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OVERVIEW OF A SECONDARY USE OF WASTE

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ОГЛЯД НАПРЯМІВ ВТОРИННОГО ВИКОРИСТАННЯ ВІДХОДІВ

At the present time, in market conditions, waste from the agrarian sphere of production is considered unprofitable, but at the same time, this information is changed by the fact that most of the waste from the production of agricultural products can also benefit people after secondary processing. Preparation for the reuse of waste ranks second in waste management. It has been investigated that according to the EU Waste Directive, preparations for reuse are recycling operations such as inspection, cleaning or recovery, when products or their components that have become waste are prepared for reuse without other pretreatment. Accordingly, the implementation of measures for the reuse of waste will bring not only a positive environmental effect, but also an economic and social one. New jobs that will reduce the number of unemployed will prevent new waste from entering processing plants, as well as give low-income segments of the population cheap used goods. The issue of secondary use of agriculture in the context of waste-free production of agricultural enterprises in modern economic conditions is considered in the article. An analysis of the achievements of European countries in the processing industry, a scheme of indicators for the efficiency of agricultural waste processing (technical indicators, natural environment indicators, economic indicators and socio-cultural indicators) was proposed. Expected results from the implementation of the system of extended responsibility of producers working in agriculture were determined. The analysis showed that for business, the reuse of waste will bring significant savings in resources and money, and subject to a successful advertising campaign, additional concessions and profits.

Therefore, the successful reduction of the amount of waste through its reuse is a real goal that will reduce the consumption of raw materials, energy and reduce emissions of pollutants in the process of producing new products. However, the intentions and strategic plans of Ukraine to become a member of the European Union encourage many Ukrainian manufacturers to take measures regarding the secondary processing of waste and introduce a closed cycle economy at the enterprise.

У теперішній час, в ринкових умовах відходи аграрної сфери виробництва вважаються неприбутковим, але в той же час дану інформацію змінює той факт, що більшість відходів виробництва продукції сільського виробництва також може приносити користь людині після вторинної переробки. Підготовка до повторного використання відходів займає другу сходинку у поводженні з відходами. Досліджено, що згідно з Директивою ЄС про відходи, підготовка до по-

вторного використання являють собою такі операції з утилізації, як перевірка, очистка чи відновлення, коли продукти або їх компоненти, що стали відходами, готують для повторного використання без іншої попередньої обробки. У статті розглянуто питання вторинного використання сільського господарства в контексті безвідходного виробництва аграрних підприємств в сучасних умовах господарювання. Здійснено аналіз досягнення європейських країн у переробній галузі, запропоновано схему індикаторів ефективності переробки відходів сільського господарства (технічні індикатори, індикатори природного середовища, економічні індикатори та соціально-культурні індикатори). У статті авторами наведено очікувані результати від впровадження системи розширеної відповідальності виробників, які працюють у сільському господарстві.

Аналіз наукової літератури показав, що повторне використання відходів є найпростішим та корисним для довкілля і здоров'я способом управління відходами. Відходи сільського господарства являються субстанцією, енергоносіями, які можна повторно і цілеспрямовано використати в землеробстві, тваринництві, квітникарстві, озелененні і інших галузях народного господарства. При цьому, завдяки біотехнології відходи сільського господарства можуть прискорено перероблятися для вторинного використання, не завдаючи шкоди навколишньому середовищу. Відтак, вирішення проблеми забруднення довкілля відходами має бути спрямоване на виконання двох основних завдань: попередження і виключення забруднення довкілля, а також ефективне використання повторно перероблених відходів у сільському господарстві, а саме у землеробстві й тваринництві.

Key words: waste, agriculture, processing, performance indicators, recycling.

Ключові слова: відходи, сільське господарство, переробка, індикатори ефективності, рециклінг.

PROBLEM STATEMENT

The problem of agricultural waste in Ukraine is particularly significant due to the lack of an adequate response to its challenges for a long time. The significant scale of resource use of the national economy, together with the outdated technological base, determined and will continue to determine high rates of waste generation and accumulation. Such circumstances lead to the deepening of the ecological crisis and the worsening of the socio-economic situation in society and determine the need for reform and development, taking into account the domestic and world experience of the entire legal and economic system, which regulates the use of natural resources in general and waste management of agricultural enterprises in particular.

At present, the world has accumulated quite a lot of experience in the use of plant and animal waste from agricultural production. Ukraine has a highly developed agricultural sector, in particular crop production, which annually generates a large volume of various wastes and residues. The high level of waste generation by agricultural enterprises and low indicators of their use as secondary raw materials have led to the fact that in Ukraine every year significant volumes of organic waste are accumulated in agriculture, of which only a small part is used as raw material for the production of biofuel, the rest gets into the soil and groundwater, while polluting the environment. The difference between the situation with the waste of agricultural enterprises in Ukraine, compared to other developed countries, lies in the large amount of organic waste generation and the lack of practice in handling it. At the same time, effective management of livestock and crop production waste is an indispensable feature of all economies of developed countries.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

The works of economists A. Voytsikhovska, O. Kravchenko, O. Melen-Zabramna, M. Pankevich, N. V. Pryshlyak, D. M. Tokarchuk, S. V. Berezyuk, Y. V. Palamarenko are devoted to the study of effective methods of secondary waste processing. V., Melnyk L., Karateeva O. I., Koval O. A., Groza V. I., Yevchuk Kh. - I. and others. Zvarych R. E., Zvarych I. Ya., Gurochkina V. V., Budzynska M. S. devoted their work to the circular economy.

This issue is relevant at the present time and scientists have made a significant contribution to the development of theoretical, methodical, methodological and management provisions in matters related to the management of agricultural waste. At the same time, the issue of revealing the nature of secondary waste use remains unresolved.

FORMULATION OF RESEARCH OBJECTIVES

The purpose of the study is to review the domestic and foreign experience in the areas of secondary use of agricultural waste.

PROBLEM STATEMENT

Currently, more than 26 billion tons of household and industrial waste are generated in Ukraine. The countries of the European Union have long understood the importance of recycling. In Europe, recycling is understood as a disposal operation in which waste is processed into products, materials or substances for a primary or other purpose. It includes the processing of organic material, but not energy recovery or processing into materials to

Table 1. Achievements of European countries in the processing industry

Country	Achievement	The results
Germany	In 1991, a new state system "Duales System Deutschland GmbH" was adopted. The company from Aachen also invented how to better distinguish and separate different polymers with the help of sensors.	Such studies have made it possible to significantly increase the share of secondary processing of various materials over the past decades. Forty percent of all synthetic materials collected in Germany today can be sorted.
Germany	As a result of secondary processing, materials were obtained that did not exist before.	The Reluma company manufactures breakwaters that are used on the coast of the Baltic Sea. Breakers made of synthetic materials last longer.
Switzerland	Imposition of fines for leaving garbage in the wrong place or without paying tax. The country is considered one of the leaders in waste disposal and processing in Europe.	Improvement of the ecological situation. Already in 2000, landfills were banned in the country, so today more than half of all garbage is recycled, and the rest is burned.
Sweden	Recycling more than 99% of its waste	Complete water purification, improvement of the ecological situation.
Poland	Implementation in 2007 in the city of Poznań of a cogeneration module at a solid waste landfill	Production of thermal energy, which is supplied through local power grids for the needs of the city

Source: created by the author based on [2].

be used as fuel or aggregate. In other words, recycling is an operation that provides benefits by substituting other materials.

It is important to note that the benefit mentioned above is not profitable in most cases. That is, the orientation of European countries is aimed at the quality of life and health of the population, therefore the issue of ecology is decisive for them [2].

Guided by the experience of European countries, it can be noted that recycling imposes a great responsibility not only on the average person, but also on other management systems.

MAIN BODY

Waste is divided into primary, that is, those generated directly during the harvesting of agricultural crops, and secondary — those generated during crop processing at enterprises. Primary waste includes straw of grain and other crops, waste from the production of corn for grain and sunflower (stalks, rods 2, baskets, etc.). Secondary waste is sunflower husks, buckwheat husks, rice husks, sugar beet pulp and the like. Part of the waste and residues is used for the needs of agriculture itself (organic fertilizer, bedding and livestock feed), part of it is used by other sectors of the economy, and the rest of the biomass remains unused and is often disposed of (burned in the field, taken to a landfill) without benefit. A significant part of the biomass, which is not used, seems reasonable to involve in energy production. At the same time, the question of what proportion of agricultural waste and residues can be used for energy needs without causing a negative impact on soil fertility is important.

Modern waste management, based on recycling, solves problems related to climate protection and efficient use of resources [1]. The conducted studies showed that the

field of waste management includes all activities related to the generation, collection, storage, use, disposal, transportation and disposal of waste. At the same time, waste disposal is an important element in the general chain of creating waste-free production systems. It involves the involvement of various types of waste in new technological cycles or their use for other useful purposes [8].

Waste prevention is the action taken before a substance or product becomes waste. Accordingly, these measures are aimed at reducing the amount of waste, including the reuse of products or extending the life cycle, at reducing the adverse impact of generated waste on the environment, human health, etc.

At the end of the 20th century, the Swedish economist Thomas Lindqvist developed a model of extended producer responsibility. Separate collection and extended producer responsibility are the basis of a closed-loop economy. Accepting RBB, the manufacturer is responsible for collecting and disposing of used goods that have reached their expiration date, packaging, or organic waste [6].

Accordingly, such a waste management strategy allows solving environmental problems and stimulates business to make important changes. Lindqvist's strategy allows: first, to reduce the amount of waste in landfills; secondly, for manufacturers to switch to a closed production cycle, since they, in turn, will control not only the quality of products and their distribution on the market, but also the collection and further processing of waste.

The analysis of literary sources showed that effective waste management of agricultural enterprises, with the application of advanced technologies, can turn from an environmental problem into a potentially profitable activity — the production of valuable secondary products [12].

It can be clearly observed that the recycling process is quite complex and requires decisive actions from different sides. Let's consider the results of the process of implementing technologies and equipment for secondary waste processing on the example of various European countries (Table 1).

As we can see on the example of European countries from Table 1, waste processing is almost the only solution to preserving the cleanliness of the environment. A serious attitude to the problem of environmental pollution and the bad impact of a large amount of packaging waste on the health of the population stimulates various countries of the Union to take measures to solve this issue.

Ukraine's aspiration to one day join the European Union also means that European standards will become decisive in the formation of Ukrainian strategy regarding further actions in the field of secondary waste processing.

In Ukraine, the processing (processing) of waste is understood as the implementation of any technological operations associated with changing the physical, chemical or biological properties of waste, with the aim of preparing it for environmentally safe storage, transportation, disposal or disposal. That is, processing is a preparatory stage for further operations, in particular disposal or

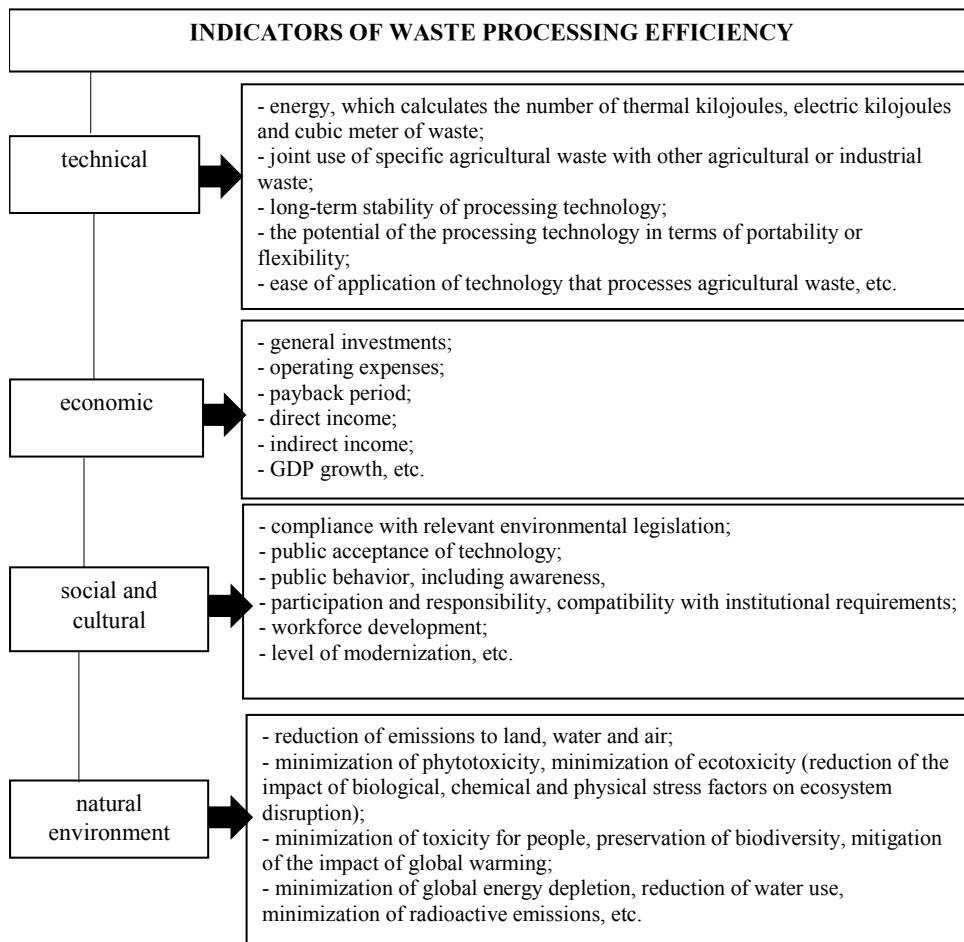


Fig. 1. Scheme indicators of the efficiency of agricultural waste processing

Source: summarized by the author based on the studied literature [4].

removal. As we can see, the legislative understanding of the concept of recycling in Ukraine and in the EU countries is somewhat different.

Unlike European countries, where a significant part of waste is subject to secondary processing, in Ukraine the effectiveness of the application of recycling methods is at the stage of study [2].

Studies have shown that Europe is on the way to introducing a "circular economy concept", which assumes that resources are retained in the economy even when a product has reached the end of its life cycle, so that the resources can be used again, creating their further added value. The transition to a closed-loop economy requires changes in the scale of values, from product design to new business and market models [5].

The analysis of the literature showed that it is worth distinguishing four main economic and technological indicators of the efficiency of agricultural waste processing, namely technical indicators, indicators of the natural environment, economic indicators and socio-cultural indicators (Fig. 1).

The analysis of the fig. 2 showed that proper waste management in the circular economy will improve the economic efficiency of waste processing [14]. It is worth paying attention to the steps that Ukraine is taking in order to get closer to the European standards of secondary waste processing.

In 2014, Ukraine signed the Association Agreement with the European Union, and in 2017 approved the National Waste Management Strategy. Thus, the government undertook to standardize the management system of various types of waste — household, industrial, specific (packaging waste, electrical and electronic equipment waste, used batteries, medical and other waste).

On June 20, 2022, the Verkhovna Rada adopted the Law "On Waste Management". The law establishes the procedure for the collection, removal and processing of municipal waste, ensures the implementation of their separate collection and recycling, provides requirements for the quality provision of waste management services and the charging of fees for such services.

It will allow:

- implement the European hierarchy of waste management;
- to organize the planning of the waste management system at the national, regional and local levels;
- create conditions for the construction of modern waste processing infrastructure in Ukraine according to European rules and open borders for investors;
- establish the "polluter pays" principle;
- to implement the extended responsibility of the product manufacturer [10].

At the same time, the introduction of extended producer responsibility is already a step towards improving the processing process. 11 of the world's most famous manufacturers even before the approval of the relevant legislation signed a Memorandum of Cooperation on the creation of an organization of extended responsibility of manufacturers. The expected results from the implementation of the extended producer responsibility system are shown in fig. 2.

Analysis of fig. 2 shows that the introduction of extended producer responsibility has not only positive environmental consequences, but can also directly affect the economy of Ukraine.

Regardless of the rate at which waste management legislation will change, manufacturers are ready to implement the principles of waste management in Ukraine. They are ready to adapt their work to European practices and await the approval of industry legislation in the field of waste management [13].

It should be noted that the issues of rational use of nature (greening) of agricultural enterprises, reduction of the material intensity of domestic products and stabilization of resource provision of production as a whole, as well as issues related to clandestine processing of waste [3] remain unresolved.

It has been studied that attempts to use agricultural waste accumulated in various types of storages encounter great difficulties associated with a number of technological, technical and economic reasons. In addition to the main method of processing livestock waste — composting, the technologies of biocomposting, drying and high-temperature fermentation are being timidly introduced. Unfortunately, they are high-cost, energy-intensive, non-ecological [7].

The conducted research showed that in today's conditions, prevention of the next ecological crises is impossible without the use of new eco-biotechnologies for the purpose of wastewater treatment, the use of promising methods of processing both solid and liquid industrial waste, increasing effective methods of biological restoration of soil pollution, replacing agrochemicals with new ones organic fertilizers, etc. [9; 11].

Therefore, the greening of production is impossible without supplementing production complexes with special facilities designed for the processing of all types of industrial and household waste. The degree of waste disposal of each production or type of activity should be considered as one of the important indicators characterizing the environmental friendliness of the respective productions, that is, the degree of their impact on the environment and the full use of natural resources.

Analyzing the experience of other countries and the experience of Ukraine, it can be seen that the mechanism due to which the economic stimulation of waste processing in the EU countries takes place is absent in our country. At the same time, it is worth noting that recycling is the most effective, as it is not only environmentally friendly, but also resource-saving [15].

However, this is not an obstacle for enterprises to apply European recycling standards in their production. The relevance of the issue of environmental ecology and the possibility of reusing secondary raw materials

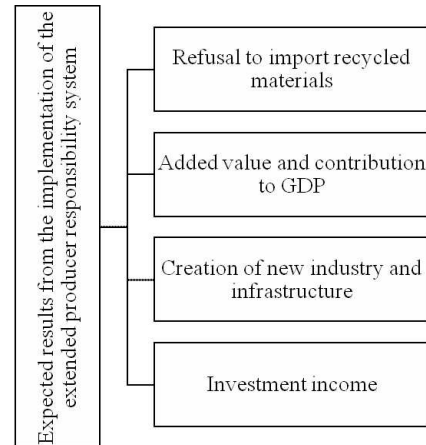


Fig. 2. Expected results from the implementation of the extended producer responsibility system

Source: created by the author based on the studied literature.

in the production process should encourage entrepreneurs to implement the latest technologies for waste processing.

CONCLUSIONS

Today, the state of affairs in Ukraine in the field of waste management is extremely unsatisfactory. However, the intentions and strategic plans of Ukraine to become a member of the European Union encourage many Ukrainian manufacturers to take measures regarding the secondary processing of waste and introduce a closed cycle economy at the enterprise.

The adoption of the Law "On Waste Management" and the introduction of extended producer responsibility can be called a step towards European standards. ORVV is a promising system, the positive results of which are expected in the next 5 years.

Recycling is an important part of responsible consumption. Therefore, in order to keep up with the global transformations of the world order, Ukraine should take into account the experience of progressive countries as soon as possible and make decisions at the legislative level about the effective waste plug and the introduction of extended responsibility of enterprises of the agro-industrial complex.

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