Научная статья

Original article

УДК 332.365

DOI:10.24412/2588-0209-2021-10424

THE PROJECT OF ON-FARM LAND MANAGEMENT AS THE MAIN TOOL OF AGRICULTURAL LAND USE

ПРОЕКТ ВНУТРИХОЗЯЙСТВЕННОГО ЗЕМЛЕУСТРОЙСТВА КАК ОСНОВНОЙ ИНСТРУМЕНТ СЕЛЬСКОХОЗЯЙСТВЕННОГО ЗЕМЛЕПОЛЬЗОВАНИЯ

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Abstract. The statistics of the World Bank show the importance of the development of agricultural production in rural areas of the Republic of Kazakhstan, where more than 40% of the country's population lives and the number of rural population slowly continues to grow further. Land use in Kazakhstan has its own differences from other countries, for

example, the Russian Federation, as well as in the world as a whole, which is quite understandable for various objective reasons. In Kazakhstan, there is almost twice as much arable land per person as in Russia and nine times more than in the world as a whole. The main agricultural production is concentrated on the areas of medium and large rural producers; therefore, based on this economic reality, land management in Kazakhstan should play a particularly important role in the development of agriculture in these organizations. Selection of optimal solutions based on the preparation of the project of on-farm land management and crop rotation system, increasing the economic efficiency of agricultural land use taking into account environmental indicators by organizing land use. The results of the study are given on the example of the production cooperative "Kazakhstan", Merke district, Zhambyl region.

Аннотация. Статистика Всемирного банка показывает важность развития сельскохозяйственного производства в сельской местности Республики Казахстан, где проживает более 40% населения страны и численность сельского населения медленно продолжает расти. Землепользование в Казахстане имеет свои отличия от других стран, например, Российской Федерации, а также от мира в целом, что вполне объяснимо по разным объективным причинам. В Казахстане пашни на душу населения почти вдвое больше, чем в России, и в девять раз больше, чем в мире в целом. Основное сельскохозяйственное производство сосредоточено на площадях средних и крупных сельских товаропроизводителей; поэтому, исходя из этой экономической реальности, землеустройство в Казахстане должно играть особенно важную роль в развитии сельского хозяйства в этих организациях. Подбор оптимальных решений на основе подготовки проекта системы внутрихозяйственного землеустройства и севооборота, повышения экономической эффективности использования земель сельскохозяйственного назначения с учетом экологических показателей за счет организации землепользования. Результаты исследования приведены на примере производственного кооператива «Казахстан» Меркинского района Жамбылской области.

Keywords: agriculture, land use, land management, crop rotation, on-farm project, Kazakhstan.

Ключевые слова: сельское хозяйство, землепользование, землеустройство, севооборот, внутрихозяйственный проект, Казахстан.

Introduction

Agriculture of Kazakhstan, integrated into the agro-industrial complex, is one of the important sectors of the economy, which forms the food and economic security of the country, as well as the labor and settlement potential of rural territories [1]. Compared to other countries, Kazakhstan has a low share in the world's agricultural land (2.1%), but the country has a share of arable land close to the global average (10.9%). Table 1 also shows other indicators related to the development of Kazakhstan in the field of land use and the rural environment. It should be particularly noted that organic agricultural products are one of the important competitive advantages of the agricultural sector of the economy of Kazakhstan [2]. The country has good prospects for the development of agriculture, for example, the area of arable land per person, although it has decreased by about 20% over the past 18 years, nevertheless amounts to 1.63 hectares, which is almost twice as much as in Russia and nine times more than in the world.

Table 1 - Development Indicators: Land Use and Rural Environment

Indicators		Years	Kazakhstan	Information for comparison:	
				Russia	World
Rural population, % of total		2000	44	27	53
		2018	43	26	45
Rural population growth (annual %)		2018	1.1	-0.6	0.1
Land area, sq. km thousands		2018	2,699.7	16,376.9	127,343.2
Land use	Forest area, % of land area	2000	1.2	49.4	31.2
		2018	1.2	49.8	30.7
	Permanent cropland, % of land area	2000	0.1	0.1	1.1
		2018	0.0	0.1	1.3
	Arable land, % of land area	2000	11.2	7.6	10.8
		2018	10.9	7.5	11.1
Arable land, hectares per person		2000	2.03	0.85	0.22
		2018	1.63	0.84	0.18

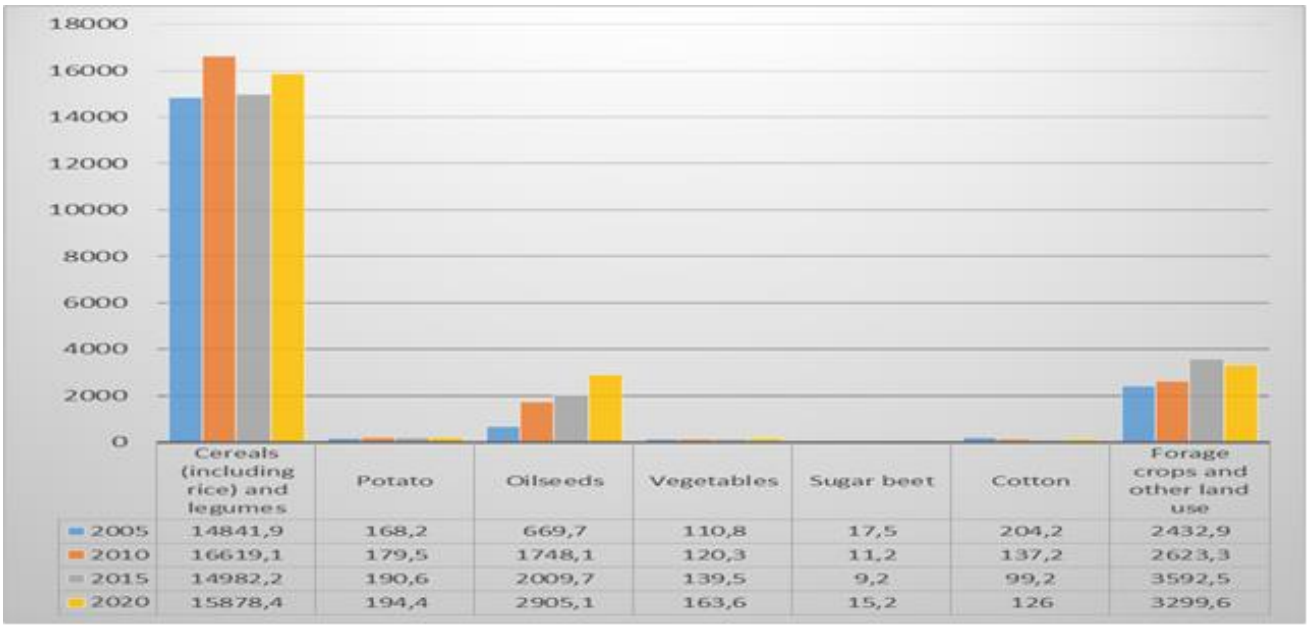
In the search for ways of rational land use, preservation of soil fertility and habitat, it is impossible to do without an integrated approach to the territorial organization of agricultural production. The creation of a land use management system that ensures the sustainable development of land use requires careful justification and verification of previously developed projects.

Research methods and materials

The purpose of the scientific work is to increase the economic efficiency of land use through the scientifically based organization of the use of agricultural land and the preservation of environmental sustainability objectives (using the example of a typical economic object in Kazakhstan). Research objectives: general analysis of indicators of land use and development of rural areas of Kazakhstan, development of projects of on-farm land management based on the expertise of existing resources and the organization of economic land use, ensuring environmental safety and increasing the competitiveness of the studied economy. Various forms and methods of research were used in the work. The object of the study is the production cooperative "Kazakhstan", one of the largest farms in the Merken district of Zhambyl region. The main type of management is crop production; an additional type of activity is dairy farming and some others. The study used a consistent approach to a comprehensive assessment of land management measures related to agricultural production and land protection, based on such research methods as economic and statistical, computational and constructive, computer-aided design of land management and others. The authors thank Kazakh, Russian and scientists from other countries whose articles helped in achieving the goals and objectives of the study.

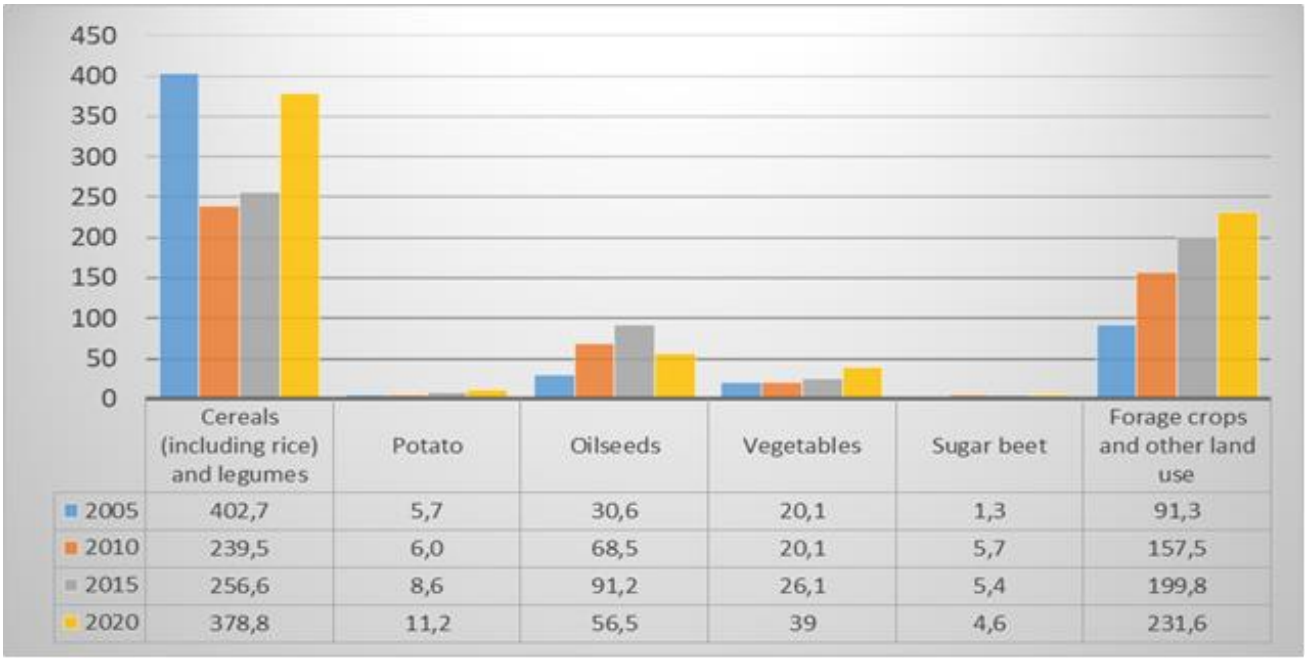
The research conducted under the leadership of T.I. Espolov comprehensively examines the current state of land use in Kazakhstan. Scientists point out that one of the main reasons for inefficient agricultural land use is a universal approach instead of individual land use planning, which also includes landscape characteristics of the land [3]. Land use planning tools and methods should help land users to choose land use and management options that increase their productivity, support sustainable agriculture and food systems, and meet the needs of society in harmony with the environment [4]. C. H. Murray notes that land-use planning guidelines can be adapted to local conditions, for

example, by listing the needs, tasks and responsibilities for a particular project [5]. There is a relationship between inter-farm and intra-farm land use, which is manifested in the common goal - the creation of an organizational and territorial basis for the rational use and protection of land resources [6]. It is important, according to some scientists, to conduct, in particular, a complete inventory of agricultural land, for the complex spatial organization of agricultural production and the development of optimal solution of land management project [7]. The on-farm land management project should contribute to the development of agrobiodiversity from monocultures to healthy agroecosystems by integrating physical, biological, social and economic needs [8]. According to some scientists, the need to develop on-farm land management projects will increase more and more every year due to the accumulating negative processes in land use [9]. In addition to guaranteeing the preservation of the ecological balance, land-use planning projects also allow analyzing the role of institutional strengthening, the reliability of financial and managerial structures, the availability of human resources, the focus of research, technology transfer and network improvement [10].



	Cereals (including rice) and legumes	Potato	Oilseeds	Vegetables	Sugar beet	Cotton	Forage crops and other land use
2005	14841,9	168,2	669,7	110,8	17,5	204,2	2432,9
2010	16619,1	179,5	1748,1	120,3	11,2	137,2	2623,3
2015	14982,2	190,6	2009,7	139,5	9,2	99,2	3592,5
2020	15878,4	194,4	2905,1	163,6	15,2	126	3299,6

Figure 1 - Sowing areas of crops in Kazakhstan (thousands of hectares)



	Cereals (including rice) and legumes	Potato	Oilseeds	Vegetables	Sugar beet	Forage crops and other land use
2005	402,7	5,7	30,6	20,1	1,3	91,3
2010	239,5	6,0	68,5	20,1	5,7	157,5
2015	256,6	8,6	91,2	26,1	5,4	199,8
2020	378,8	11,2	56,5	39	4,6	231,6

Figure 2 - Sowing areas of crops in Zhambyl region (thousands of hectares)

The sowing area of Kazakhstan in 2020 amounted to 22582.3 thousand hectares, thus it increased by 4137.1 thousand hectares compared to 2005. The total increase in acreage of 22.4% was mainly due to 1036.5 thousand hectares of cereals (including rice) and legumes, 2235.4 thousand hectares of oilseeds, 866.7 thousand hectares of fodder crops and other land use, as well as other insignificant changes in the structure of acreage. There is a tendency to decrease the share of cereals (including rice) and legumes in the structure of sown areas over a 15-year period - from 80.5% in 2005 to 70.3% in 2020. Nevertheless, this group of agricultural crops continues to occupy a significant share, which cannot be considered optimal in the structure of sown areas.

Zhambyl region is one of the important agricultural zones of Kazakhstan. The sowing area of Zhambyl region in 2020 amounted to 721.7 thousand hectares or 3.2% of the corresponding area of the country. These indicators in 2005 were respectively 532.6 thousand hectares and 2.9%, which shows a positive trend in the development of crop production in the region. The share of Zhambyl region is not as high as in some other regions of Kazakhstan, for example, Kostanay region has 23.3% of the country's sowing area, Akmola region has 21.9%, North Kazakhstan has 18.9%.

Zhambyl region can be recognized as a good example for other regions of Kazakhstan regarding the improvement of the structure of sowing area and the use of on-

farm land management projects as an effective tool for agricultural land use. In this region, during the analyzed period from 2005 to 2020, the area of potatoes increased 2 times, oilseeds - 1.8 times, vegetables - 1.9 times, sugar beet - 3.5 times, fodder crops and other land use - 2.5 times. During the same period, the area of cereals (including rice) and legumes decreased slightly from 402.7 thousand hectares to 378.8 thousand hectares. Thus, there is a better placement of crop rotations in the development of arable land in Zhambyl region compared to some other regions of Kazakhstan.

Figures 3 and 4 more clearly show the structure of the acreage of Kazakhstan and Zhambyl region, the data obtained confirm the conclusions we have previously formulated.

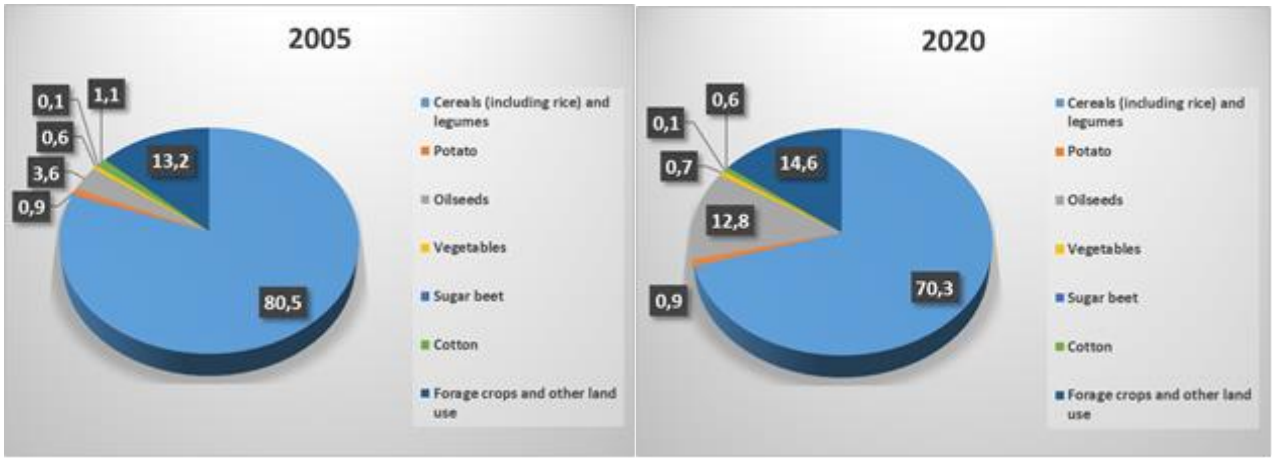


Figure 3 - Structure of sowing areas in Kazakhstan (%)

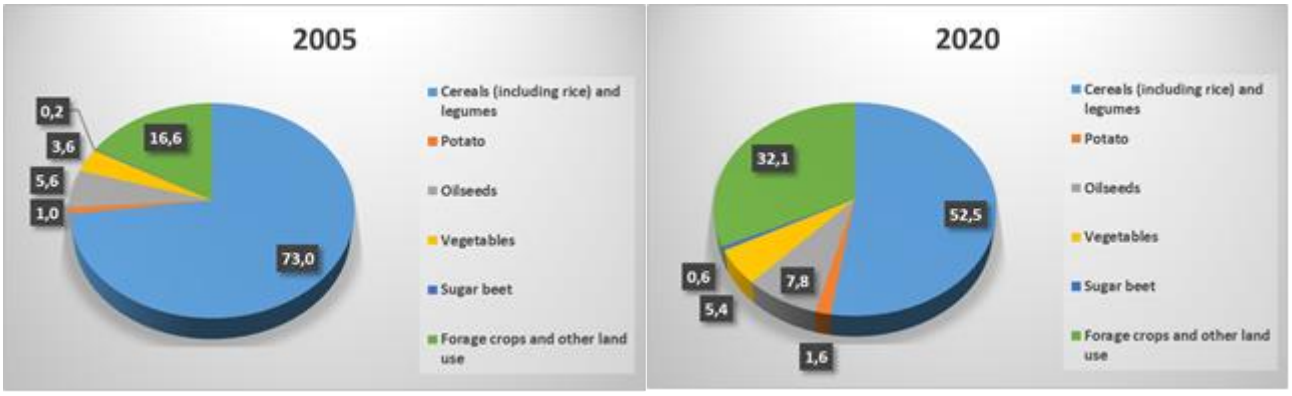


Figure 4 - Structure of sowing areas in Zhambyl region (%)

Land management is the basis of the land resources management mechanism, which allows to preserve sustainable and natural agricultural landscapes by organizing on-farm

work, rational use and protection of land [11]. It is generally recognized that land as the main natural resource, characterized by various quantitative and qualitative characteristics and including the existing natural special force, has a great influence on the development of the territory of an agricultural enterprise.

Results and discussion

The purpose of the land management project is to increase the economic efficiency of land use through the scientifically based organization of the use of agricultural land and the preservation of environmental sustainability objectives.

To achieve the goal, it was necessary to solve the following tasks: conducting an examination of the natural and economic conditions of the production cooperative "Kazakhstan"; developing projects of on-farm land management based on the examination of existing resources and the organization of economic land use; ensuring environmental safety and increasing the competitiveness of the economy, etc.

The object of the study is the production cooperative "Kazakhstan", one of the largest farms in the Merken district of the Zhambyl region. The main type of economy is agriculture, an additional type of direction is livestock and dairy [12]. The study used the computational and structural method, the method of computer-aided design of land management and a consistent approach to a comprehensive assessment of land management measures related to the production of agricultural products and land protection.

At the moment, according to the land management plan, the total land area is 9089 hectares, including arable land - 5567 hectares, hayfields - 80 hectares, pastures - 2845 hectares.

To increase the area of the most intense field, we use the transformation of the area of the land plot. The converted area is 230 hectares, the transformation is carried out by converting pastures into arable land. The payback period for capital investments in the development of arable land is 3 years.

The value of the project on the organization of land use consists in a comprehensive justification of design decisions, the essence of which is as follows: the project must be prepared technically correctly, legally competent and economically profitable, have the

ability to withstand negative impacts (reduction of soil fertility, deterioration of environmental requirements, etc.) [13-15].

The structure of sown areas depends on the type and humus of the soil, agricultural crops capable of obtaining high yields were designed on the most fertile lands (Tables 2, 3).

Table 2 - Placement of crop rotations during the development of arable land (option I)

Agricultural crops	Crop rotation						Area of agricultural crop, ha	Share of the total area, %
	No. 1 (beet crop rotation)	No. 2 (herbaceous	No. 3 (grass-steam crop rotation)	No. 4 (herbaceous	No. 5 (grass-steam crop rotation)	No. 6 (herbaceous		
Spring wheat	-	138	-	69	-	-	207	4
Barley			613		500	300	1413	25
Winter wheat	100	214	764	109	537	211	1919	34
Silage corn	-	69	-	36	-	110	215	4
Perennial grass	84	141	-	71	661	279	1252	22
Sugar beet	228	-	-	-	-	-	228	6
Pure steam	-	-	333	-	-	-	333	6
Total area of crop rotation	412	562	1710	285	1698	900	5567	100
Bonitet, average score	33	25	20	25	18.6	25		
Average distance, km	2	3	5	1.5	3.5	1		

Table 3 - Placement of crop rotations during the development of arable land (option II)

Agricultural crops	Crop rotation					Area of agricultural crop, ha	Share of the total area, %
	No. 1 (beet crop rotation)	No. 2 (herbaceous crop rotation)	No. 3 (grass-steam crop rotation)	No. 4 (herbaceous crop rotation)	No. 5 (grass-steam crop rotation)		
Spring wheat	-	-	-	162	-	162	3
Barley	283	356	731	302		1216	21
Winter wheat	-	352	427	-	787	1497	26

Silage corn	-	-	-	105	-	105	2
Perennial grass	317	-	-	911	-	1502	32
Sugar beet	400	-	-	331	-	982	11
Pure steam	-	-	333	-	-	333	5
Total area of crop rotation	1000	708	1491	900	1698	5797	100
Bonitet, average score	33	25	20	25	19		
Average distance, km	3	2	5	10	3.5		

The results of the study were compiled on the basis of the ecological and landscape system of the area, the territorial organization of production. Schemes for the placement of crop rotations are shown in the figure for options I, II (Figure 1,2).

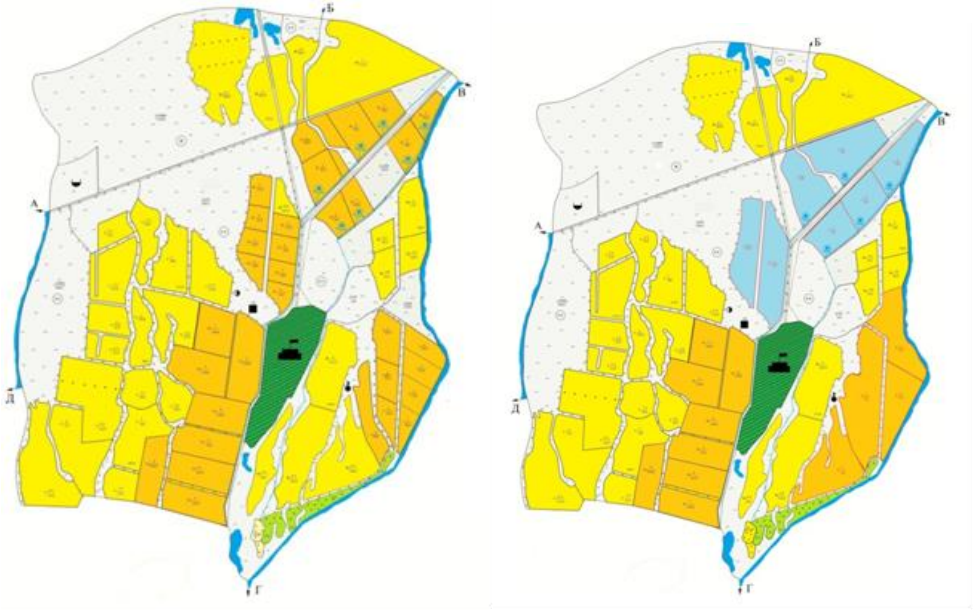


Figure 5 - On-farm land management project (option I-on the left; option II-on the right)

The structure of the projected sowing area has a great influence on the soil fertility of crop rotations. As a result of the projected works, the restoration of humus in the soil does not require additional costs for further increasing fertility.

Two options for placing crop rotations are considered. At the same time, the number of crop rotations changed from 6 to 5 crop rotations: grain grassy crop rotations with an area of 900 hectares and grain grassy fallow crop rotations with an area of 1698 hectares. To determine the cost of cargo transportation, the average distance was determined (Table 1, 2). The result of the second option is cost-effective, since crops requiring large cargo transportation were located close to the points of production and storage of products.

One of the indicators of the economic efficiency of the activities carried out under the land use project is the share of agricultural land use, which is determined as follows:

$$K=5797/5567=1.04$$

Based on the qualitative changes in land use carried out by us and the final result obtained, the land management project can be considered profitable.

Conclusions

The study showed that in modern conditions of agricultural production in Kazakhstan, the role of the project of on-farm land management is increasing. This is largely due to the need for sustainable development of land use and an effective state policy in the field of agriculture aimed at significantly increasing the production of agricultural products, both for domestic consumption and export. Despite the fact that grain crops still prevail, there are some qualitative changes in the structure of sown areas. Compared with other regions of Kazakhstan, Zhambul region has more productive data, which explains the choice of the object of research.

The conducted examination shows that the following disadvantages occur in the land use of the farm: low soil protection capacity of crops, instability of the humus balance and shallow contour of fields. The work considered information about land resources and land organization before the project was developed. The design solutions prepared on the basis of the production cooperative "Kazakhstan", and the obtained economic and environmental indicators indicate the intensity of agricultural production. As a result of project works is proved the following: reduced the number of crop rotations by combining of small arrays of 6 crop rotation for 5 crop rotation, converted to liquid land rangeland with an area of 110 hectares and 120 hectares, the structure of sown areas changed, respectively, the security feed increased by 40%. To reduce transport costs, several options for placing crop rotations have been calculated, which makes it possible to save transport costs twice. Due to scientifically-based crop rotations, gross production and commodity productivity increased. In this regard, based on scientifically sound management decisions and calculations, it can be concluded that the proposed design solutions will provide an economic effect by maintaining environmental sustainability, as

shown by the examination of the results of the intensity of agricultural land use of the production cooperative "Kazakhstan".

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Для цитирования: Нилиповский В.И., Анарбаев Ю.А., Ауесбеков Н.Р., Тлешпаева Д.И., Батырбек К., Ермекбаев Б.К. ПРОЕКТ ВНУТРИХОЗЯЙСТВЕННОГО ЗЕМЛЕУСТРОЙСТВА КАК ОСНОВНОЙ ИНСТРУМЕНТ СЕЛЬСКОХОЗЯЙСТВЕННОГО ЗЕМЛЕПОЛЬЗОВАНИЯ, International agricultural journal, 2021. № 6, 677-692.