Farmers 4 Climate: Innovations for Adaptation to Climate Change in Fruit and Viticulture in Moldova

A guide to sustainable development in agriculture




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Our common future "sustainable development is development in which the needs of the present generation can be met without compromising the opportunities of future generations to meet them."[1]

1. Moldova- characteristics

The total area of Moldova is 33,843 km2. The country is divided into 32 regions and 5 separate cities. Moreover, it includes the autonomous territory of Gagauzia and Transnistria. Agricultural areas cover 66% of the country's area. The main crops grown are:

• cereals: wheat, corn and barley,

• industrial plants: sunflower, sugar beets, tobacco, oil plants.

Viticulture plays an important role (vineyards in Moldova cover over 100,000 hectares, and wine exports constitute an important part of exports from this country).

Moldova it has some of the best soil in Europe. Fertile chernozems cover as much as 80% of the country's area (2 million hectares), they reach up to 250 m above sea level. Above this height there are forest soils covering 0.5 million ha. The river valleys are filled with alluvial soil. In places there are soils with a high degree of salinity.

Agriculture in Moldova creates 17% of GDP and employs 32% of the workforce, in the EU 5% of those employed in agriculture generate 1.6% of GDP.

Moldova is highly vulnerable to climate change and related disasters, with average annual economic losses amounting to 2.13% of GDP. The country's unique biodiversity

[1] from the 1987 Report of the World Commission on Environment and Development.

is currently under threat from climate change, habitat fragmentation and overexploitation.

Since 2020, fruit growing in Moldova has seen a significant deterioration. Frosts and severe drought resulted in reduced fruit production. In the case of stone fruit, the losses amounted to approximately 50%, in the case of apples, the harvest was lower than expected by approximately 20%.[2].

In recent years, Moldova has seen a decline in apple areas from 56,000 to 52,000. ha, because production is being intensified and older plantings are being removed. The average harvest per hectare is currently 13 tons of apples, in a super-intensive orchard you can collect 50 tons and only 5% of this amount goes to processing. There are many advantages of modern orchards: less work, adaptation to modern equipment, better working conditions and decent earnings for employees.[3]

The situation is similar when it comes to viticulture. Climate changes and longer periods of drought affect the quantity and quality of grapes. The harvest is smaller, which reduces wine production.

Intensive industrial agriculture, based on monoculture crops and the use of artificial fertilizers and chemical plant protection products, leads to a decline in soil fertility, destruction of ecosystems and loss of biodiversity, which makes crops much less resistant to extreme climatic conditions, which are becoming more and more frequent and are more and more violent. The ability of plants to adapt to a changing climate also decreases.

Appropriate machinery is necessary for proper cultivation of the land and will reduce its degradation. Carrying out field work at a time when the soil condition ensures good load-bearing capacity makes the impact of agricultural machinery wheels less

[2] https://www.sad24.pl/sady/jak-rozwija-sie-sadownictwo-w-moldawii/
[3] https://www.undp.org/moldova

destructive to the soil structure, and limiting slippage allows for economical energy consumption.

“Moldova is boldly leading the way in realizing its climate ambitions, being the fourth country in the world to present its updated Nationally Determined Contribution to the Paris Agreement, with the ambition to progressively achieve climate neutrality by 2030.”[4]

A chance for Moldova's socio-economic development is accession to the European Union. This process began in 1998, when the Partnership and Cooperation Agreement entered into force, and since 2010, negotiations on the Association Agreement have been ongoing, culminating in the signing of the Association Agreement on June 27, 2014. After Russia's invasion of Ukraine, Moldova submitted an application for admission to European Union and gained candidate status in June 2022. On December 14, 2023, during the summit of European Union countries in Brussels, a decision was made to start negotiations with Moldova.

On June 23, 2022, at the European Council summit, EU leaders granted Moldova the status of an EU candidate country.[5].

[4] Dima Al-Khatib z UNDP, Resident Representative for the Republic of Moldova.

[5] https://www.consilium.europa.eu/pl/policies/eastern-partnership/moldova/

2. Sustainability

Sustainable development is intergenerational solidarity, which involves finding solutions that guarantee further growth, which allow for active inclusion of all social groups in the development processes, while giving them the opportunity to benefit from economic growth.

3. Sustainable development goals

The main sustainable development goals are set out in the 2030 Agenda for Sustainable Development, adopted in 2015 by 193 countries of the United Nations (UN). The 2030 Agenda is universal, horizontal and very ambitious. It includes 17 Sustainable Development Goals (SDGs) and 169 related goals that reflect the three dimensions of sustainable development - economic, social and environmental.

Goal 1. No poverty

Goal 2. Zero hunger

Goal 3. Good health and quality of life

Goal 4. Good quality of education

Goal 5. Gender equality

Goal 6. Clean water and sanitation

Goal 7. Clean and accessible energy

Goal 8. Economic growth and decent work

Goal 9. Innovation, industry, infrastructure

Goal 10. Less inequality

Goal 11. Sustainable cities and communities

Goal 12. Responsible consumption and production

Goal 13. Actions in harmony with the climate

Goal 14. Life under water

Goal 15. Life on land

Goal 16. Peace. Justice and institutions

Goal 17. Partnerships for Goals[6]

[6] From the UN Resolution – Transforming our World: Agenda 2030 for Sustainable Developmenthttps://ec.europa.eu/eurostat/web/sdi/database

4. Sustainable agriculture

Sustainable agriculture covers not only natural and agrotechnical issues, but also economic and socio-cultural issues. Sustainable agriculture is therefore not the same as the concept of ecological or organic farming. This definition cannot be limited to the definition of environmental balance either. Sustainable agriculture applies to all decisions we make to shape social well-being, i.e. what and to what extent social interest is taken into account when making development decisions.[7].

Sustainable agriculture therefore requires:

1) integration of biological and ecological processes in the agricultural production process,

2) minimizing the consumption of non-renewable resources, especially those harmful to environment and human health,

3) substitution of external inputs by human capital,

4) increasing people's ability to cooperate in common solutions problems related to the management of natural resources.

When implementing the assumptions of sustainable development in agriculture, the threats posed by economic activity to ecosystems and the finiteness (limitation) of natural resources should be eliminated. The natural environment determines the conditions for life and potential opportunities for civilization development. It is about the renewability (sustainability) of agrosystems. The most important activities in this matter include:

1) Creating soil structure and fertility - by increasing the circulation of organic matter (nutrients created on the farm) and thus reducing the use of chemical fertilizers, making decisions about fertilization based on soil tests, minimizing plowing, treating

[7] Collective work under the supervision of prof. Dr. hab. Józef St. Zegar; Sustainability of Polish agriculture; General agricultural census 2010, p. 15

the soil as a living system, maintaining plant cover throughout the year, strengthening the resistance of the soil cover to degradation (amount of organic matter, its structure).

2) Protection of water quality – through practices increasing organic matter in the soil and supporting biologically active humus, practices preventing soil erosion, perennial crops (feed plants, trees, shrubs), buffer zones along watercourses, water reservoirs, proper drainage management, animal husbandry based on in the pasture system and actions to increase water retention (water reservoirs, storage of drainage water in mid-field reservoirs, protection of wetland ecosystems: swamps, peat bogs and meadows, abandoning or limiting to the minimum necessary hydrotechnical and land improvement procedures leading to increased runoff, increasing the resources of organic matter in the soil);

3) Ecological fight against weeds while minimizing the use of pesticides - by selecting plants (neighborhood, succession), building biologically active soil, treating the farm as a component of a larger ecosystem (which also has room for weeds; it depends on the intensity of their occurrence)[8]. Before starting chemical intervention, it is necessary to recognize the properties (ecology) of pests and use chemical agents as a last resort and as least toxic as possible;

4) Increasing biodiversity on the farm - through the integration of plant and animal production, appropriate agricultural practices (maintaining hedges, plants "for insects", ponds, etc.), plant rotation, catch crops, undersowing, etc., and the cultivation of perennial plants and shrubs, optimization of the area share of forests and trees in space.

5) The quality of the breeding environment (room size, lighting, temperature) is of fundamental importance for animal welfare)[9].

[8] Zob. Reaping the Benefits: Science and the Sustainable Intensification of Global Agriculture. The Royal Society, London 2009

[9] ibidem, str. 16

Currently, the concept of sustainable agriculture focuses on agricultural technologies and practices that:

1) have no harmful environmental effects (do not exert pressure on the environment),

2) are available and effective for farmers,

3) they lead to increased agricultural productivity and have positive side effects on environmental goods and services.

Of particular importance are agricultural technologies and practices that increase natural capital resources (strengthening its potential), such as:

1) integrated plant protection management - using the ecosystem's resistance to pests and diseases and using pesticides only when other options are ineffective;

2) integrated nutrient management - seeking balance within the farm only with the necessary external input;

3) minimizing cultivation work (plowing) - to protect the soil and use available moisture resources more effectively;

4) agroforestry – including trees and shrubs in the agricultural system;

5) aquaculture - including fish, crustaceans and other aquatic organisms in agricultural systems, irrigation of rice fields, fish ponds, to increase protein production;

6) water retention,

7) integration of farm animals in agricultural systems[10].

Agricultural sustainability can be considered at various levels, starting from a specific field, crop or other agricultural activity, through the farm, local, regional and national levels, and ending with the continental and global levels.

According to this level, various characteristics and indicators of sustainability need to be taken into account. For example, in the case of agriculture at the country level, the most important attributes of agricultural sustainability can be considered:

[10] ibidem, str.17

1) rational use of agricultural production space and maintaining the production potential of soil,

2) ensuring a justified degree of food self-sufficiency of the country,

3) production of safe food,

4) production of raw materials with parameters desired by consumers and industry qualitative,

5) reducing threats to the natural environment,

6) preservation of biodiversity,

7) ensuring animal welfare,

8) obtaining parity income in agriculture compared to other sectors of the economy [11].

At the sector level (macroscale), agriculture that is able to increase prosperity by providing a sufficient amount of food and other products and services in an economically effective, socially responsible and compliant with environmental protection requirements (including preserving the environment for future generations).

[11] ibidem, str. 19

5. Natural capital

One of the important elements of sustainable development, including agricultural development, is natural capital. The term is used to describe elements of nature that provide important benefits called "ecosystem services".

These include 'capturing' or removing CO2, protecting against soil erosion and flood risk, habitat for wildlife, pollination and providing space for recreation and wellbeing.

The natural environment provides key social benefits to individuals and communities around the world.

The combination of soils, species, communities, habitats, and landscapes that provide these ecosystem services are often called "natural resources."

Natural capital is divided into resources:

• renewable - solar energy, geothermal energy, arable land, forests, air, wind, water;

• non-renewable - crude oil, natural gas, coal, ores;

Natural capital represents certain values.

Generally, the values of natural capital functions and ecological services are divided into:

• ecological values,

• socio-cultural values,

• economic values.

The values listed together form the total value[12].

Even if economic growth does not deplete natural resources, it may have negative effects on the environment, e.g. greenhouse gas emissions and pollution.[13]

- 1. Increase in natural capital per capita and GDP per capita in 1996-2018

[12] Prof. Ph.D. Piotr Jeżowski, "Natural capital and sustainability in environmental and ecological economics", Department of Environmental Economics and Natural Resources, Warsaw School of Economics, 2008

[13] Sources – World Bank statistics; https://datatopics.worldbank.org/sdgatlas/goal-1-no-poverty/?lang=en

- Moldova natural capital per capita decrease by minus 41%, GDP increase by 218%
- Poland natural capital increase by 42%, GDP increase by 316%.
- Vietnam natural capital increase 97%, GDP increase 452%[14]

[14] Sources – World Bank statistics; https://datatopics.worldbank.org/sdgatlas/goal-1-no-poverty/?lang=en

6. Actions at various levels for sustainable development.

The Changing Wealth of Nations initiative analyzes whether countries' production is sustainable. SDG 12 also calls for sustainable consumption. This means, for example, that resources should not be wasted, but rather recycled and safely managed. If production or consumption is not sustainable, economic production will be reduced, leading to greater pollution, greenhouse gas emissions and loss of biodiversity.

An important action for governments in this effort is to reduce fossil fuel subsidies. Fossil fuel subsidies create incentives to prioritize unsustainable production and discourage the use of renewable resources. This is a short-term strategy that contributes to greenhouse gas emissions and climate change.

Most countries benefit from fossil fuel subsidies to some extent, with some spending more than five percent of their national income, Moldova 0.7% of GDP, Poland 0.29% of GDP.

The private sector can also play a role in supporting sustainable development. Companies can use recycled materials, renewable energy, reduce their impact on biodiversity and more. Some companies have taken these actions, driven in part by consumer demand as well as by targets set by governments and the Sustainable Development Goals. One example comes from the automotive industry, where electric car sales have reached a record of almost 9% of all cars sold.

The role of private citizens is also important in ensuring that resources are managed sustainably and used effectively. Particularly in wealthier countries, citizens have the opportunity to choose renewable energy for transport, heating and electricity. All over the world, people can minimize food waste. Much of food production is never eaten. In poorer countries, most food waste occurs during production and storage. In North America and Europe, much of the waste is at the consumer level, meaning households throw away large amounts of food they have purchased.

If this food waste can be reduced, it would reduce the need for natural resources for production, storage and transport, putting us on a more sustainable path.[15].

[15] Sources – World Bank statistics; https://datatopics.worldbank.org/sdgatlas/goal-1-no-poverty/?lang=en

7. Good practices of sustainable development in agriculture

Moldova's agriculture and processing industry face enormous challenges. Development requires an increase in the technological potential of agriculture. The need to implement modern technologies leading to agriculture 4.0 is becoming more and more clear. This requires overcoming many barriers that are very visible in Moldova:

• low agricultural productivity,

• insufficient financial resources allocated to research and development and their subsequent transfer to agriculture

• awareness barriers, reluctance to change and lack of trust in digital solutions and insufficient education,

• lack of specific strategic directions for the development of agriculture 4.0.

The Food and Agriculture Organization of the United Nations (FAO) emphasizes that the measure of technological progress in agriculture is no longer measured by increasingly powerful machines, but by automation, reduced consumption of raw materials and precision of agrotechnical work[16].

Report of the Directorate-General for Agriculture and Rural Development of the European Commission EU Agricutural Outlook. For markets, income and environment for 2020 also indicates that with increasing environmental and social requirements and limited resources, improving agricultural practices and research and development will support the development of agriculture, and digitalization will be a key element of this process.[17]

[16] Technologies in agriculture Startup Poland, Warsaw 2021
https://startuppoland.org/wp-content/uploads/2021/07/RAPORT-AGRITECH-2021-v36-5.10-www.pdf

17 EU agricultural outlook for markets, income and environment 2020-2030, https://op.europa.eu/en/publication-detail/-/publication/e7824a90-5c65-11eb-b487-01aa75ed71a1/language-en

1. Digitization

- The four most popular areas of digital technologies that Polish farmers are interested in include:
- digital production documentation (68%),
- telemetry (74%),
- increasing efficiency using digital solutions (65%),
- selling products via e-commerce platforms (68%).[18]

Farmers in Poland use the Internet to sell food in various ways. Most often, this involves placing advertisements on special sales platforms for farmers. The choice of a platform for selling food online was largely determined by the ability to post ads free of charge. This factor was mentioned by the largest group of surveyed farmers (76.4%). [19]

- Digital farming can cover virtually any area of agricultural production. In plant production, starting from assessing the quality and richness of the soil to indicating the optimal harvest date for the planned product. Digital agriculture also means optimizing the production process, maintaining production profitability by reducing inputs, achieving planned yields and meeting product sales conditions - while limiting the burden on the environment.
- Examples of the use of digital tools in Polish agriculture:
- Rolnik ON, farm management system - https://rolnikon.pl/,
- AgroAsystent, a computer program supporting farm management in plant production - http://www.agropower.pl/,

• AgroPomiarGPS, land management program - http://www.agropower.pl/, NawSald, a program intended for agricultural producers and agricultural advisors as a tool for

[18] Technologies in agriculture Startup Poland, Warsaw 2021
[19] Sale of food products by farmers using the Internet from the perspective of producers and consumers, Research report commissioned by the Agricultural Advisory Center in Brwinów, Branch in Radom,2022, https://sir.cdr.gov.pl/wp-content/uploads/2022/12/Raport_ver_1_revised-2.pdf

preparing fertilization plans on farms for arable land in accordance with the principles of sustainable management of minerals - http://www.iung.pulawy.pl,

• MacroBil, a program for balancing nutrients on the farm on the field surface - http://www.iung.pulawy.pl/,

• Assistant Register, a series of Assistant programs used to support breeding - http://www.meteoryt.pl/.

These are paid tools to which farmers and processors can purchase access.

2. **Earth surface imaging: satellite monitoring of crops, drones, remote sensing are becoming more and more widely used in Polish agriculture.**
    - Earth imaging data (using satellites, drones or planes) have many applications for individual farmers and public institutions, e.g.:
    - • monitoring large areas of crops,
    - • damage estimation,
    - • land development analysis,
    - • crop identification,
    - • analysis of the use of the plot,
    - • yield forecasting,
    - • analyzing the condition of the soil, e.g. its moisture[20].

Technological advances enable this data to be collected in real time, allowing farmers to apply variable rates of fertilizer to specific parts of the field. Creating multi-layer maps of fields regarding weather, fertilization, use of plant protection products, crops, plant condition, weeds, amount of biomass and soil profiles of the field provides wide opportunities to improve productivity (e.g. reducing the amount of fertilizers or plant protection products) and reducing the impact on the environment natural. By analyzing data from longer periods, you can tell whether the crop is developing properly and

[20] KOWR, Satellite remote sensing in agriculture. Chances and possibilities, Warsaw 2019, www.kowr.gov.pl/uploads/pliki/dep_innowacji/ teledetekcja/teledetekcja_sat_w_rolnictwie.pdf

evenly. In case of problems, it is easy to identify areas that are less developed for some reason and take corrective actions .[21]

3. Robotics and artificial intelligence (AI) in agriculture

The use of robots significantly reduces the share of human labor in agriculture, for example, instead of several dozen people, one robot can collect fruit and vegetables, which saves time and costs.[22] An example is a robot called Żukbot, built by students from the Gdańsk University of Technology, which sprays plants. The artificial intelligence inside it causes special cameras and sensors to take photos of plants and then compare them with the collected images from its own database and is able to distinguish diseased leaves from healthy ones.[23]

Artificial intelligence is already widely used in agriculture. The earliest use of its elements was introduced for remote sensing of areas, combining their processing with other image analysis techniques. AI using drone technology is important for agriculture and livestock farming as it provides a convenient way to monitor, assess and scan crops through the use of high-quality and high-resolution images. The use of learning algorithms recognizes the state of plant development, the risk of pests and diseases, so that plant protection products can be used in a reasonable manner and fertilizer needs and deficits can be assessed. A serious problem when using automatic fruit and vegetable harvesters is their proper adjustment to eliminate crop damage during harvesting. Condition assessment through quick image analysis allows for virtually immediate adjustments to settings. Another example of the use of AI in agriculture is the use of deep machine learning models to classify sugar beet roots according to their quality and correct the settings of the combine's working elements..[24]

[21] Technologies in agriculture Startup Poland, Warsaw 2021
https://startuppoland.org/wp-content/uploads/2021/07/RAPORT-AGRITECH-2021-v36-5.10-www.pdf
[22] ADVANCES IN FOOD PROCESSING TECHNOLOGY 2/2019, Dr. Jan Boguski, Application of robots on farms
[23] GKA, KSZ, KSK, ZAN, Żukbot –robot rolniczy, który rozpoznaje chore rośliny i chwasty, https://www.
pap.pl/aktualnosci/news%2C1183983%2Czukbot- --robot-rolniczy-ktory-rozpoznaje-chore-rosliny-ichwasty.html
[24] Precise and intelligent agriculture – status and prospects for implementation, Warsaw 2023
https://www.ksowplus.pl/files/Innowacje/Precyzyjne_i_inteligentne_rolnictwo-epdf.pdf

It should be emphasized here that the basic mechanism for financing the modernization of agriculture in Poland is the Common Agricultural Policy (CAP), and within it the Rural Development Program (RDP), whose budget for 2014–2020 amounted to over EUR 13.6 billion, while years 2021-2027 exceeds EUR 25 billion.

As we mentioned earlier, in order to achieve the full benefits of agricultural crops in Moldova using the latest technological solutions, in the form of reducing the impact on the natural environment and improving economics, the use of advanced equipment must be accompanied by competent support, therefore, as part of the Farmers 4 Climate: Innovations for Adaptation project for Climate Change in Fruit and Viticulture in Moldova, we provided comprehensive support, both training and advisory, as well as the purchase of modern agricultural equipment.

The main criterion for selecting machines was to follow the current direction of greening all work processes in agriculture, minimizing working time and increasing efficiency. Each device has been designed and created to be environmentally friendly. The equipment purchased as part of the project perfectly meets the requirements and financial aspects, the quality is directly proportional to the cost.

Below are the units that were purchased as part of the project based on current requirements in agriculture:

LP.	Powierzone mienie	jednostka miary	liczba	Przyjmujący mienie
1.	Grass mowers Frutti 230 Zestaw Mulchingowy	Szt.	1	FPC Cheton Grup SRL Chicinau city, street Muncesti 121/1 Republic of Moldova Represented by the Director Andrei Zincenco

2.	Module fotovoltaice Longi 445 W Moduły fotowoltaiczne Longi 445 W	Szt.	33	**Di and Trade Energy S.R.L.** Adres: Moldova, Chisinau, str. M.Banulescu-Bodoni, 12, ap 7 Rerezentowane przez: Valeriu Galetchi And Crama Mircesti SRL Chisinau, sec. Buiucani , strett Alba-Iulia, 87/1, ap. 33 , Moldova
3.	Invertor trifazat on-grid 15 k W Sofar Falownik trójfazowy on-grid 15kW Sofar	Szt.	1	
4.	Panouri de distrbutie AC/DC Panele dystrybucyjne AC/DC	Szt.	1	
5.	Set pentru ocapersi din tila metalica faltuita profil. Zestaw do dachów z profilowanej blachy falistej.	Szt.	1	
6.	Lucrari de constructie; montere, reglare inclusiv cheltuieli de regie, asigurare, proiectare. Roboty budowlane; montaż, regulacja wraz	Szt.	1	

	z kosztami reżyserskimi, ubezpieczenie, projekt.			
7.	Grass mower VARY/W 180-285 Zestaw Mulchingowy	Szt.	1	Et Cetera Wine S.R.L. Crocmaz city, Stefan Voda, Republic of Moldowa Represented by the Director Olga Luchianov
8.	Ecorow/ D seria DF 4 Przycinarka i kosiarka precyzyjna	Szt.	1	S.C. Farm Prod S.R.L. Olanesht city, Stefan Voda, Republic of Moldova Represented by the Director" Valeriu Bulgari
9.	Mobilna maszyna do przycinania kolumnowego z dwoma nożami Mobile column trimming machine with two knives	Szt.	1	„TOHUM-STOK" S.R.L Causen, str. Stefan cel Mare, 3/A, ap.(of.)11, Republic Moldov Represented by the Director:Vladim Dragulea
10.	Zestaw mulchingowy-Hydrauliczna międzyrzędowa, dwurzędowa kosiarka do chwastów z niezależną ramą, z systemem	zestaw	1	S.C. „TRIOPRODUCT" S.R.L Olanesht city, Stefan Voda, Republic of Moldova Represented by the DIrectro Tulei Ion

	rozdrabniania trawy i gałęzi. Mulching kit - Hydraulic inter-row, two-row weed mower with an independent frame, with a system of mulching grass and branches.			

Photo 1. Grass movers Frutti, CHETON GRUP S.R.L

Photo 2. Trimmer and precision mover, FARM PROD S.R.L.

PHOTO 3. Photovoltaic panels, CRAMA MIRCESTI S.R.L

Photo 4. Grass Mover viner, ET CETERA S.R.L

Photo 5. Mulching kit - Hydraulic inter-row, two-row weed mower with an independent frame, with a system of mulching grass and branches, TRIOPRODUCT S.R.L

Photo 6. Mobile column trimming machine with two knives, TOHUM STOC

The machines purchased as part of the project improve soil, reduce the use of chemical plant protection products and increase work efficiency, thereby reducing costs and increasing income.

The mulching set will allow you to produce organic mass to protect the soil against external factors, providing a green alternative to, among others, plastic tarpaulins.

A mobile column trimming machine with two knives is a machine that streamlines work and reduces the involvement of people who are directed to other work.

Machines eliminate the need to use chemicals to kill weeds, and a lawn mower reduces the need to use chemical fertilizers.

A mulching set for use on a winery allowed the production of organic mass to protect the soil against external factors, providing a green alternative to, among others, plastic tarpaulins.

A set of durable solar panels increased the partner's energy security, basing it on renewable energy sources. Additionally, it will eliminate the problem of producing electronic waste that would arise when purchasing cheaper substitutes, due to the fact that the purchased panels are much more durable and can be repaired.A foldable mulching set will allow you to avoid using non-degradable foils and other plastic products.

Currently, instead of using pesticides, farmers around the world are paying attention to mechanical weed control and the importance of crop rotation, as well as the use of herbicides. Soil herbicides work effectively and decompose in a predictable time provided that the soil is well moist, so it is very important to use appropriate machines that will mechanically remove weeds without damaging the soil.[25].

The possibility of using a rain shower is also important here.

[25] Andrzej Dominik, Jan Schönthaler; Agricultural Advisory Center in Brwinów, Branch in Radom, Integrated plant protection on the farm Practical guide - general principles, Radom 2012

The Agricultural Experimental Station of the University of Technology and Life Sciences in Minikowo was equipped with an innovative irrigation system - the Irtec Hippodrome bridge sprinkler with a span of 212 m.

An alternative or complement to other methods of reducing weeds is the use of mulches. In addition to the popularly used foil and non-woven covers, the use of biological litters is worth recommending. These may be winter catch crops - planed in spring or mechanically shredded and then mixed with the soil - for example, rye with vetch.

In fruit and wine growing, shredded branches of trees and vines as well as cut and shredded grass will serve as mulch. Experiments conducted with vegetables have shown that biological mulches significantly reduce weed infestation and contribute to increasing the yield of plants with a long growing season. The disadvantage of this cultivation system is that spring vegetation causes the soil to dry out and without irrigation it is difficult to sow and ensure a good start of vegetation for the plants.

Another direction is to keep the weed population at the lowest possible level and prevent flowering, i.e. activities that limit the supply of weed seeds in the soil. The harmfulness of weeds as competitors for water and nutrients with crop plants is well known. The effectiveness of mechanical weed control depends primarily on the type of machines used for this purpose and their operating parameters.

Agriculture in Moldova is by nature more conservative and changes are slower here, so the real technological revolution is still ahead of us. Technology is and should be used intensively because we build competitive advantages on its basis.