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ECONOMIC EFFICIENCY FROM THE IMPLEMENTATION OF NEW TECHNOLOGIES FOR CROPS

Transformations in the food sector are primarily associated with technological reform of the industry. Currently, society is beginning to understand the priority role of high-performance production as a strategic factor for achieving the competitiveness of domestic agribusiness, but the tools of economic analysis and assessment of the effectiveness of innovation, namely for the introduction of progressive technologies that are adequate to modern market conditions, are currently absent in agricultural economic science, which does not allow to single out separately and accurately the influence of technology on productivity growth.

The article discusses the decision on whether the introduction of newtechnology in agriculture is rationally sound is made in terms of cost advantages representing the combined savings of all operating resources (human labor, materials, capital investment) that agricultural enterprise receives as a result of using advanced technologies in organic farming and soil management and which ultimately results in increasing income in agricultural planning and economic.

It was also revealed that the economic efficiency of the measures depends on the ratio of the values of the stored crop, taking into account its quality and the cost of using plant protection products soil protection products.

It is quite fully determined by indicators of net income, cost and labor productivity and. But each of these indicators highlights only one side of the business process. Therefore, the economic efficiency of plant protection measures can be characterized only by a set of indicators.

Keywords: *economic process, economic efficiency, zero technology, minimal technology, agricultural planning, wheat production, labor productivity, complex tractor, environmental situation, the cost of production.*

Кілт сөздер: *экономикалық процесс, экономикалық тиімділік, нольдік технология, минималды технология, ауыл шаруашылықты жоспарлау, бидай өндірісі, еңбек өнімділігі, трактор комплексі, экологиялық жағдай, өнімнің өзіндік құны.*

Ключевые слова: *экономический процесс, экономическая эффективность, нулевая технология, минимальная технология, планирование сельского хозяйства, производство пшеницы, производительность труда, комплекс тракторов, экологическая ситуация, себестоимость продукции.*

Jel classification: J23

Introduction. The economic efficiency of technologies depends on the ratio of the conserved harvested crops, taking into account its quality and the cost of using crop protection agents. It is quite fully determined by the indicators of net income, cost of production, and labor capacity. But each of these indicators highlights only one aspect of the economic

process. Therefore, the economic efficiency of measures to introduce technologies can only be characterized by a set of indicators.

The theory and methodology of this thesis are based on the problems of evaluating the effectiveness of the application of one or another innovative technology for the cultivation of grain in general and grain in particular.

The information base for research includes the statistics of Mongolia, immediate information from the Ministry of Agriculture, scientific publications on the studied issue and other sources.

The following methods have been used for conducting this research: abstract-logical, statistical-economic.

Literature review. Based on the research results, published in [1] Social and educational project L'Association 1901 «SEPIKE» to improve knowledge in the field of economics. ISSN (print): 2196-9531, Index Copernicus ICV 5.15, 2019; [2] in the IOP conferences: Earth and Environmental Sciences doi: 10.1088 / ISSN: 1755-1307, vol. 341, 2019 (SciVerse Scopus); [3] Topical issues of modern science and education: materials of the XVII international scientific and practical conference (Kirov, April 17-20, 2018) / Kirov branch of the Moscow Financial and Law University MFLA. – Kirov: MFYuA, 2018. – 897 p. ISBN 978-5-94811-286-2 (RSCI); [4] Eurasian international scientific-analytical journal «Problems of modern economics», 2011.

The existing domestic methods of assessing the effectiveness new agricultural technology's introduction analyze only the economic aspect of problem. They are applied only to the conditions of the planned economy. The existing domestic methods for assessing the effectiveness of the introduction of new agricultural technologies do not allow to provide separately and accurately the influence of technology on the increase in productivity. In addition, the applied methods of economic assessment of technologies require improvement.

Research on the development of grain production (wheat). The country's economy has developed a steady price disparity for agricultural products and the resources needed for wheat production. Tariffs for energy resources are increasing, prices for farming machinery, equipment, and fuel are rising, and prices for crop products remain low. In these conditions, it is necessary to increase production per unit area at a minimum cost.

There is an increasing need for the use of advanced scientific developments, where high productivity of crop production will be achieved mainly due to the technologies used and with the limited use of herbicides.

The evaluation of economic efficiency of wheat cultivation is based on the computation of yield, upon which the volume of sales depends, and therefore the net income and the level of profitability [4].

The lower the cost of grain production is, the higher is the economic efficiency of grain growing and production. The performance indicators reflect the use of all inputs of production: land, labor, and material resources. The main indicators are the manufacturing costs, profitability, net income per unit of area, and costs per unit of production.

Regardless of the yield level, there are constant expenses that the farmer bears on each hectare of crops: plowing, cultivation, harrowing, seed rolling, seeding, sowing, seeds, harvesting, etc. These are unavoidable expenses. You can reduce them using 'low-cost technologies' for a certain, short time or at the expense of the quality of crops, which will inevitably affect the productivity of the fields over time. Moreover, it will affect them downwards. Thus, the larger is the hectare, the higher are the costs. Conclusion: to look for ways to reduce fixed costs [5].

The technology of minimum tillage has gained global significance due to its environmental and economic advantages, which include limiting wind and water erosion of the soil, as well as a significant reduction in production costs. The positive elements of the minimum technology are reduction of production costs, as a rule, by 25-30%, a decrease in the impact of chemical and mechanical agents on soil, leading to

soil degradation and unfavorable environmental situation. The disadvantages of such technology are as follows: small-scale cultivation does not create the optimal soil structure in the plough-layer, necessary for plants; does not provide meltwater absorption into a low level, especially with heavy snow; does not cope with the destruction of rhizomatous and offset weeds [5].

The yield of winter wheat and the cost of grain when growing it with minimal and zero tillage is slightly lower than with traditional technology with all tillage operations. However, due to lower costs for its cultivation, the cost of grain is much lower with minimum and zero technology.

Let us consider the scale of implementation at enterprises in the central region of Mongolia (table 1).

Table 1

The scale of advanced technologies introduced in the central region of Mongolia 2009-2019 *

№	Indicators	Number of enterprises
1.	The total number of enterprises, units	1400
2.	The number of enterprises with the introduction of new technology, units	496
3.	Coverage of agricultural enterprises with new technologies, %	35,4

* *Based on statistics Central Mongolia*

According to the table, by the end of 2019, the coverage of agricultural enterprises with new technologies in the central region was 35,4%, that is, 496 enterprises out of a total of 1,400 enterprises. If we take into account 'Gatsuurt' LLP, the company used traditional technologies until 2012, but since 2012 the scale of implementation was 72,5%, and from 2015-2019, its coverage had already been 100%. In the central region of Mongolia, the scale of introducing crop acres using resource-saving technology was 257,714 thousand hectares of the entire crop acreage in 2012. That is, only 19% used resource-saving technologies; by 2017, the percentage of introducing new technologies reached only 38% [6].

Table 2

Economic efficiency indicators of wheat cultivation depending on the applied technologies for 2009-2019 *

Indicators	Unit of measurement	Traditional	Minimum	Zero
'Gatsuurt' LLP, Mongolia: USD / Tugrik exchange rate as of 2019 (2440.63)				
Average prices, per ha	tugrik/ USD	420 000 /$172	420 000/ $172	420 000 /$172
Costs, per hectare	tugrik / USD	295 192.7 /$120.9	268 998.4 /$110,2	267 549.8 /$109.6
Yield capacity	C / ha	15.6	16.0	17.6
Profitability	%	42.27	56.13	56.98

* *Based on company data «Gatsuurt» [7]*

The use of advanced scientific developments increases labor productivity, which means that it is possible to produce the necessary amount of material goods with fewer labor costs and, accordingly, with fewer people engaged in material production, which is a good reason for studying the economic efficiency of the use of new technologies (table 2).

As it can be seen, the greatest economic efficiency from the introduction of new technologies is obtained by zero treatment of grain production – the profitability reaches from 37,5 to 56,98% at the least costs. According to the table, the cost of 1 centner of grain under traditional technology is 5593,5 tenge (USD 17,4), the cost of 1 centner /ha in Mongolia under the traditional technology is 18922 Tugrik (USD 7,8), under the minimum – 16812,4 Tugrik (USD 6,9) and under zero – 15201,6 Tugrik (USD 6,2), which is confirmed in the above model.

Let us calculate the impact of crop productivity (x^1) and the share of areas tilled under new technologies (x^2) on the prime cost (y).

As a result of the correlation and regression analysis, the following equation is obtained: $y = 2120 - 1,82x^1 – 161,5x^2$ - 'Gatsuurt' LLP which shows that the connection between the indicators is reversed: with an increase in the percentage of the area by 1% with advanced technologies introduced, the cost is reduced to 161.5 tugriks (USD 0,06), and with the increased yield by 1 centner /ha, there is a decrease of cost in the amount of 1.82 tugriks (USD 0,07), provided that the factors act simultaneously. The index of correlation was R=0.92, the connection is strong [8].

Let us look at the evaluation of costs per 1 ha, tenge for wheat production, including direct expenses under the flow process chart (table 3).

Table 3

The cost structure for wheat production (on average) for 2009-2019*

Cost items	traditional			minimum			zero		
	Price, tugrik	Price, USD	Proportion %	Price, tugrik	Price, USD	Proportion %	Price, tugrik	Price, USD	Proportion %
'Gatsuurt' LLP, Mongolia, on average for 1 ha, Tugrik									
Fuel and lubricants	89 800	36.79	30.42	80 860	33.02	30.22	80 600	33.13	29.96
Salary for operating personnel	43500	17.82	14.74	32790	13.44	12.19	32870	13.47	12.29
Depreciation	18810.4	7.71	6.37	18678.9	7.65	6.94	18245.6	7.48	6.82
Equipment maintenance	5930	2.43	2.01	4760	1.95	1.77	3190	1.31	1.19
Electricity	192.3	0.08	0.07	171.66	0.07	0.06	168.9	0.07	0.06
Other expenses	8320	3.41	2.82	2645	1.08	0.98	3456	1.42	1.29
Seeds	96000	39.33	32.52	91928.5	37.67	34.17	89579.3	36.70	33.48
Pesticides	19440	7.97	6.59	23424.4	9.60	8.71	25180	10.32	9.41
Fertilizers	13200	5.41	4.47	14000	5.74	5.20	14000	5.74	5.23
Total average:	295,192	120.95	100	268,998.4	110.22	100	267,549.8	109.62	100

* Based on company data «Gatsuurt» for 2009-2019

According to table 3, it can be seen that there is a saving on fuel and lubricants. If under the traditional technology the share at 'Gatsuurt' LLP is 30%, under zero soil treatment the share is about 20%, 6.7% respectively. The analysis of the economic efficiency of wheat production with the use of zero technology allowed to save fuel by 27 l / ha, taking into account that the reduction of equipment running through the field, the cost of equipment and personnel with zero technology are lower than under the traditional by 24.4% - 'Gatsuurt' LLP.

Since plowing is an energy-consuming approach, it leads to high wear of equipment: with zero technology, depreciation is reduced by 3% for 'Gatsuurt'.

The cost of herbicides is reduced almost at 48.8 % compared to traditional technology, as under zero soil treatment stubble remains (plant residues) are not carried from the field, organic substances remain in the soil, which reduces the need for using fertilizers, so the costs of fertilizer are reduced in Kazakhstan, whereas in Mongolia, on the contrary, there is an increase by 6% since the plant remains are eaten by cattle. The growth of pesticides by 29.5% at 'Gatsuurt' LLP is motivated by the fight against pests and weeds. In general, when comparing the zero technology with the traditional one, there are cost savings of 9.3% at 'Gatsuurt' LLP [9].

The costs associated with their use at the first stage of the phytosanitary situation deterioration may increase due to the content of spring cereals impurities with oatgrass, which involves the use of special anti-oat herbicides, as can be seen on the example of 'Gatsuurt' LLP.

However, these calculations do not take into account the fact that the cost escalation for plant protection in resource-saving agriculture is observed only at the first stage of such systems implementation, in the future, the need for pesticides is significantly reduced.

Let us consider the additional expenses on the efficiency of grain cultivation technology (table 4).

Table 4

The operational and economic indicators (on average) of grain (wheat) cultivation per 1 ha of crops *

Indicators	Unit of measurement	Type of technology		
		traditional	minimum	zero
		John Deere 8353		
Useful swath width	metre	8.0	8.0	8.0
Depth of cultivation	cm	17-18	10-12	-
Speed of operation	km / h	6.7-6.9	8.1	14.2
Production rate	ha / hour	2.66	2.66	8.18
Fuel consumption	kg / ha	18.6	12.4	6.2

* Based on company data «Gatsuurt»

To analyze the main indicators of soil cultivation when comparing the three technologies, we used the John Deere – 8353 system, whose useful swath width is 8 m in terms of technological parameters.

The depth of cultivation in traditional soil treatment involves autumn cultivation (autumn plowing), the depth of which is 17-18 cm. When using this technology, there is also spring cultivation with an average depth of 10-12 cm.

When using minimum technology, pre-sowing treatment is applied to a depth of 10-

12 cm. Replacing deep cultivation with more yielding, smaller, or surface ones, using wide-cut implements with active tools that provide high-quality cultivation per one running of the unit. In this regard, the least number of complex tractor units running across the field is achieved during the entire process of crop cultivation as the most important condition for preserving potential fertility and protecting the soil from erosion, improving the balance of humus, reducing the loss of soil nutrients and moisture.

When using zero technology, soil treatment is used for direct seeding combining operations in one work process, where seedbed combination used, allowing several technological operations to be performed in one work process.

This is effective both in agrotechnical and economic terms. To analyze the main indicators of soil cultivation when comparing the three technologies, we used the John Deere – 8353 system, whose useful swath width is 8 m in terms of technological parameters.

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For all types of new grain sowing units (sowing machines), there was a steady decrease in fuel consumption by a comparable scope of work from 42.1% in comparison with the traditional technology, as well as the higher speed of 7.3 km/h with traditional and 4.7% km/h with zero technology, although all the considered options for new sowing units (machines) are effective, see table 5.

Table 5

Reserves of productive moisture in steam and grain fields depending on the system of tillage in 'Gatsuurt' LLP, Mongolia (2012-2019) *

Soiltechnology	On average by crop rotation	Productive moisture, mm	
		Before sowing	Before harvest time
Traditional		19.8	17.9
Minimum		39.8	25.1
Zero		47.2	44.8

* Based on company data «Gatsuurt»

At 'Gatsuurt' LLP, according to the minimum and zero technology, water availability is close to 39.8-47.2 mm before sowing, 25.1-44.8 mm before harvesting. The lowest water availability by traditional technology before so-wing is 19.8 mm and before harvesting - 17.9 mm.

According to all the conducted ratios, it is clear that the acceptable and most profitable

technology for growing grain is zero technology. Thus, the economic efficiency of minimum tillage and zero technology of direct sowing of winter wheat are higher than the efficiency of growing this crop using traditional technology.

Conclusion. Calculating the economic efficiency of wheat cultivation allows farmers to choose a particular cultivation technology, depending on the technical and economic capabilities of the farm. At the same time, it should provide high-yielding crops of high-quality grain with minimal costs for its production.

One of the most important ways to improve crop production is to optimize current costs, that is, to reduce the cost of production. High-efficiency resource-saving technologies are of primary importance here.

They not only partially reduce the environmental impact throughout the country, but also are very profitable from a financial point of view for the agricultural enterprises themselves. The less fuel, electricity, fertilizers, seeds, labor hours, and other resources are spent on the unit of production, the lower its cost, and the higher the profit from its sale.

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С.М. Төкенова, Ә.Е. Айтқожина

ДӘН ӨНДІРУГЕ АРНАЛҒАН ЖАҢА ТЕХНОЛОГИЯЛАРДЫ ҚОЛДАНУДАҒЫ ЭКОНОМИКАЛЫҚ ТИІМДІЛІК

Аңдатпа

Азық-түлік саласындағы өзгерістер ең алдымен саланың технологиялық реформаларымен байланысты. Қазіргі уақытта қоғам отандық агробизнестің бәсекеге қабілеттілігіне қол жеткізудің стратегиялық факторы ретінде жоғары өнімді өндірістің басым ролін түсіне бастады, қазіргі кезде экономикалық талдау мен инновациялардың тиімділігін бағалау құралдары, атап айтқанда қазіргі заманғы нарық жағдайына сәйкес келетін озық технологияларды енгізу агроэкономика ғылымында жоқ, бұл өнімділіктің өсуіне технологияның әсерін бөлек және дәл көрсетуге мүм-кіндік бермейді.

Мақалада жаңа технологияны енгізудің орындылығы туралы шешім экономикалық тиімділік негізінде қабылданады, бұл ауылшаруашылық кәсіпорыны алдыңғы қатарлы технологияларды қол-дану нәтижесінде алатын барлық өндірістік ресурстардың (өмір сүретін жұмыс күші, материалдар, күрделі салымдар) жинақталған қаражаты, нәтижесінде кірістің өсуіне айналатынын көрсетуде.

Сонымен қатар шаралардың экономикалық тиімділігі оның сапасы мен өсімдік қорғау құ-ралдарын пайдалану шығындарын ескере отырып, сақталған дақылдың шамаларының және топы-рақтың ылғалдылығының арақатынасына байланысты. Бұл таза табыс, өзіндік құн және еңбек өнімділігі көрсеткіштерімен толығымен анықталған. Бұл көрсеткіштердің әрқайсысы бизнес-процестің тек бір жағын ғана көрсетеді. Сондықтан өсімдіктерді қорғау шараларының экономика-лық тиімділігін тек индикаторлар жиынтығымен сипаттауға болады.

С.М. Токенова, А.Е. Айтхожина

ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ОТ ВНЕДРЕНИЯ НОВЫХ ТЕХНОЛОГИЙ ПО ПРОИЗВОДСТВУ ЗЕРНОВЫХ

Аннотация

Преобразования в продовольственном комплексе связаны прежде всего с технологическим реформированием отрасли. В настоящее время общество начинает понимать приоритетную роль высокопроизводительного производства как стратегического фактора для достижения конкурентоспособности отечественного АПК, но инструменты экономического анализа и оценки эффективности инновации, именно по внедрению прогрессивных технологии, адекватные к современным рыночным условиям, в сельскохозяйственной экономической науке в настоящее время отсутствуют, что не позволяет выделить отдельно и точно влияние технологии на прирост продуктивности.

В статье рассмотрено решение о целесообразности внедрения новой технологии на основе экономического эффекта, представляющего собой суммарную экономию всех производственных ресурсов (живого труда, материалов, капитальных вложений), которую получает сельскохозяйственное предприятие в результате использования прогрессивной технологии, и которая в конечном счете выражается в увеличении дохода.

А также выявлено, что экономическая эффективность защитных мероприятий зависит от соотношения величин сохраненного урожая с учетом его качества и затрат на использование средств защиты растений и влажности почвы. Она достаточно полно определяется показателями чистого дохода, себестоимости и производительности труда. Но каждый из этих показателей освещает лишь одну из сторон хозяйственного процесса. Поэтому экономическая эффективность мероприятий по защите растений может быть охарактеризована лишь комплексом показателей.