

1.2 Action Plan for *Conservation system of soil tillage without herbicides for winter wheat technology*.

The technology passed through technology prioritization phase of TNA Project performed by national experts and completed through a stakeholder consultation process. In Moldova's current economic and social conditions proposed technology was considered a much needed agricultural management sustainable practice with high economic, social and environmental benefits. Deployment of this technology would have a high impact on whole agriculture sector, as it promotes conservative agriculture principles and is an effective measure of adaptation to climate change.

1.2.1. General description of technology

Conservation system of soil tillage without herbicides is a sustainable land management practice that contributes to improving soil fertility and structure, adding high amounts of biomass to the soil, causing minimal soil disturbance, conserving soil and water, enhancing activity and diversity of soil fauna, and strengthening mechanisms of elemental cycling. *Conservation system of soil tillage without herbicides for winter wheat* technology can be extended to other cultivars, such as sugar beet and sunflower.

This technology has advantages comparing to conservation tillage with herbicides or conventional tillage.

- Moldboard plow is replaced by combinator, which contributes to the reduction of soil erosion and uncompensated mineralisation losses;
- By reducing soil erosion and mineralisation losses of soil organic matter we decrease global warming through increased carbon sequestration;
- By reducing the consumption of fuel as a result of replacing the moldboard plow with minimum tillage it is possible to adapt to the limited sources of non-renewable sources of energy, to the fluctuation of prices for non-renewable sources of energy at the international level;
- By keeping mulch on the soil surface it is possible to reduce evaporation of soil moisture and to increase the resistance;
- By using minimum tillage it is possible simultaneously to reduce or even avoid application of mineral fertilizers and pesticides for weed, pest and disease control, which requires a proper soil management system.

The above mentioned advantages allow also to adapt better to the limited sources of non-renewable sources of energy, to the fluctuation of prices for non-renewable sources of energy at the international level, to adapt to global warming by increased carbon sequestration, to increase biodiversity in the soil and on the soil surface through less dependence from mouldboard ploughing and chemicals for pest, disease and weed control.

Minimum tillage system is studied in the long/term field experiments at the RIFC "Selectia". Research results are available for farmers through publications of books, recommendations, articles, TV, radio etc. Farmers are visiting experimental plots of the institute with different systems of soil tillage. Each year we organize seminars for farmers at least two times (in the spring, before sowing spring crops, and in the fall before sowing winter cereal crops). During these seminars farmers can see the equipment in operation for minimum tillage in crop rotation.

Economic benefits:

- Increasing the sustainability of the agricultural sector, including profitability
- Reducing the dependence from non-renewable sources of energy and their derivatives (mineral fertilizers and pesticides), which we have to import at the moment and in the future
- Creating conditions for the development of small and medium enterprises

Environmental benefits:

- Achieving a more sustainable use of natural resources through preventing soil degradation, soil and water pollution, preservation of biodiversity etc.
- Higher carbon sequestration which allows to reduce global warming;
- Reduction of soil erosion and better storage of soil moisture;
- Reduction of pollution of ground water with nitrates;
- Reduction of GHG emission as a result of lower amount of burned fuel.

Social benefits:

- increasing the rural communities stability by maintaining people on the land

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- improving health of people
- creation of new working places and increasing the economic stability for the wellbeing of people

1.2.2. Targets for transfer of *Conservation system of soil tillage without herbicides for winter wheat technology.*

1. Stimulate using of resource conserving agriculture at least by 50% of agricultural producers in 2020 and 70% of sowing areas by 2030.
2. Adopt conservation tillage on three agro-ecological zones of the Republic of Moldova.
3. Increase environmental beneficial influence via lowering the intensity of soil erosion and higher compensation of mineralisation losses of soil organic matter, reducing the consequences of global warming by higher carbon sequestration, efficient adaptation to climate change. Increase the capacity of soil for a better accumulation of water from atmospheric precipitations as a result of a better soil structure and good soil coverage, which reduces water losses during water erosion.
4. Adopting conservation tillage technology to reduce labour, time and fuel costs by 50% or more compared to conventional agriculture, reduce the economical expenditures on 20-25% per 1 ha of sowed area with winter cereal crops.
5. Promote wildlife (crop residues provide shelter and food for wildlife, such as game birds and small animals, which can result in additional farm revenue), improve air quality (reduced wind erosion, reduced fossil fuel emissions from tractors, reduced release of carbon dioxide into the atmosphere).

1.2.3. Enabling business environment of *Conservation system of soil tillage without herbicides for winter wheat technology.*

- Import taxes and tariff regime. By reducing the import taxes it is possible to promote better technologies.
- Local production is cheaper than imported; stimulation of local production is economically advantageous.
- Elaborated standards for production and trade, quality control and enforcement. They assist in promoting high quality production they promote high quality requirements for producers and consumers.
- Subsidy allocation for farmers. By decreasing the interest rates for credits we can increase the availability of credits for more agricultural producers.
- Legislative acts supporting good agricultural practices: registration of land and property, preservation of natural resources and people's health, legal requirements for contracts. The legislation of the state should promote and support sustainable farming systems, which are preserving natural resources and maintain a healthy society.
- Producers and consumers associations for promoting the common interest of high quality production and consumption. Both producers and consumers develop actions to protect their rights to high quality production and consumption.
- Prevention of corruption on the different levels in society, through Governmental and NGO organizations, help promoting a healthy economy, environmental friendly and socially acceptable.

A number of services are available for technology transfer, among which the most important are:

- Financial services provided by banks, delivery of credits.
- Delivery of information, knowledge and skills; business advice from currently functioning extension service.
- State services for trials of varieties (hybrids), chemicals and agricultural machines. In order to find the best varieties, chemicals and agricultural machines they are tested before importing. Some equipment can be unsuitable for local conditions and can compromise the idea of good climate technologies. Provision of training for technicians and technical specialists.
- Engineering services are provided by equipment maintaining companies, mostly related to fixing of the equipment with some maintenance operation.
- Scientific investigation and innovation activities still exist in the country (even at not needed level) and capacity building developed by research institutions and universities.

1.2.4. Barriers to technology diffusion.

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Economic and financial

- High cost of capital (high interest rate);
- Lack of inadequate access to financial resources (lack of access to credits);
- Inappropriate financial incentives and disincentives (non consideration of externalities);
- Uncertain macroeconomic environment (unstable currency and exchange rates).

Policy, legal and regulatory

- Insufficient legal and regulatory framework (lack of coherent economic policies, inadequate or unwieldy regulation for climate change);
- Inefficient enforcement (insufficient willingness or ability to enforce laws and regulations);
- Policy intermittency and uncertainty (lack of long-term political commitment).

Market imperfection

- Poor market infrastructure (poorly articulated demand, missing of underdeveloped supply channels);
- Underdevelopment competition (insufficient number of competitors);
- Inadequate sources of increasing returns (low ability or willingness to pay among consumers).

Network failure

- Weak connectivity between actors favoring the new technology;
- Lack of involvement of stakeholders in decision making ((stakeholders dispersed and poorly organized, multiple stakeholders collaborative learning and knowledge transfer activities absent or weak).

Information and awareness

- Inadequate information (poor infrastructure for communication of small scale project support, lack of knowledge or access to climate technologies);
- High risk perception of climate technologies (high investment risks, uncertain of complexity)

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Table 1.2.1. Proposed Action Plan for *Conservation system of soil tillage without herbicides for winter wheat technology.*

S.No.	Measure	Why the measure/action is needed	Who (government agency, private sector, etc.)	Mode of implementing (How should they do it?)	When (0-5 years, 5-10 years, or 10-20 years)	How much the measure/action will cost how it can be funded (domestic or international funding)	Indicators of success, risks
1.	Encourage creation of agricultural banks with low rate of interest.	To facilitate access of farmers to low rate of interest credits.	Government, private business.	Starting capital should be invested by state agencies.	0-5 years	Domestic and international funds: 200 mln - 250 mln mdl.	<ul style="list-style-type: none"> ✓ More farmers accessing credits in the bank. ✓ More profit generating farms. ✓ Increased access to climate adaptation technologies.
2.	Reduce or avoid for profit taxation for farmers promoting sustainable farming system with good agricultural practices.	This will facilitate reorientation of farms from maximum profit to environment friendly agricultural practices.	Banks, fiscal authorities, Government agencies, private business.	To establish a good monitoring system under the sustainability of farming system. Taxation will be avoided or reduced only for most sustainable farming system.	0-5 years	Domestic funding according to calculations considering real possibilities. At least 1 mln. mdl costs for ecological expertise.	<ul style="list-style-type: none"> ✓ Increased soil fertility. ✓ Reduced rates of mineral fertilizers and pesticides.
3.	Reduce taxes for import of climate technologies and equipment.	It will facilitate implementation of advanced climate technologies and equipment.	Fiscal authorities, Government, NGOs, entrepreneurs, farmers.	To avoid taxation for the imported new climate technologies and equipment. The state will gain more from such technologies than from taxation	0-5 years	Domestic funding. Costs depend on the imported quantity of equipment.	<ul style="list-style-type: none"> ✓ Reducing the negative consequences of drought. ✓ Reduced soil erosion.
4.	Enforce promotion of climate	This way it would be possible to replace	Government, banks.	A monitoring system should be established in	0-5 years	Domestic funding. At least 100	<ul style="list-style-type: none"> ✓ Decreased soil degradation by

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	technologies through allocation of subsidies to farmers who comply with the requirements of good farming system by respecting and implementing the whole farm plan.	stimulation of economic profit by stimulation of environment and social services provided by farmers.		order to differentiate the level of farm sustainability and select farms that comply with requirements of good farming system. Promotion of climate technologies through the allocation of subsidies could be made for the amount allocated nowadays in agriculture considering the implementation of the whole farming system.		mIn.mdl, which consists 25% from the actual fund for subsidies in agriculture. Farmers own investments.	erosion. ✓ More farmer practicing climate technologies. ✓ Reduced use of pesticides.
5.	Create an Agency (preferable Governmental) responsible for organizing and monitoring of sustainable land management.	Currently is not an established level of soil fertility. There are not assigned responsibility for the state of soil fertility.	Cadastre Agency, ministry of Agriculture, Ministry of Environment.	For each farm it should be worked out a plan for rational land use, a system of soil quality monitoring.	0-5 years	Domestic and international funds. Based on existing infrastructure, to put in place efficient managerial actions.	✓ Better land management (ecologic, economic indicators). Increased resilience to climate risks. ✓ Improved population health.
6.	Enforcement of relevant legislation regarding soil conservation and soil management.	We need rules for good farm management system.	Parliament of Moldova, Ministry of Agriculture, rural entrepreneurs.	The law should provide incentives for farmers respecting the requirements for good agricultural practices.	0-5 years	Domestic funds. The cost for the elaboration of the Law by Parliament is 8	✓ Supporting progressive farming systems. ✓ Improving the quality of soils and

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	Adoption of Law on Soil.					thousand mdl	water. ✓ Increased resilience of soils to climate risks.
	Develop the logistic for procurement by agricultural producers of equipment for climate technologies.	To facilitate the access of farmers to different equipment produced by diverse international companies. Will be possible to lower equipment costs by applying tougher competition	Private or State agencies, rural entrepreneurs.	Branches (affiliations) of international companies must operate in Moldova.	0-5 years	Incentives have to be applied to encourage foreign companies to invest in agriculture sector of Moldova.	✓ The amount of equipment sold in Moldova; ✓ The improved economic efficiency and environment parameters etc.
7.	Establish of a state extension service as a component part of the whole, system: research-education-extension network (technological transfer). (Improve R&D system of Agriculture sector).	It will provide connection between researchers and producers, researches and educational workers and feedback for both research and educational sector	Government , ACSA Agency, Universities, research institutions.	To involve experienced researchers, professor from universities and producers from different districts in a national network.	0-5 years	The infrastructure is here already, but a good coordination work is missing. Domestic and international funds are required.	✓ A faster implementation of know how in production. ✓ Better access to knowledge for more farmers.
8.	Increasing media interest in promoting climate technologies with larger participation of	Large audience has to be aware and have general knowledge about climate technologies and	TV, radio, researchers, Universities, NGOs, consultants, producers.	TV, Radio and newspapers information about climate technologies. Scientific and popular publications	0-5 years	Domestic and international funds.	✓ More information about the positive influence of climate technologies.

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	researcher, consultants and producers.	environmentally friendly agriculture techniques.		disseminated.			✓ More people interested in climate technologies.
9.	Organizing national and regional network groups of farmers interested in promoting climate technologies.	The will allow to share gained experience in promoting climate technologies	Farmers, entrepreneurs, NGOs.	Participants of networking groups are voluntary.	0-5 years	Self-supporting	✓ More farmers involved in promoting climate new technologies
10.	Lobby at the consumer association for consumption of ecological agricultural products.	Consumers should serve as an engine to growing food of high quality and environmental health	Non-governmental organizations.	Different categories of consumers should be involved together with producers, processors, retailers, lowers etc.	0-5 years	Domestic and international fund	✓ Better quality of agricultural products. ✓ Better health indexes.
11.	Support to national /international cross disciplinary research program on sustainable, including ecological type of farming. (Improve R&D system of Agriculture sector).	Majority of researches have been done for conventional agriculture and they are supported by transcontinental companies interested in promoting chemicals, seeds, agricultural machines etc.	Government, regional and international, research programmes.	The interdisciplinary researches should be done on competitive basis with international evaluation and regional coordination.	5-10 years	Domestic and international funding. The cost should be at least 500,000 euro.	✓ New data regarding possibilities of transition to a more sustainable agriculture ✓ Reducing the use of chemicals etc.
12.	Support to long-term	It is necessary to collect	Preferable	To do the evaluation of	5-10 years	Domestic and	✓ Indicators for

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	field experiments on sustainable farming systems. (Improve R&D system of Agriculture sector).	data regarding the environmental impact of different farming systems. By using these data it would be possible to work out the criteria for determining the level of sustainability of farming systems.	Government Agency. There is an increasing role attributed to State in providing funds for interdisciplinary researches, excluding short term interest.	the existing long-term experiments by determining their relevance to the subject of sustainable development of agriculture.		international funds, cooperation at the international level is crucial here. Costs will depend upon the number of selected long-term field experiments.	the evaluation of the level of farm sustainability will be obtained. ✓ Will be developed a tool for evaluation of global warming risks.