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MECHANISMS OF STATE REGULATION FOR THE DEVELOPMENT OF ALTERNATIVE ENERGY IN UKRAINE

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Energy conservation is one of the measures of Ukraine's energy policy regarding the distribution, use and economic use of fuel and energy resources in the national economy. The issue of ensuring rational and economical use of energy resources attracts considerable attention in Ukraine.

Currently, scientific developments are being implemented at the national level, in particular, state programs for energy conservation; differentiated tariffs for electricity, stimulation of energy saving; concept, technical requirements and standard solutions for building automated energy accounting systems in the global energy market. Energy organizations work on the problems of modern energy, the development and implementation of new types of energy, as well as energy-saving measures in Ukraine, the implementation of which is impossible without the creation of an appropriate regulatory framework.

National documents of Ukraine in the field of energy, regulating energy saving and energy efficiency, establish the relevant competence of state authorities, giving them the necessary powers. Some legislative and regulatory documents in the field of energy conservation directly relate to the issues of reducing energy consumption, practical possibilities of implementing energy conservation measures, and their financing mechanisms.

Although there are about 50 national standards of the Energy Saving Group in the field of energy efficiency, in Ukraine there is no clear mechanism for stimulating the implementation of energy saving measures, there are no rules and mechanisms for their regulation, but there are economic incentives for energy efficiency.

According to the legislation of Ukraine, energy saving is an activity (organizational, scientific, practical, informational) aimed at the rational use and economical use of primary and transformed energy and natural energy resources in the national economy and is implemented using technical, economic and legal methods. Energy efficiency and energy saving are interrelated, since energy saving is the main factor in increasing the level of efficiency in the use of fuel and energy resources. The concept of energy efficiency is somewhat broader and includes not only direct ways of energy saving, but also indirect ways that lead to a reduction in the consumption of fuel and energy resources.

The level of energy consumption in Ukraine is almost three times higher than in the EU countries, and therefore the potential for the development of efficient energy use in Ukrainian companies is huge. The investment market of Ukraine in various sectors is at an initial stage. But, despite the constant and inevitable increase in energy prices and the participation of the WTO, competitiveness in the world market is possible due to the reduction of energy consumption, i.e. investing in its efficient use. By implementing energy-saving measures, industrial enterprises, housing and communal services intend to take advantage of the implemented measures and increase the energy efficiency of the enterprise both at the expense of their own, state funds, and the funds of domestic and foreign investors.

The main argument is that the reduction in the cost of electricity and natural gas will immediately have a positive impact on the company's income. At the same time, the company's competitiveness is growing, in particular, due to the increase in energy prices. Productivity is limited by inefficient production processes involving the use of energy. Improving the latter automatically increases productivity and increases company profits. Business revenues will also increase through emissions trading. Dependence on energy prices is becoming less and less - fewer risks for the company.

Reducing energy consumption also leads to a reduction in emissions, improves the environmental condition and image of the enterprise. Such investments can bring a number of additional positive results.

Underestimation of the level of wages of employees of enterprises, rejection of long-term investments and modernization of production capacities, use of tax evasion schemes is unacceptable for the development of the state. Such approaches do not contribute to increasing the efficiency of the use of fuel and energy resources of the national economy; they support the high level of energy intensity of Ukraine's GDP, and the consumption of scarce energy resources threatens Ukraine's national security.

The experience of the member states of the European Union shows the need to observe the principle of consistency between management influence and the established indicator (group of indicators) of energy efficiency, which will clearly define the goals, assess the effectiveness and efficiency of management actions and their compliance with EU legislation.

Compliance with this principle requires developing a system of energy efficiency indicators that would reflect the entire sphere of energy efficiency regulation. The results of research into the legal framework of the energy sector and statistical data made it possible to identify a number of priority factors in the energy sector that hinder the economic and social development and energy security of Ukraine.

It should be noted that the state of energy-intensive industries is deteriorating due to the aging of fixed assets and the entire energy supply system. District heating systems, which provide half of the heat for industry and heating, almost 55% of households are in urgent need of modernization and implementation of a tariff system based on consumption and total costs. The fund of buildings and structures is in a bad condition.

Regarding transparency in the energy sector, energy flows, limited reporting and leverage, poor implementation of legislation and prices, inconsistent government regulatory policies, subsidies and insufficient incentives for energy efficiency investments are not sufficiently taken into account.

The results of the research made it possible to formulate the priority areas of energy saving in order to increase the level of energy efficiency in Ukraine by introducing the following measures:

- improvement of the legislation and standardization system in the field of energy efficiency, renewable energy and fuel;
- optimization of the structure of the energy balance of the state;
- improvement of pricing mechanisms for fuel and energy resources;
- conducting an energy audit of energy consumers in order to implement energy-saving measures;
- implementation of mechanisms to support the implementation of means of accounting for the use of fuel and energy resources;
- introduction of energy efficiency requirements for equipment, goods, works and services;
- improvement of methods for calculating energy efficiency indicators;
- Ukraine's participation in international agreements, energy efficiency projects;
- attraction of significant and long-term investments to ensure modernization, sustainable development, safety and competitiveness of energy saving;
- develop programs for the implementation of energy saving measures, including facilitating access to loans and removing legal restrictions on investments in energy efficiency;
- develop programs and create partnerships aimed at increasing the capacity of local lenders, municipalities and homeowner associations to develop attractive energy efficiency financing projects;

- development of measures to stimulate the spread of energy management systems in energy-intensive industries;

- to improve the methodology by facilitating access to energy aid services; - timely cash payments under the "green tariff";

- adaptation of state management mechanisms to the principles and requirements of EU legislation.

The study identified factors affecting energy efficiency and the use of fuel and energy resources, as well as the main perspective measures that must be implemented in the country to increase energy efficiency, which will lead to the profitability of the enterprise and energy savings.

In order to increase energy efficiency and the field of energy saving, there are a number of unsolved problems that need to be solved - the implementation of innovative activities in the field of energy saving, as well as the implementation and financing of experimental organizational, information and investment projects.

ANAEROBIC FERMENTATION OF ORGANIC WASTE USING BIOSTIMULATORS

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Keywords: biostimulant, biomethane production, anaerobic fermentation, organic waste

Biostimulators of methane fermentation are indispensable auxiliary agents for the processing of organic waste from agriculture, food production, processing plants, sewerage and household waste to obtain a high-value alternative fuel, i.e. biogas and high-value biofertilizer. In low concentrations, these substances are effective, contribute to the good functioning of the vital processes of the fermentation of the substrates and allow you to get a high yield of biogas and good quality products [1].

The aim of the work is to highlight the work on intensifying the process of "methane" fermentation, where biostimulants of gas formation are often used (enzymes, probiotics, trace elements, apple pulp, amaranth pulp, synthetic preparations from organic origin, dietary supplements, etc.). In the world, this direction is developing at a fast pace, because humanity needs renewable energy sources [2,3].

All cutting-edge research examines the effect of biostimulants on the change in the ratio of carbon and nitrogen in the fermented mass and on other parameters of the anaerobic fermentation process. In particular, questions on the behavior of biostimulants in the biochemical process are highlighted, where the rate of anaerobic digestion intensity increases in a small amount. The positive effects of bioactivators are being studied, where they lead to a reduction in process time, thereby it enables a significant reduction in operating and capital costs [4-7].

We recommend to the general public promising ways to solve anaerobic fermentation of various substrates using effective biostimulants. A model of biochemical stimulation of processes was developed methanogenesis using natural biological activators, increasing the yield of biomethane and improving the quality of biofertilizer.

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ECONOMIC GROWTH AND ENERGY DEMAND PROBLEMS

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Abstract. The article aims to analyse demand for energy as modern world deals with energy consumption, economic growth and environment pollution problems. Present situation, in the context of Russian – Ukrainian war, reveals that EU countries face with energetic security problems as most of the countries are highly dependent on the import of oil, uranium for nuclear plants, and natural gas from Russia. The article analyses the consequences of energy crisis to business companies and further impact on economy of the EU.

Keywords: energy demand, renewable energy, energy crisis, Russia, economic growth

Introduction

Since 1970s a great number of focuses on the relationship between energy consumption and economic growth has been published. However, various studies find controversial and non-conclusive results. It has been proved that at the same time increasing energy consumption might boost economic growth through the productivity enhancement and cause environmental damages. Scientific research provides four different hypotheses on economic growth and energy consumption: growth, conservation, feedback, and neutrality. Based on the growth hyphotesis, energy is the vital source for the economic growth and has direct impact on the growth or decline of economy. Furthermore, reducing the consumption of energy would have destructive impact on economy. For example, the other study proves that renewable energy (biomass) has positive impact on the economic growth in the case of the U.S. The growths hypothesis has been confirmed on the impact of renewable energy in the OECD countries. According to the conservation hypothesis, the consumption of energy performs a vital role in economic development in both directly and indirectly way (Šimelytė, 2020). Thus, in this case, there is unidirectional nexus running from economic growth to consuming energy. It means that the reduction of energy use will not affect economic growth adversely. For example, in the case of the Baltic States during the period of 1990 to 2011, the conservation hypothesis has been confirmed. Thus, in the Baltic States the economic development causes the expansion of renewable electricity consumption, but not vice versa (Šimelytė, Dudzevičiūtė, 2017). The feedback hypothesis shows the bidirectional relationship between output and energy use. This relationship indicates that energy conservation has a negative impact on economic growth and vice versa (Ozcan, Ozturk, 2019). The aim of the article to analyse demand for energy, economic growth and environment pollution problems.

Energy Challenges and economic consequences

Expansion of cities, urbanization and industry demands more energy and puts pressure on existing infrastructure and relative high demand on investment. Thus, oil-rich countries have been taking competitive advantage over the others by decreasing supply of oil. In this way, the prices of oil have been increasing with the short-time decline during the COVID-19 period. According the OPEC, despite scale of renewables are expanding, however the demand for oil and gas would make even 45% by 2045. Even more, by 2045 the demand for energy might to increase by 28%. Meanwhile, electricity generation from renewables that grew up by 6% in 2020 with PV solar and wind technologies together accounting up to 64%. International Energy Agency expects that the electricity generation from renewables will make 50% by 2030. However, since industrial revolution people have been trying to reduce energy consumption, optimize processes and to increase profitability. The other way to reduce production cost is to use cheaper energy sources. Thus, energy has been generated from fossil fuels. Renewables have been much more expensive energy source compared to fossil ones. Nowadays, prices of energy generated form renewables have decreased significantly. Renewable energy sources are fast becoming cheaper than fossil fuels. Based on World Economic Forum report (2021) renewable energy sources were cheaper than fossil ones in 2020. Yet, solar and wind energy has been scaling-up continuously, however it is not enough to predict future prices of renewables. Renewable energy has great potential in the future as demand for energy increasing and fossil energy sources are running out. Due to limited fossil resources or access to fossil resources or energetic security, countries introduce in application of alternative energy sources such as solar thermal energy, photovoltaic, waste, wind energy, wind wave energy, biofuels, geothermal energy, bio-gas, heat pump and small hydro power. Greenhouse gas increases due to using fossil fuel and causes climate change. Thus, based on the World Economic Forum report (2022), the rapid transition from fossil energy to emissions-free 'green' energy might save many trillions of dollars in energy costs and at the same time it might combating climate change. However, there is another point of view that future relies on both renewables and nuclear power. Although some countries, due to probability of nuclear power plant accident, close nuclear power station (for example Lithuania) and focus more on renewable energy potential. They state that the expansion of production technologies based on nuclear energy and renewable energy would significantly reduce future emissions of greenhouse gases emissions. Wind energy as one the most perspective renewable energy sources is seen by Italian scientists. Savino et al. (2017) state that although big wind power plants have reached a relative maturity; however there is a lack of research on profitability of medium wind turbines and their environmental perspective. Meanwhile, small and medium size wind power plants require more investment compared to large ones. Thus, the cost of electricity made by small and medium size wind power plant rises. In addition, the sharp and continuous increase in energy prices, the global warming, and running out primary energy sources require that renewable energy would be appropriately managed and used to sustain economic development. Nevertheless, the most of the studies prove that consumption of energy stimulate economic growth, however, at the same time even renewable energy causes environmental degradation (Simelyte 2020). Moreover, renewable energy sometimes is a vital strategic decision for the countries, which have limited fossil energy resources and are dependent on other energy importing countries. The worst situation is when a country becomes reliable on the one particular energy importing country. However, European countries including Germany, Italy, Serbia, Bulgaria and the Baltic States are highly depended on the imported energy (European Commission 2016). Mainly, the EU is depended on imports of natural gas, and oil from Russia. Even more, EU countries import uranium for nuclear power plants form Russia as well. Thus, it raises the concerns of energy security and sustainability. As the EU supporting the Ukraine introduced sanction on Russia. It has started to manipulate gas supply to threaten the EU energetic security and solidarity. The EU commission recognizes that 13 Member States are influenced by partial or total supply reduction 12 with five Member States (Bulgaria, Poland, Lithuania, Latvia and Finland) no longer receiving any gas supply from Russia. However, gas and electricity prices have not been ever so high in the history of EU as in 2022. It has been noticed that the energy prices have been rising much faster and it used to be increasing gradually over the last several decades. Prices of electricity produced by using natural gas increased significantly due to raised prices of gas since the Russian- Ukrainian war. Although the prices of energy have been rising even during the period of COVID-19 lockdown as the world introduced restrictions. At the same time, the EU consumed much less than it usually did. High temperature during the summer of 2022 increased demand for energy due to intensive cooling and added pressure to energy generation. The shortage of domestic produced electricity in the Baltic States resulted extremely high prices in the Nord Pool market (Figure 1). As energy prices hits the ceiling, companies tend to stop production, shorten working hours or safe electricity. Even more, closing one company may results the downtime in the another. For example, in Lithuania, one of the largest corporations "Achema" has stop its production. At the same time, the other large company "Lifosa" had to stop its own production as "Achema" was its main supplier. In France, the other solution has been made by Saint-Gobain, the French building materials group. It has been decided to cut gas consumption and turn the thermostat down. Thus, the temperatures will be closer to 8C, instead of the usual 15C. Turning down the thermostat is no mere cost saving for many of Europe's industrial companies as the difficult and cold winter is expected.

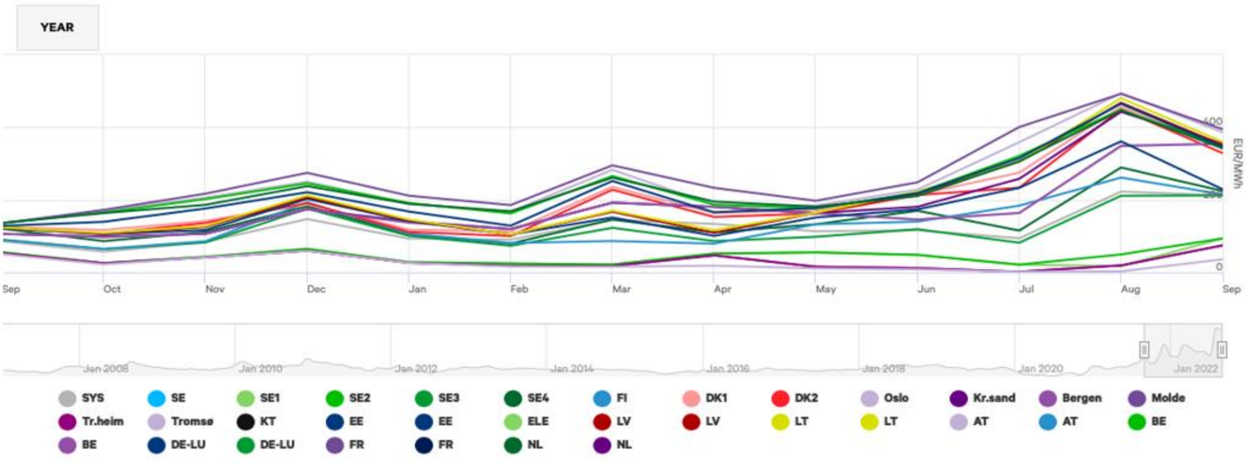

Fig. 1. Dynamics of Electricity prices in Nord pool market from September 2021 to September 2022 (source: NORD POOL, 2022)

With energy prices soaring to unprecedented highs after Russia's invasion of Ukraine, it has become a matter of survival. Over the 10 years to 2020, European gas prices were on average two to three times higher than the US, according to the International Energy Agency. Europe's industrial base employs some 35mn people or roughly 15 per cent of the working population (Hollinger, P, 2022). Increased energy prices have effect on the inflation in all business sectors. The average inflation in the Eurozone is 10%. The European countries have not been facing with such high inflation for decades. Thus, in order to reduce inflation, the ECB made difficult decision to increase EURIBOR which resulted the increase of interest rates. Pandemic, energy crisis and Russian-Ukrainian war challenges Europe to solve its economic, political, social issues and still to keep solidarity over democratic and liberal values.

Conclusion

Energy sector represents a fundamental economic sector, as its efficiency strongly affects competitiveness of the entire national economy, particularly as regards industry. The changes and energy crisis make impact on the other sectors significantly. Even more, consequences are economic and environmental as well. Especially, in the times with limited energy supply, countries start to use less sustainable resources such as fuel oil and pollutes even more. Thus, energetic security with diverse energy sources may assure that the states would not face with the shortage of energy so much.

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USE OF BIOGAS PLANTS IN UKRAINE AND IN THE WORLD

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In recent years, interest in biogas production processes and the rational use of agricultural waste has been growing significantly. This is manifested not only in the growing number of construction of new biogas plants, but also in the interest of a growing number of farmers, communal enterprises, politicians, and private enterprises, who are constantly monitoring the development of this field [1]. For a long time in Ukraine, manure of agricultural animals was used mainly as an organic fertilizer, only in recent years the widespread introduction of modern technologies effective for its processing in special industrial installations for the production of biogas and organic biofertilizers began. Thanks to such an installation, it is possible to process various types of organic raw materials into biofuel, fertilizer and energy.

Annually, 109 million tons of waste are generated in the agricultural sector of Ukraine, of which 49 million tons is inefficiently used and disposed of, and 60 million tons are used from for the purpose of further processing [1,2]. Only 1 million tons of recycled waste is used for obtaining heat and electric energy (EE), and the remaining 59 million tons used as a fertilizer to improve the quality of soils, bedding in stalls and fodder for animals (birds). From 49 million tons of unused waste almost 20 million tons can be directed to the implementation of production projects energy that pays off economically.

A review of the available information materials and an analysis of the information shows that the development of biogas plants is going in two directions. The first is a rational simplification and, accordingly, a reduction in the price of those installations, during the use of which the production of biogas is not the main goal compared to the requirements of ecological safety of the environment and production of highly effective organic fertilizers. These developments are usually offered for use in small farms [2].

The second direction is the creation of modern high-performance complete biogas plants based on the latest improved designs of bioreactors, modern automated technological process control systems, highly efficient thermal, electrical and technological equipment.

Active growth in the construction of biogas plants in European countries began thanks to the state's policy to improve the environmental situation and combat greenhouse gas emissions as a result of weak processing of household and industrial waste. During its decomposition, waste creates methane (the main component of biogas), which without processing enters the atmosphere, polluting the environment. Therefore, companies located in Europe engaged in the processing of household and industrial organic waste, biogas production, with subsequent production of electricity, heat and bioethanol received "green" tariffs, bonuses and low interest rates on loans for such projects.

After the establishment of the bioenergy industry, farmers began growing special energy crops, which are fully used as raw materials for biogas production. In the same Germany, more than 1.2 million hectares of land are cultivated under such energy crops. On the market of Western Europe there is a significant variety of biogas plants of different capacities and designs: large (more than 1000 kW), medium (from 500 to 1000 kW) and small (up to 500 kW) [3].

The main obstacle to the development of biogas plants in Ukraine is that the biogas plants available in Ukraine have a small specific amount of biogas output. This is primarily due to the fact that their designs do not provide for effective mixing of the fermented mass, inoculation of the incoming mass, and retention of anaerobic microflora in the methane tank. The issue of thermal efficiency of biogas plants and the economic efficiency of using fermented manure and litter has not yet been resolved for industrial-scale plants. In general, "bioenergy" is one of the most promising components of renewable energy in Ukraine. It is based on the use of biomass energy - carbon-containing organic substances of plant and animal origin. Biomass, unlike other renewable energy sources, is a universal energy source that can be used both for the production of electricity and thermal energy, and for obtaining biofuel for transportation needs.

According to the State Energy Efficiency Agency, as of the beginning of October 2019, 45 biogas plants with a total capacity of 70 MW were installed in Ukraine.

Growth in energy capacities for 2020-2021 exceeded 50%, but Ukraine is still far from the leader of the biogas industry, Germany, where the number of biogas plants since 201 exceeds 9,500 plants generating more than 5,000 MW of electricity. In Ukraine, a "green" tariff for electricity from biogas was introduced by the Law dated 25.04.2019 No. 2712-VIII, which provides for the preservation of the current "green" tariff for electricity from biogas until 2030, the voluntary participation of developers of such projects in auctions, the possibility of selling electricity from biogas for at the auction price for 20 years.

According to the State Energy Efficiency Agency, since the beginning of 2012, about 112 million euros have been invested in biogas plants in Ukraine. At the same time, as of October 2021, 50 MW of electricity is generated by biogas power plants that operate on agricultural waste, and 26 MW is generated by landfills. If compared with the leader of the European bioenergy market, Germany, on the one hand, Ukraine lags far behind the development of the biogas market. But, on the other hand, that is why it has huge potential, both due to the low saturation of the market (1.3% of the volume of bioenergy generation in Germany), and due to the high rate of development of agriculture in our country, which produces the bulk of bioenergy raw materials.

The energy obtained as a result of the implementation of commercially effective projects for processing of available waste, will reduce Ukraine's need to import natural gas by 8 billion cubic meters per year. Savings from reducing imports can to make about 28 billion hryvnias. Wet waste is technologically expedient to ferment in reactors with the subsequent production of biogas [4]. Projects on anaerobic fermentation, biogas production and further energy production require costs from € 5,000 to € 23,000 per 1 ton of used waste per day with a payback period of 6 to 14 years.

In addition, such projects have a positive impact on the environment by replacing energy production from carbon fuels and, as a result, reducing CO_2 emissions. Thus, if the energy produced from 8 billion cubic meters of natural gas is replaced by energy obtained from agricultural waste, the reduction of greenhouse gas emissions will amount to about 15.8 million tons CO_2 per year.

A significant part of agricultural waste (more than 80%) consists of agricultural waste, i.e. crop and animal husbandry [3,4]. Some types of agricultural waste (cob straw, cattle manure, pig manure, bird droppings) should be processed to obtain thermal and electrical energy. Annually, up to 29 million tons of waste is generated in the animal husbandry and animal processing industry of Ukraine. Of them, primary waste (manure and droppings) make up 28.5 million tons, which is 98% of the total mass of livestock waste.

The most appropriate technologies for processing agricultural waste for energy production in Ukraine are:

• incineration, mainly for dry materials (dry matter content (DS) is more than 40%);

• anaerobic fermentation with obtaining gaseous fuel - for wet materials (SR content less than 12%).

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ЛЬОН-ДОВГУНЕЦЬ ЯК ЕНЕРГЕТИЧНА КУЛЬТУРА І ФАКТОРИ СОБІВАРТОСТІ ВИРОБНИЦТВА ЛЬОНОТРЕСТИ

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За різними класифікаційними ознаками льон-довгунець розглядають як прядивну, олійну, технічну, продовольчу, кормову та лікарську рослину [1]. Проте льон-довгунець можна характеризувати і як енергетичну культуру. Про це свідчить використання лляної олії для виробництва дизельного біопалива [2] і тому льон-довгунець посідає відповідне місце в біоенергетичних системах агропромислового комплексу.

В Україні від переробки льонотрести щорічно одержували 380 тис. т костриці, що відповідало річному приросту деревини на площі 92,5 тис. га лісу. На льонозаводах кострицю використовували як висококалорійне паливо [3]. За відповідною технологією з костриці отримують екологічно чистий утеплювач, застосування якого для теплоізоляції будівель дає можливість скоротити тепловтрати житла і заощадити теплові ресурси держави. За літературними джерелами костриця містить 45–48% целюлози, похідні якої, крім іншого, застосовують для виготовлення пороху, а мішані порохи використовують як тверде ракетне паливо.

Виробники льону-довгунця волокнисту складову урожаю реалізують переважно трестою, яку готують шляхом росяного мочіння. Таку тресту називають рошенцевою. В попередній публікації [4] висвітлені результати дослідження собівартості виробництва рошенцевої льонотрести, яка разом з урожайністю льоносировини формує конкуренто-спроможність льонарства (А.С. Малиновський, 2006).

В якості вихідних даних використані результати виробничої діяльності 52 великотоварних сільськогосподарських підприємств поліських районів Житомирської області в роки усталеного і за державної підтримки розвитку льонарства в Україні. Розмах варіювання собівартості 1 ц трести становив 15,0–43,9 грошових одиниць (гр. од.) за середнього арифметичного значення і середнього квадратичного відхилення відповідно 26,2 і 6,2 гр. од. та коефіцієнта варіації 23,7%.

При цьому собівартість 1 ц насіння коливалася від 27,8 до 136,2 гр. од. за середнього арифметичного значення і середнього квадратичного відхилення відповідно 56,1 і 20,4 гр. од. та коефіцієнта варіації 36,3%. Собівартість 1 ц льоносоломи змінювалася в межах 6,9–25,3 гр. од., а її середнє арифметичне значення і середнє квадратичне відхилення дорівнювали відповідно 13,3 і 4,3 гр. од. за коефіцієнта варіації 32,2%.

Серед факторів собівартості виробництва льонотрести визначали розмір землі в обробітку, тобто площу ріллі в підприємстві, концентрацію посівів льону-довгунця, технічну забезпеченість підприємств, яку оцінювали тракторо- та машинозабезпеченістю, забезпеченість підприємств механізаторами та інтенсивність використання машинно-тракторного парку, за оцінний показник якої прийнятий коефіцієнт змінності роботи тракторного парку. Основні статистичні показники емпіричних розподілів факторіальних ознак наведені в табл. 1.

Обробки зібраних статистичних даних здійснена з використанням основних засад кореляційно-регресійного аналізу. Визначали коефіцієнт кореляції між досліджуваною результативною ознакою і прийнятими для аналізу факторіальними ознаками. Вели розрахунок кореляційних відношень результативної ознаки на факторіальні. Пошук рівнянь регресії кількісної зміни результативної ознаки залежно від факторіальних здійснювали з використанням стандартних комп'ютерних програм за R^2-коефіцієнтом, що характеризував вірогідність апроксимації експериментальних значень результативної ознаки відповідною прогностичною функцією.

Таблиця 1. Основні статистичні показники емпіричних розподілів факторіальних ознак в дослідженні собівартості виробництва рошенцевої льонотрести

Досліджувані факторіальні ознаки	Розмах варіювання	Середнє арифметичне значення	Середнє квадратичне відхилення	Коефіцієнт варіації, %
Площа ріллі в підприємстві $F_р$, га	683–5597	2668	1258	41,7
Концентрація посівів льону-довгунця $K_{пл}$, %	4,2–13,6	9,25	1,62	17,5
Тракторозабезпеченість $T_{заб}$	0,61–1,75	0,96	0,21	21,9
Машинозабезпеченість $M_{заб}$	1,10–4,04	2,30	0,63	27,4
Забезпеченість підприємств механізаторами $З_{мех}$	1,21–3,45	1,98	0,45	22,7
Коефіцієнт змінності роботи тракторного парку $k_{зм}$	1,00–1,52	1,12	0,11	9,8

Визначали показники оцінювання вирівнювання експериментальних значень результативної ознаки визначеною апроксимуючою функцією залежно від чисельних значень факторіальних ознак. Цей показник розраховували як відношення основної помилки вирівнювання до середнього значення експериментального ряду результативної ознаки. Помилку опрацьованого рівняння регресії визначили з використанням обрахованих показників кореляційного зв'язку між результативною ознакою і факторіальними.

Між собівартістю виробництва рошенцевої льонотрести $C_{лт}$ і тракторозабезпеченістю $T_{заб}$ підприємств та їх забезпеченістю механізаторами $З_{мах}$ виявлений додатний кореляційний зв'язок з коефіцієнтами кореляції відповідно плюс 0,181 і плюс 0,131 за кореляційних відношень результативної ознаки на факторіальні в тій же послідовності відповідно 0,363 і 0,811. Між $C_{лт}$ і площею ріллі в підприємстві $F_р$, концентрацією посівів льону-довгунця $M_{заб}$, машинозабезпеченістю підприємств $M_{заб}$ та коефіцієнтом змінності роботи тракторного парку $k_{зм}$ виявлений від'ємний кореляційний зв'язок з мінусовими значеннями коефіцієнтів кореляції відповідно 0,156; 0,150 та 0,110 і 0,056 за кореляційних відношень результативної ознаки на досліджувані факторіальні в тій же послідовності 0,306; 0,219 та 0,408 і 0,544. Перевищення кореляційного відношення над коефіцієнтом кореляції в досліджуваних парних кореляційних зв'язках свідчить про криволінійну зміну собівартості трести залежно від оцінних показників розміру підприємств, визначених в цьому дослідженні.

З'ясовано, що кількісна зміна собівартості трести залежно від площі ріллі в підприємстві, концентрації посівів льону-довгунця, машинозабезпеченості та коефіцієнта змінності роботи тракторного описується спадними гіперболами з визначеними асимптотами цих гіпербол. Зміна собівартості трести залежно від тракторозабезпеченості підприємств описується рівнянням увігнутої параболи другого порядку. Дослідження з'ясованого рівняння на екстремум показало, що собівартість трести мінімізується за тракторозабезпеченості 0,94. Зменшення чи збільшення тракторозабезпеченості супроводжується підвищенням собівартості трести. Так, зменшення тракторозабезпеченості до 0,72 викликає підвищення собівартості трести на 4,9%. Із збільшенням тракторозабезпеченості до 1,64 собівартість трести зростає на 51,2%.

Зміна собівартості трести залежно від забезпеченості підприємств механізаторами описується рівнянням зростаючої експоненти, за якої R^2-коефіцієнт дорівнював 0,891.

Найменша собівартість трести спостерігалась у підприємствах за забезпеченості механізаторами 1,43. Підвищення забезпеченості механізаторами до 1,88; 2,33 і далі до 3,23 супроводжувалося зростанням собівартості трести відповідно на 7,7%; 51,2 і 75,6%.

В досліджуваних парних зв'язках показник оцінювання вирівнювання експериментальних значень собівартості трести апроксимованими значеннями за відповідними прогностичними функціями залежно від досліджуваного зв'язку коливався від 0,007 до 0,086. Наведені значення показника оцінювання вирівнювання значно менші числа 0,1, яке прийнято за умову задовільного вирівнювання залежної змінної від визначеного аргумента. Помилки з'ясованих рівнянь регресії коливалися в межах 3,62–6,05, що значно менші середнього арифметичного значення емпіричного розподілу собівартості виробництва льонотрести.

Асимптоти рівнянь гіпербол зміни $C_{лт}$ залежно від $F_р$, $K_{пл}$, $M_{заб}$ і $k_{зм}$ дорівнюють відповідно 19,46; 16,62 та 17,46 і мінус 1,22. За визначеними асимптотами граничне зниження $C_{лт}$ залежно від $F_р$, $K_{пл}$ і $M_{заб}$ усереднено може становити близько 17,8 гр. од. Підвищення інтенсивності використання тракторного парку за коефіцієнтом змінності його роботи є фактором, що майже на 30% за визначеним коефіцієнтом детермінації причинно зумовлює варіацію собівартості трести. Серед досліджуваних факторів найбільш впливовим на собівартість трести виявилась забезпеченість підприємств механізаторами. За розрахунками коефіцієнт детермінації, що характеризує зв'язок $C_{лт}$ і $З_{мех}$, дорівнює 0,658. Отже, варіація забезпеченості підприємств механізаторами на 66% причинно зумовлює варіацію собівартості виробництва льонотрести. Варіація собівартості виробництва трести на 13 і 17% причинно зумовлена варіацією відповідно тракторо- і машинозабезпеченості. Варіації концентрації посівів льону-довгунця і площі ріллі в підприємстві відповідно на 4,8 і 9,4% причинно зумовлюють варіацію собівартості виробництва льонотрести.

Аналіз відповідних графічних залежностей і опрацьованих модельних рівнянь криволінійної регресії засвідчив, що площа ріллі в підприємстві має бути обмежена значенням 3000–3140 га, концентрація посівів льону-довгунця бути в межах від 8,6 до 10,0%, тракторозабезпеченість становити 0,94, машинозабезпеченість має бути обмежена значенням 2,5, забезпеченість механізаторами не повинна перевищувати значення 2,0, а коефіцієнт змінності роботи тракторного парку повинен бути не меншим 1,25.

З'ясовані кореляційні зв'язки і визначені модельні рівняння криволінійної регресії варто враховувати при опрацюванні організації і технології виробництва рошенцевої льонотрести та стратегії і тактики відродження льонарства в Україні.

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