

Specific costs remain constant for both technologies. Other costs are 2% of direct costs, which are 3,600 soums in traditional technology and 2,300 soums in zero technology.

One of the most effective herbicides to protect plants from weeds on irrigated and non-irrigated lands is 75% Granstar, which is applied from 10 to 20 grams per 1 hectare.

Indicators of the economic evaluation of technologies are given in Table 5. The fact that the cost-effectiveness of growing winter wheat on zero technology is higher than traditional technology testifies to the usefulness of the use of resource-saving technologies. For the economic evaluation of the technology, the total cost, profit, profitability, and additional indicators of winter wheat cultivation were calculated. The differences in cost were due only to changes in the cost of tillage, and the cost of seeds and fertilizers was assumed to be the same. The cost of plant protection products is doubled for the first and second years on zero technology. In comparative economic evaluation, traditional technology was selected as the base technology. Profit growth, which is a key economic indicator in no-till technology, is as follows:

$$ISn = Fya - Fa = 331995 – 48992.3 = 380987.0 \text{ soum}$$

where: ISn is the cost-effectiveness of zero technology; Fa, Fya are profit from conventional and no-till technology, respectively, sum.

Data on increased profits show that growing winter wheat on a farm is more economically viable using no-till technology (Table 5).

Table 5. Indicators of economic evaluation of winter wheat cultivation technologies on 1 hectare of land

№	Indicators	Unit of measurement	Technology	
			traditional	No-till
1	Productivity	ts/ha	10.0	15.0
2	Production volume	t	1.0	1.5
Production costs				
3	Cocktail expenses		140000.0	140000.0
4	Seed	sum	110110.0	110110.0
5	Mineral fertilizers	sum	27198.3	27198.3
6	Costs of plant protection	sum	8153.6	16307.2
7	Operating costs	sum	180000.0	115000.0
8	Fuel costs	sum	177190.4	77978.9
9	Other expenses	sum	3600.0	2300.0
10	Total costs	sum	646252.3	488894.4
11	Product cost	sum	646252.3	325929.6
12	Sale price	sum / t	447260.0	447260.0
13	Product value	sum	447260.0	670890.0
14	Benefit	sum	-48992.3	331995.6
15	Economic efficiency	sum		380987.8
16	Profitability	%	-7.6	67.9
Additional indicators				
16	Labor costs for 1 ha	person/day	1.7	1.23
		sum	29240	20292
17	Labor costs for 1 ha	person/hour	0.24	0.18
		sum	4177	2898
18	Labor costs for 1 ts	person / hour-t	0.023	0.011
19	labor productivity	sum / person-hour	107.1	231.4
20	Fuel consumption	l / ga	84	37
21	Coverage period	year		5.03

Winter wheat yields 5 ts/ha higher than traditional technology; grain cost is 2.3 times lower than zero technology. The payback period of the FANKHAUSER drill was calculated based on the book value amount and the decrease in operating costs for mechanized work compared to previously used machines and depreciation allowances, and the payback period was 5.03 years.

Based on the calculated parameters, it is recommended to cultivate wheat on dry lands with conditions with a yield of more than 20 ts/ha.

When using zero tillage technology in wheat cultivation, the yield is 15 ts/ha, and the yield is 67.9%, while in traditional technology, the yield is 10 ts/ha, and the yield is -7.6%.

The economic assessment results, which included labor and fuel costs, showed the advantage of zero technology.

In some of the lands in the Adir region (partially supplied with moisture), it is possible to use the experience gained in using arable lands in neighboring Afghanistan and Iran. The study of scientific sources shows that this method produces 220.0 - 250.0 quintals of melons per hectare from the dry lands of the Adir region of these countries, which was previously widely used in some regions of the country (Khorezm, the Republic of Karakalpakstan). In addition, the placement of lalmi, water-resistant wheat, and sorghum crops on the part of the arable lands of this region gives good results.

In the Yakkabag district, the area of arable lands is 129.35 thousand hectares which are used as pasture or lalmi crops. Due to the low level of rainfall, productivity on dry lands does not always justify the costs, and pastures are degraded and degraded due to repeated grazing. Restoration of the landscape of the foothills and lowland foothills can be done by planting the pistachio tree seedlings, which can germinate and bear fruit in extremely dry conditions.

Handon pistachio cultivation technology traditionally begins with soil preparation (plowing. Chiseling); before planting, piles are driven into the planted areas according to the scheme 6x8 m (planting density 208 pcs / ha). To prevent the animals from being fed, rosehips are planted around the plantations and surrounded by barbed wire. After 2-3 years, the rosehip itself becomes a barbed wire fence, and the wire is used for other plots. Post-sowing irrigation is carried out at the rate of 1.5-2 liters of water per plant, and during the three months of summer, irrigation is carried out in a primitive way from plastic containers 3-5 times a month. For semi-arid lands (300-500 mm/year) with rainfall, irrigation is carried out only in the first two years. Drought-resistant crops (safflower, peas, alfalfa) are grown between rows of plantations in the first 8 years, which covers the initial costs to some extent. The amount of mineral fertilizers applied is 290 kg/ha (N 33-34.5%) for ammonium nitrate and 220 kg/ha (P 45%) for superphosphate. To accelerate fruiting in the last 3–4 years after planting, pistachio tree seedlings are grafted with the selected variety.

5 Conclusions

The results of the study show that in organizing the use of arable lands in these four regions of the Yakkabag district of the Kashkadarya region, it would be more appropriate to take the composition of land and crop types in the compositions mentioned above for the respective regions. At the same time, of course, the use of land assessment materials, particularly the data of soil assessment distributed in dry areas, gives good results. The establishment of industrial plantations from selected pistacia forms will increase forest productivity and, in turn, economic efficiency. Because the productivity of each form is different, the economic benefits derived from them will also vary. Economic efficiency was determined by the amount of income and expenses incurred from the additional crop. The main costs in calculating economic efficiency were the cost of preparation and welding of welds and welds. The remaining costs (maintenance and agrotechnical measures) were not considered because they were the same. The optimal planting scheme for establishing pistachio plantations in dry conditions is 8x6 m. There will be a total of 192 trees per hectare. Of these, if 1 pollinator tree is placed on 7 seed trees, a total of 168 fruit-bearing seed trees will be placed.

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