

**CURRENT CHALLENGES OF AGRICULTURAL
TRANSFORMATIONS IN UKRAINE: BIODIESEL PRODUCTION**

Stoyanets Nataliya, Doctor of Economic Sciences, Professor

Sumy National Agricultural University, Ukraine

In modern market conditions, innovative development becomes one of the main activities of the enterprise, including agricultural enterprises and should be aimed at creating an innovative structure, updating fixed assets and technologies (updating technologies, improving the quality and quantity of products, new products and services), improvement of management and economy of the enterprise, introduction of effective innovation and investment projects. But this is possible due to state support for the development of innovation in the agricultural sector. State support in the field of agricultural entrepreneurship in Ukraine is carried out in two directions, traditional and innovative Figure 1.

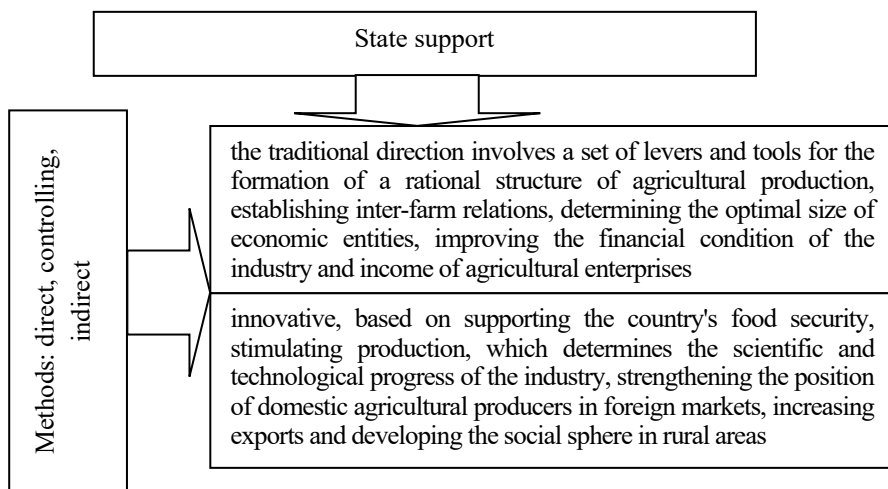


Fig. 1- State support of agricultural entrepreneurship in Ukraine

Direct state assistance is provided through: financing of innovative project programs; financial support for exports; providing property for innovation activities; training, retraining and advanced training for innovation; provision of free consulting and expert services; government order.

Indirect methods of state support include: formation of a preferential system of taxation of innovation activities; simplification of certification and licensing procedures; marketing support of knowledge-intensive products; monitoring of innovation activity and active use of antitrust measures; subsidizing the interest rate on the loan.

Controlling methods of supporting innovation processes in agricultural entrepreneurship are carried out through the active use of antitrust measures, examination of innovation activities and its monitoring [1].

Government R&D appropriations (GBARDs) are a funding-based approach to R&D reporting that identifies all budget items that may support R&D and measures or evaluates their research content. This makes it possible to link these budget lines to policy considerations by classifying them by socio-economic objectives. However, it provides only a partial indicator of investment in state agricultural research, as it is a research funding tool dedicated to agriculture. Government spending on agriculture has declined over time in several major exporting countries. This may jeopardize the ability of public research to cover areas of less interest to producers (long-term, public goods) and to participate in joint activities (for example, internationally). In countries with significant private investment in research and development, this has not necessarily replaced public investment, as private and public research is expected to be complementary.

The state is the most important institution that influences innovative transformations in the agricultural sector. Ukrainian scientists have developed the main criteria by which agricultural producers can apply for state support aimed at innovation [2]. The main ones are:

1. High-tech projects. If we are talking about the crop industry, then in the technological process it is advisable to use varieties that are resistant to diseases and pests. Seeds should have a high level (up to 98-100%) of germination, give a high level of profitability.

2. Creation of new jobs and development of domestic production. High technologies require highly qualified personnel and an appropriate incentive and motivational mechanism.

3. The problem of low readiness of investment objects, which is that various institutions and departments are involved in innovation processes. Some resources necessary for innovation in Ukraine are completely absent - they should be purchased abroad.

4. Cost-effectiveness and self-sufficiency of the project. In a market economy, every project must be self-sustaining. An innovative project should yield higher profits in the short term. Yes, an innovative project will not be invested if the projected profitability is lower than the interest rate.

5. Joint participation in the project of public and private capital.

6. Import substitution. Projects that involve national capital and that involve the production of products that can be produced in Ukraine and reduce imports must be given a clear advantage.

7. Environmental friendliness. The innovative project must meet environmental criteria. Products made on the basis of this project must be safe for life and have a positive impact on the environment.

To ensure the effectiveness of state regulation of the innovative potential of the agricultural sector in Ukraine, we have proposed a functional model that provides for the unification of such participants as: the state (adopts legislation, prioritizes science and technology, technology, develops foresight projects, science concepts,

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

scientific technical programs, road maps, etc.), scientific and educational sector (formation of techno-parks and small innovation enterprises; conducting basic research and experimental testing of their results in technology parks, etc.), agricultural sector (production of innovative products; attracting own resources for innovation; formation of new structures, etc.) and the public (forms various requests for goods and services and other needs of society up to individual orders of individuals and legal entities) [3].

According to paragraph 7 Environmental friendliness, State support for innovative development of agricultural enterprises and the Regional Development Strategy of Sumy region for 2021 - 2027 and the Program of development of agro-industrial complex of Sumy region for the period until 2027 which states that the innovation project must meet environmental criteria. Products made on the basis of this project must be safe for life and have a positive impact on the environment [6, 7].

Considering the process of innovation and investment development in the environmental aspect, it should be noted the significant impact of this element of economic activity of the enterprise on the environment. Thus, the process of innovation and investment development: supports and implements economic activities aimed at improving the quality of the environment; stimulates the reduction of environmentally hazardous waste and emissions, as well as the processing and rational disposal of waste generated by enterprises as a result of economic activities, and thus helps to minimize the harmful effects on the environment; promotes the production, as well as financial support of environmentally friendly products and the introduction of appropriate environmentally friendly technologies; contributes to the sustainable regional development of the country.

In the current conditions of transformational changes, its fuel and energy dependence has a significant impact on the efficiency of agricultural production, which is due to the use of fuel and lubricants, which are mainly imported. The experience of many foreign countries, such as the United States, Germany, France, Austria, shows the possibility of significantly reducing energy dependence through the cultivation and processing of oilseeds for biodiesel. Given the significant shortage of energy resources, agriculture can significantly contribute to solving the problem of self-sufficiency of agricultural enterprises in fuel.

As already mentioned, biodiesel as an alternative to diesel fuel produced from petroleum products has been widely used around the world. It is used both in pure form and in various proportions in a mixture with petroleum fuels. Our study proposes a significant (over 70%) replacement of the consumption of diesel fuel produced from petroleum products with appropriate fuel of vegetable origin based on oilseeds.

Biogas plants are very popular in Ukraine and this is not surprising, because they provide the most efficient processing of organic waste, provide additional income and most importantly biogas plants are environmentally friendly.

The costs of industrial production of biofuels consist of the cost of oilseeds, catalysts and production costs for the production, purification of oil less the cost of meal, glycerin, husk. We calculated the production cost of 1 ton of biodiesel from major oilseeds in two ways:

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

- 1) when using raw materials of own production;
- 2) when using purchased raw materials.

Thus, in 2019, when using raw materials of own production, the cost of production of biodiesel from sunflower was 3995.9 UAH / t, from rape - 3001.2 UAH / t, from soybeans - 4475.4 UAH / t. According to the second option, when using the purchased raw materials, the cost of biodiesel from sunflower was UAH 9,689.4 / t, from rapeseed - UAH 3,275.3 / t, from soybean - UAH 6,644.3 / t. Thus, the lower level of costs among oilseeds is characterized by the production of biodiesel from soybeans due to high purchase prices for soybean meal and soybean oil.

Comparison of the average profitability of biodiesel production in 2020 from sunflower, soybean, rapeseed conditions of the same price per 1 ton of biodiesel at UAH 9,000 / t with VAT and in terms of sales of all by-products at average market prices provided the following results. According to the 1st option of biodiesel production (own raw material) the first position among oilseeds is occupied by rapeseed (profitability 71.3%) due to the high price of soybean meal, the second position belongs to sunflower (profitability 47.7%), the third position is soybeans (profitability 35.19%).

The world's leading countries are switching to biofuels. Every year, the production of gasoline containing fuel ethanol increases in the United States and Western Europe. World rapeseed production exceeds 47 million tons, the annual increase in sown area is recently 17%. The total world area of rapeseed crops has a steady upward trend. Among the world's countries, the largest sown areas of rapeseed are: India, China, Canada, USA, and Australia. In European countries, the sown area of rapeseed reaches about 3.5 million hectares. The largest producers of rapeseed are the EU countries; their share in world rapeseed production is 38.5%. In the EU, exports of rapeseed to other countries are declining; imports are growing, indicating an increase in demand for industrial processing.

In Ukraine, rapeseed as an industrial crop began to be intensively introduced in the last 10-15 years. Despite the long agitation for this crop, rapeseed has not become widespread in our country. The reason is that a number of issues remain unresolved. Rapeseed is a crop with very fine grains, and therefore for its sowing, harvesting and primary processing requires special equipment or advanced traditional. Acquisition of such equipment or re-equipment of existing ones requires considerable expenditure of working time and funds, which farms usually lack. In the structure of arable land, winter rapeseed occupies about 0.2-0.3%, and the average yield is 10.7 c / ha. For comparison: in Germany, the sown area for rapeseed is 1.3 million hectares, almost 10% of arable land, and its average yield is about 30 centners per hectare. The producer receives more than 230 euros per ton of rapeseed.

For Ukraine, there are two alternative uses for rapeseed: to establish its own production of biodiesel or to grow rapeseed and export it to Western countries. If economic calculations are made, their results will show that today it is more profitable for farms to sell rapeseed on the foreign market than to produce biodiesel from it for their own needs. Currently, Ukraine is able to produce about 200 thousand tons of rapeseed for industrial needs. At the same time, there is every reason to hope that in the case of the introduction of new advanced technologies and technical

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

means it will be possible to increase the gross harvest of rapeseed to 1.0-1.5 million tons, process it in domestic plants, create new jobs and increase competitive ability of the Ukrainian producer in the domestic and foreign markets. A major obstacle to increasing the production and development of the rapeseed market is the backward technical base of agricultural enterprises. Due to violations of cultivation technology, including precision sowing, insufficient fertilizer application, non-compliance with sowing and harvesting deadlines, farms lose almost 60% of potential yield, which leads to increased production costs of one ton of rapeseed. In addition, most farms have a low level of agronomic measures, as a result of which they have a gross rapeseed harvest only due to the natural fertility of the soil.

The high rapeseed harvest in Ukraine contributes not only to increasing exports, but also to increasing the volume of its processing within the country. During 2019/2020, according to preliminary data, about 20 thousand tons of rapeseed were processed, which is one and a half times more than in July 2009. (12.4 thousand tons). Seasonal reduction in stocks of major oils in the European market has contributed to the development of relevant price conditions. Ukraine annually consumes about 5.5 million tons of diesel fuel, the needs of the agricultural sector are about 1.9 million tons of diesel fuel. To equivalently replace this amount of mineral diesel, it is necessary to produce 2.147 million tons of biodiesel. Depending on the quality of raw materials and technological aspects, the production of 1 ton of biodiesel requires from 2.54 to 3.05 tons of rapeseed. Therefore, from 5.5 to 6.5 million rapeseed is needed to completely convert the agro-industrial complex to biodiesel. The average yield of rapeseed (winter and spring) in Ukraine for the last three years was 1.4 t / ha. In 2019, the demand for biofuels in the EU increased by 30%. Therefore, Ukraine began to build plants for its production to establish supplies to Europe. It was previously thought that Ukrainian products could occupy up to 20% of the EU market. The volume of rapeseed production in Ukraine in 2019 decreased by 36% to 1.8 million tons. The loss of some winter rapeseed crops in early 2020 led to an increase in raw material prices by UAH 300 / t - to 2.80- 2.85 thousand UAH / t. The cost of biodiesel (10-12 UAH / l) obtained from such rapeseed is higher than that of traditional fuel sold at 7-8 UAH / l. The production of biological substitutes for traditional motor fuels requires the creation of a domestic market. Therefore, the Verkhovna Rada in 2019 passed a law according to which the country until January 1, 2014 set a zero rate of excise duty on all types of biofuels. Producers were exempted from paying income tax and import duties for ten years. Only production of more than 5,000 tons per year is licensed.

A number of European countries, which have a shortage of their own oil resources, have begun to develop rapeseed as an energy raw material that grows every year in the fields and self-renews. After all, to grow this crop on an area of 1 hectare. consumed 170 kg. fuel, and from the harvest (seeds) you can produce 1.2-1.5 tons of biofuels, in addition, get more cake - concentrated feed for animal feed. In Germany, Belgium, the Netherlands, Switzerland and other countries, the technology of biodiesel production is well improved, it is widely used for agricultural machinery, public transport, machinery that works on rivers and lakes and more. The main value of biodiesel in its environmental friendliness and the

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

ability to obtain from renewable raw materials. Under natural conditions, biodiesel and rapeseed oils are neutralized by microorganisms for 7-8 days by 95%, and conventional petroleum products by 16%. The main factor holding back the practical use of biodiesel is that the energy of this fuel is too expensive. With the use of biofuels, the number of technical inspections is reduced by two or three times, which in turn saves a lot of money on spare parts, materials and wages [4].

For the period 1990-2009 rapeseed area increased 12 times, gross harvest - 14.4 times. A record harvest of 2.8 million tons was recorded in 2008. In 2009, enterprises reduced production by 36% to 1.8 million tons. The main factor in reducing production was the reduction of sown area by 30%. The reduction in the area under rapeseed was a reduction in demand for it from the EU. The area under rapeseed was divided between barley and soybeans.

The current situation on the rapeseed market is reminiscent of the situation on the sunflower market in the 90s, when seed raw materials were exported and processing plants were idle. We believe that today it is necessary to take incentives to establish rapeseed processing in Ukraine, which will increase the workload of processing plants. Rapeseed prices are also high, so this crop remains economically attractive to Ukrainian farmers.

In the forest-steppe of Ukraine, along with sunflower and soybeans, rapeseed is the main oil and protein crop. As an industrial culture, it began to be intensively introduced only in recent decades. The area under it increased to 100 thousand hectares, and the yield averaged 15 centners per hectare. Some farms receive 30-35 centners per hectare. seed. In the structure of sown areas it occupies 0.3-0.5%.

Insignificant volumes of production of commercial rapeseed are due to the lack of state procurement system, material and technical base, fertilizers, highly effective pesticides, equipment for growing, harvesting and cleaning crops, lack of processing industry. Calculations show that the area under rapeseed in the coming years can be increased 6-8 times and increased to 500,000 hectares. and more, and increase the yield of commercial seeds to 24-26 centners per hectare. This will allow to produce 380-400 thousand tons of oil, 500-600 thousand tons of concentrated feed protein, which is 8-10 times more protein than compound feed. One hectare of rapeseed yields 20 tons of green fodder, 20 tons of green manure, 100 kg of honey, 3.0-3.5 tons of seeds, and 13 quintals. oil, 16 quintals cake, 500 kg. paper. 00-grade meal (meal), containing 37% protein, can be used in any animal feed mixture, can replace soybean and sunflower meal. In 1 kg. Rapeseed meal contains 14-16 g of essential amino acids, including lysine (in grains of barley, oats, corn and wheat – 5 g). The use of non-food rapeseed oil is now widely studied in various industries, especially when there is a risk of oil entering the water and entering groundwater.

Oils of high ore grades are used for the production of lubricants with high resistance: hydraulic oils, lubricants, cooling lubricants, anti-corrosion, for lubrication of dust chains and dust, rust removal oils, biodiesel, motor and transmission oils, oils for soft oils. In the near future, most mineral oils may be replaced by vegetable ones. In addition, rapeseed oil is used to make glycerin, methyl ester, and fatty acids, which are used to make acids, soaps, alcohols, sulfates, esters, and amines. Rapeseed oil can compete with other vegetable oils and animal

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

fats used for technical purposes. Replacement of mineral oils with vegetable oils is caused by environmental problems. Rapeseed oil decomposes quickly and does not pose a threat to water bodies: in the soil it decomposes in 95 days by 95% (mineral oil only by 16%).

The economic feasibility of growing rapeseed is beyond doubt. According to the analysis of world and European prices, its cultivation provides high profitability. The selling price of rapeseed is 1.8-2.4 times higher than the price of cereals. You can get high added value by processing rapeseed into biofuel. In addition, during processing we get meal - a valuable feed additive to animal feed. In addition to economic benefits, rapeseed has a positive effect on the ecological state of the environment.

Comparing the average profitability of biodiesel production in 2020 from sunflower, soybean and rapeseed at the same price per 1 ton of biodiesel at UAH 9,000 / t with VAT and at the level of sales of all by-products at average market prices provided the following results. According to the 1st option of biodiesel production (own raw material), the first position among oilseeds is occupied by rapeseed (profitability 71.3%) due to the high price of soybean meal, the second position belongs to sunflower (profitability 47.7%), the third position is soybeans (profitability 35.19%). (Table 1.)

Table 1 - Comparative characteristics of economic efficiency of biodiesel production from major oilseeds in agricultural enterprises of Ukraine in 2020

Indexes	Sunflower		Rapeseed		Soy	
	1 option own raw	2nd - purchased raw	1 option own raw	2nd - purchased raw	1 option own raw	2nd - purchased raw
Costs for biodiesel production, UAH / t.	6195,6	12519,1	13581,9	20051,5	7081,3	9192,4
Sales price of 1 ton of biodiesel, UAH without VAT.	7480	7480	7480	7480	7480	7480
Total revenue from sales of biodiesel and other products, UAH without VAT.	9897,5	9897,5	23861,3	23861,3	10228,3	10176,1
Profit from sales of biodiesel and other products, UAH / t.	3325,4	-2731,3	10301,2	3985,1	2866,1	693,2
Cost of biodiesel production, UAH / t.	3995,9	9689,4	3001,2	3275,3	4475,4	6644,3
Profitability of biodiesel production, %.	47,7	-19,9	71,3	15,4	35,9	6,9

Source: own calculations based on statistical data [5].

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

During the production of biodiesel in the 2nd option (purchased raw materials) in the first position - rapeseed biodiesel (profitability 15.4%), the second position was occupied by soybeans - (profitability 6.9%), and sunflower was generally unprofitable.

Since the cultivation of rapeseed is one of the best options in the production of biodiesel, we conducted a study of the effectiveness of self-sufficiency in fuel from rapeseed processing (as own raw materials) for LLC "AF" Lan "in the coming years under the introduction of rapeseed crop rotation.

To determine the required amount of rapeseed oil and the corresponding gross harvest and sown area of rapeseed (Table 2.), Which should meet the existing need for biodiesel, a number of conditions were adopted:

1) the value of yield taken for calculations corresponds to the achieved value of this indicator by similar agricultural enterprises of Sumy region in 2021;

2) rapeseed oil content was taken at the level of 37% (potential oil content of varieties of the studied crop is 44 - 47%, but when squeezing the seeds in the poppy remains about 7 - 10% of oil);

3) the required amount of rape-methyl ether (PME) was determined by increasing by 5% the annual consumption of diesel fuel (due to the lower heat of combustion of biodiesel);

4) the share of PME output is taken at the level of 96%, which is explained by the chosen technology, which produces about 960 kg of biodiesel from 1 ton of oil;

5) due to the objective features of the existing agricultural technology in the farm, research will be conducted only on the cultivation and processing of spring subspecies of rape.

Studies of analytical materials of the enterprise have shown that regulatory decisions that lead to the improvement of innovation management system should be aimed at:

- reducing the impact of negative factors;
- corresponding increase in the influence of positive factors;
- increasing the value of indicators that positively characterize the innovation management system;
- management staff;
- organizational management structure;
- organizational communications.

The results of the study showed that to cover their own needs in the diesel fuel plant under study, it is necessary to have 7.6% of rapeseed in the total sown area of 246 hectares. According to the consultations with the agronomic service of LLC "AF" Lan "is quite acceptable for crop rotation allocation of such a number of hectares for rapeseed. At the same time, the size of the share of spring rapeseed sowing does not exceed scientifically sound norms in crop rotation, ie 10% - 12%. This fact is a very important argument (from an agronomic point of view) in favor of the feasibility of such calculations.

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

Table 2 - Calculation of the need for self-sufficiency in biodiesel from rapeseed for LLC AF "LAN"

Indexes	
Rapeseed yield is actually average in Sumy region, t / ha	3,1
Yield of rapeseed oil from 1 ha, t.	1,1
Annual consumption of diesel fuel on average for the last 3 years, t.	240,0
The required amount of PME, t.	252,0
The amount of oil to meet their own needs in diesel fuel, t.	262,5
Gross collection to meet own needs for diesel fuel, c	709,5
Area under rapeseed to meet own needs in diesel fuel, ha.	228,9
The required share of rapeseed in crops,%	7,6

Source: developed by the author on the basis of data f. № 50 s.-g. and own observations.

The next stage of our study involved the selection of equipment for biodiesel production. After studying the available proposals, our choice focused on the model range of biodiesel plants of the domestic company "Biodiesel-Carpathians", which has a good business reputation and cooperates with many foreign companies. In order to justify the choice of biodiesel equipment of the required capacity, the average monthly consumption of diesel fuel for the last 5 years was determined according to the relevant statistical reports of the studied enterprise. Based on the results of such calculations for LLC "AF" Lan "- EXON-50, the production characteristics of which (productivity was 6000 and 1200 l / day, respectively) fully meet the existing needs for diesel fuel.

Given the identified need for biodiesel, we have selected the appropriate equipment for oilseed processing. To calculate the cost of investment in the project, the useful life of the equipment involved was determined. Based on the period of use of the biodiesel plant, it was decided that the project will last for eight years. Accordingly, the total number of units of other equipment was calculated and its cost for the entire project period was determined (Table 3.). In addition, capital expenditures included the cost of preparing equipment for the transition to biodiesel, which includes the purchase of a comprehensive fuel heating system in the cold season, the purchase of filters-separators and filter elements of the fuel system.

The next step in our work was to plan the current costs of the project (Table 4). In this context, it should be noted that the cost of production of PME in general is represented by three components: the cost of grown rapeseed, the cost of processing seeds into oil, the cost of processing oil into biodiesel.

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

Table 3 - Calculation of capital costs for the proposed project for the processing of rapeseed for biodiesel

Equipment	LLC AF "LAN"	
	Required quantity, units	Cost (including VAT), thousand UAH.
I. Processing of rapeseed into oil		
Screw oil press	2	377,0
Filter line	2	156,4
Filter elements	4	24,0
Oil tanks	2	5,0
Together	10	562,4
II. Oil processing on PME		
EXON complex	1	809,6
Total	x	1372,0
Other expenses		
Preparation of equipment	x	798,4

Source: calculated by the author based on his own observations.

Table 5 - Calculation of the total amount of future costs for the production of biodiesel from rapeseed for LLC "AF" Lan "

.№	Cost items	thousand UAH
	The cost of growing rapeseed	4539,9
	Processing of rapeseed into oil	
1	Depreciation of equipment	29,3
2	The cost of repairing fixed assets	8,1
3	Remuneration with accruals	183,6
4	Electricity	93,7
	Total costs	314,7
	Oil processing on PME	
1	Depreciation of equipment	42,2
2	The cost of repairing fixed assets	23,6
3	Remuneration with accruals	183,6
4	Electricity	257,6
5	The cost of methanol, catalyst and ion exchange resin	382,4
	Total costs	889,3
	The total cost of growing and processing rapeseed	5743,8

Source: calculated by the author based on his own observations.

Thus, the "lion's" share of all costs will be the cost of growing rapeseed (79%). About 5% will be involved in oil production, and 16% - oil processing into biodiesel.

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

In the context of the study, the next stage was to calculate the economic efficiency of biodiesel production. In the process of processing rapeseed into biodiesel, we have three end products - biodiesel, meal and glycerin. Meal and glycerin were estimated according to existing market prices. The determination of the price of meal was based on the cost of its sunflower counterpart, because the market for rapeseed meal in Ukraine for some reason does not exist. To estimate the biodiesel, which is planned to replace conventional diesel fuel, used the actual average purchase price of diesel fuel in 2021, ie 27.6 thousand UAH / t. to their value at selling prices. (Table 6).

Table 6. Forecast economic efficiency of rapeseed processing into biodiesel in LLC "AF" Lan "

№	Indexes	thousand UAH
1	Benefits of rapeseed processing:	
1.1	biodiesel (volume of Substituted Diesel Fuel), t	240,0
	cost	6 624,0
1.2	meal (58%), t	411,0
	cost	3 288,0
1.3	glycerin, t	57,6
	cost	691,4
2	Cost of received products, UAH	10 603,4
3	Costs for growing and processing of rapeseed, UAH	5 743,8
4	The amount of costs attributable to: biodiesel	3 588,2
	meal	1 781,1
	glycerin	374,6
5	Cost of 1 ton: biodiesel	15,0
	meal	4,3
	glycerin	6,5
9	Savings from diesel fuel substitution (profit), UAH	4 859,6
10	Profitability of self-sufficiency,%	84,6

Source: calculated by the author on the basis of data f. № 50 agriculture and advanced research.

The results of the study allowed us to state that in the process of implementation significant performance indicators were obtained (profitability at the level of 84.6%). Thus, despite the fact that the project to process rapeseed for biodiesel is profitable, a comparison of two alternative uses of seeds in terms of profit and level of profitability showed that the current price situation in the markets of rapeseed and diesel fuel in 2021 for the study enterprises it is more expedient to sell its seeds. At the same time, the situation may change next year.

REFERENCES

1. Bondar-Pidgurska O.V. Scientific and methodological principles of sustainable innovative socially oriented economic development: monograph. Higher educational institution of Ukoopspilka "Poltava University of Economics and Trade" (PUET). Poltava: PUET, 2016. 531 p.
2. Gebremariam, S. N., and Marchetti, J. M. (2018). Economics of biodiesel production: review. *Energy Convers. Manage.* 168, 74–84. doi: 10.1016/j.enconman.2018.05.002.
3. Li, M., Zhang, W., Zhou, S., and Zhao, Y. (2020). Preparation of poly(vinylalcohol)/palygorskite-poly(ionic liquids) hybrid catalytic membranes to facilitate esterification. *Separat. Purif. Technol.* 230:115746. doi: 10.1016/j.seppur.2019.115746
4. Gholami, A., Hajinezhad, A., Pourfayaz, F., and Ahmadi, M. H. (2018). The effect of hydrodynamic and ultrasonic cavitation on biodiesel production: an exergy analysis approach. *Energy* 160, 478–489. doi: 10.1016/j.energy.2018.07.008
5. https://ukrstat.org/uk/operativ/oper_new.html
6. Strategy of sustainable development "Ukraine - 2020". Decree of the President of Ukraine of 12.01.2015 № 5/2015. Database "Legislation of Ukraine" / Verkhovna Rada of Ukraine. URL: <https://zakon5.rada.gov.ua/laws/show/5/2015> (access date: 25.02.2020).
7. Strategy of innovative development of Ukraine for 2010-2020 in the context of globalization challenges: project. URL: <http://blogs.kpi.kharkov.ua/News/file.axd?file=2009/6/strategia.doc>. (application date: 25.02.2020).