THE ECONOMIC EFFICIENCY OF IRRIGATED AGRICULTURE LAND USE IN KAZAKHSTAN

ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ИСПОЛЬЗОВАНИЯ ЗЕМЕЛЬНЫХ РЕСУРСОВ В ОРОШАЕМОМ ЗЕМЛЕДЕЛИИ КАЗАХСТАНА

Researcher Genadiy Rau,
Kazakh National Agrarian University - Almaty, Kazakhstan
genadiyr@gmail.com

Abstract: *Irrigated agriculture plays an important role in agricultural production in Kazakhstan. In case of optimal use of land and water resources irrigated agriculture could become a significant driving force of agricultural production. Strategically important crop products such as cotton, rice, sugar beet, tobacco, vines, melons are grown only on irrigated lands of Kazakhstan.*
KEYWORDS: *LAND RESOURCES, IRRIGATION, EFFICIENCY, PROFITABILITY, INVESTMENTS.*

1. Introduction

Irrigated agriculture occupies 2 335 thousand hectares or 7% of the total cultivated area of agricultural production in Kazakhstan. In case of optimal use of land and water resources irrigated agriculture could become a reliable sector of agricultural production and provide up to 30% gross output of all crop production. Meanwhile, strategically important for the country crop products such as cotton, rice, sugar beet, tobacco, vines, melons are grown only on irrigated lands.

2. Methods and study results

Indicators of economic efficiency of land use in irrigated agriculture were defined on the basis of data collected from the water and agricultural organizations, farms and cooperative farms, as well as pilot studies in production conditions.

Irrigated agriculture is stringently an economic reason. On irrigated and ameliorated lands cost per unit increases sharply. So in the cotton zone of irrigated farming expenses per 1 ha of irrigated land, including development costs, reach 12 thousand US dollars. The specific working conditions on those lands increase spending on agricultural development and intensification of production in order to reach the level corresponding to the potential of improved land. Also increase labor costs. The existing surface irrigation technology increases labor costs to maintain irrigation network and water costs, compared with rainfed agriculture, from 15% (for crops) up to 50-60% (industrial crops). [1] In general, per unit investments in 1 ha of irrigated areas agriculture are 4 times greater than on non-irrigated land, and capital-labor ratio nearly 2.7 times.

On the other hand, irrigated agriculture demonstrates accelerated cost recovery compared with rainfed agriculture as land productivity sharply increases, as well as the proportion of high-performance technical and other crops which have high commodity output and provide a significant increase in revenues for farms per unit of area. Thus the irrigated land productivity is 5.3-8.7 times higher than rainfed agriculture. (Table 1)

Table 1. *Gross output from 1 ha of irrigated and non-irrigated crops in arid zones*

Years	Output in US dollars		Increase, number of times
	irrigated	rainfed	
2008	1210.4	224.1	5.4
2009	1231.1	141.5	8.7
2010	1230.2	273.3	4.5
2011	1308.7	278.4	4.7
2012	1350.5	164.6	8.2
2013	1340.3	216.2	6.2
2014	1351.8	237.1	5.7
2015	1360.8	256.7	5.3

On average the productivity of irrigated land in the arid zones of the Republic of Kazakhstan over 6 years constituted 1346.8 US dollars per hectare, while between regions the range is from 1230.2 to 1434.0 US dollars per hectare. In southern regions of Kazakhstan where 82% of all irrigated lands are concentrated productivity is 1438.0 US dollars per hectare, in the eastern and western regions 1230.2 US dollars per hectare.

The development of irrigation in Kazakhstan is shaped not only by the social transformations that have taken place in the Republic of Kazakhstan, but also its rich and extremely diverse natural landscapes. The vast territory, significant land resource reserves allow to develop diversified agricultural production and increase its profitability, despite the dry climate on most areas, especially in southern and south-eastern parts.

The leading crops in the farm irrigated zone of Kazakhstan are winter wheat, rice, barley and rye, which occupy 75-85% of all grain crops.

For such crops as spring wheat, oats, millet, and buckwheat small areas are assigned. Data on the yield of winter wheat in the south and south-east of Kazakhstan are shown in Table 2, the coefficient of production efficiency is 1.6.

Table 2. *Efficiency of winter and spring wheat production on irrigated lands in the south and south-east of Kazakhstan*

Region	Winter wheat				Spring wheat			
	Yield, t / ha		Effective ness ratio	Water consumption m^3 / t	Yield, t / ha		Effect ivenes s ratio	Water consumption m^3 / t
	Irrigated	Rainfed			Irrigated	Rainfed		
Almaty	1.80	1.12	1.6	1171	1.72	0.70	2.46	1319
Zhambyl	1.59	0.94	1.69	1108	1.59	0.62	2.56	1176
South Kazakhstan	2.19	0.81	2.71	1473	1.77	0.58	3.05	1330
Kyzylorda	0.81	-	-	2023	1.49	0.21	7.12	2002
Total for south and south-east	1.92	0.11	2.00	1294	1.43	0.53	3.80	1457

Particular note can be taken of the South Kazakhstan and Zhambyl regions, where year after year high and stable grain yields are obtained. These regions employ a range of agricultural practices. The forerunner of winter wheat, almost everywhere is a beet or maize. After harvesting of forerunner crop farmers conduct before plowing watering to trap moisture. Then introduce phosphate fertilizer at the rate of 0.205 t/ha and plowing to a depth of 22.25 cm with harrow. Typically in September from 15 to 30 sowing of certified seed, close-drilled, at the rate of sowing 220-260 kg/ha.

The economic efficiency of irrigated crops in Zhambyl region in the period from 2010 to 2015 can be judged from the following data: the yield of sugar beet increased from 17.54 to 20.32 t/ha, melons from 9.61 to 15.83 t/ha, vegetables from 10.93 to 15.02 t/ha, potatoes from 13.72 to 15.93 t/ha and grain from 1.26 to 2.07 t/ha. On the scale of districts virtually all cultivated crops demonstrate increase in productivity.

Concerning potato yields the greatest growth was obtained in Korday District 151.2% and the lowest in Moyinkum District 102.2%. The highest yield 20.0-24.0 t/ha were achieved in Zhualynskiy and Kordai Districts.

Vegetables yields have significantly increased in Talas District (202.2%) and amounted to 20.4 t/ha, while in Shu District decreased by 8.8%.

Concerning sugar beet Merke District in 2015 achieved yield of 30.09 t/ha which an increase of 67% compared to 2010.

Rice is one of the leading crops of irrigated agriculture in the south of Kazakhstan, it has great economic importance, contributes to soil desalinization.

Rice is cultivated in Kyzylorda, Almaty and South Kazakhstan regions which have favorable soil and climatic conditions, water and land resources.

However, the efficiency of rice cultivation is not identical everywhere. It motivates to maximize the internal reserves, which are now available in every farmland cultivating rice.

Experience shows that rice-growing farms with carefully leveled land with engineered irrigation network have significantly higher rice yields. So, in 2015 in Kyzylorda region on carefully leveled land with engineered irrigation network rice yield was 4.83 t/ha and on primitive -3.56 t/ha. At individual farms the difference is even greater. (Table 3)

Table 3. *Economic indicators of rice production on the irrigated lands of Kazakhstan (2010-2015)*

Region	Sown area, hectare	Yield, t/ha	Unit price, US dollars per tonne of rice	Profit (+) loss (-) t/ha USD per hectare	Profitability,%	Water consumption, m^3/t
Almaty	12900	2.83	258	2890.4	39.5	9434
South Kazakhstan	2232	3.430	346.5	4631.0	3.8	8090
Kyzylorda	68777.5	3.53	249.8	3896.7	44.1	7507
Total for Kazakhstan	83909.5	3.42	253.6	3650.6	42.0	7768

Heightening investment in rice production and more efficient land use will lead to the rational agriculture, introduction of sophisticated agricultural machinery, reduction of irrigation costs, will allow farmers to employ the huge opportunities that are provided by nature in the south Kazakhstan. [2]

Functioning irrigation and drainage network, high-quality layout of rice fields will increase rice yield and reduce the cost of 1 ton of rice. The minimum cost of raw rice is 340.0 US dollars per 1 ton of rice is achieved under permanent flooding condition, with the change of water on rice field once during the germination of rice plants. This irrigation technology of rice provide yield of 5.93 t/ ha, irrigation rate - 26000 m^3/ha, the consumption of water per ton of rice - 4390 m^3/t, drainage runoff - 2300 m^3/ha. With the decrease in rice yield, its cost increases (Figure 1).

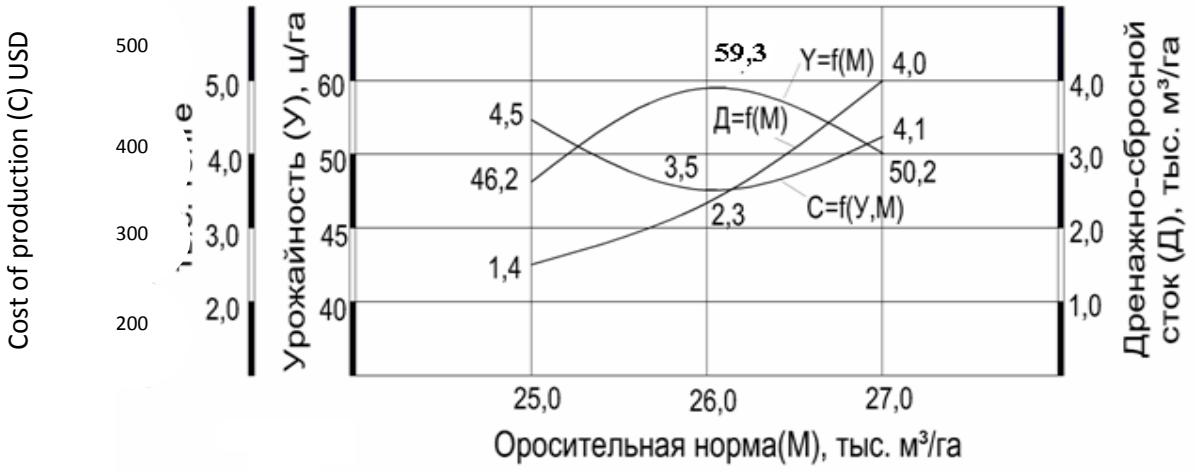

Figure 1 *- Effect of irrigation rate (M), drainage flow volume of (D) on rice yield (Y) and cost of production (C)*

Such rice irrigation technology allows to save irrigation water and provides high economic and environmental efficiency of land use in the cultivation of this crop

3. Conclusion

An important role in determining the economic efficiency of irrigated agriculture plays the volume of investment in creation of irrigation systems, as well as labor supply on farms over the periods of the year covering the periods of cultivation of crops and livestock. Consideration of the economic efficiency of agricultural crops cultivation on the basis of these criteria will allow a better assessment of the cultivation feasibility of a crop in the area, identify measures to enhance the effectiveness of cultivation and efficient use of irrigated lands.

4. References:

1. Нерозин С. Анализ продуктивности земли и воды / в кн. Управление орошением для борьбы с процессами опустынивания в бассейне Аральского моря. Оценка и инструменты. – Ташкент: Vita Color, 2005.- С.209-224.
2. Koskor, D.R., 1991. Growth of a rice at different salt concentration in media a refluction on potential difference between root and shoot. J. Indian Soc. Soil Sci., 1(39): 94-98.