Eco-innovative technology - curved profiled slitters for soil work on vegetable crops in Romania

Developing and testing innovative ploughing equipment that improves farm incomes and soil fertility.

EAFRD-funded projects

Location: Călărași County, Romania
Programming period: 2014-2020
Priority: P1 - Knowledge transfer and innovation
Focus Area: Innovation and cooperation
Measures: M16 - Cooperation

Funding:		
	Total budget	449 426 (EUR)
	EAFRD	367 779 (EUR)
	National/Regional	61 801 (EUR)
	Private/own	19 846 (EUR)

Timeframe: 20/04/2021 - 20/07/2023
Project promoter: National Institute of Research - Development for Machines and Installations Designed for Agriculture and Food Industry (INMA)*
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Summary

An EIP Operational Group (OG) successfully developed a new eco-innovative technology that boosted farm incomes by 10%, increased production by up to 20%, and created cost savings of as much as 40%, while also increasing soil health by sequestering and conserving some 25% more carbon compared to alternatives. This new CAP-funded food systems equipment reduces the disadvantages of all types of classic plough such as slow working speed, high energy consumption, degree of shredding, soil compaction, etc. The OG's eco-innovative technology consists of a rotor with curved profiled slitters that dig the soil and press it in the front-rear direction, producing a simultaneous process of grinding, cutting, and breaking. Through continuous rotation, the pieces of ground soil, together with plant residues, are lifted, turned, and deposited partly left-right and forward, mixing over the entire surface. This helps promote soil fertility. The OG was led by Romania's National Institute of Research (INMA).

*The project promoter/beneficiary is an EIP-AGRI Operational Group. (https://eu-cap-network.ec.europa.eu/operational-groups_en)

Project results

- The prototype achieved a uniform, homogeneous and well-ventilated soil.
- The new technology increased production by approx. 10-20%, due to the increased soil fertility and the reduction of costs by approx. 40%. This led to an increase in the farm's income of approx. 10%.
- The use of this new technology increased carbon sequestration and conservation by approx. 25%.

Key lessons and recommendations

- This example is especially useful for small farmers who cannot afford expensive technologies.
- Innovation and cooperation support from the CAP can help identify concrete solutions that solve problems faced by farmers.

Context

Between 60% and 70% of the soils in the EU are currently in an unhealthy state. In Romania, many agricultural areas are also negatively affected by overexploitation and mismanagement. This has repercussions for the quality and costs of agricultural production.

The National Institute of Research - Development for Machines and Installations Designed for Agriculture and Food Industry (INMA) in Bucharest is a prestigious public institution conducting research in the field of agricultural machinery and mechanisation technologies in Romania. To help protect, maintain, and improve the quality of the nation's soil, INMA developed an innovative technology with two private agricultural companies that produce vegetables, cereals and certified seed, and provide mechanised agricultural services for farmers in Călărași County.

INMA set up an Operational Group (OG) to test the new technology, which incorporated equipment with curved profiled slitters that help soil decompaction and aeration; allow for greater incorporation of plant residues; improve the soil structure; provide efficient water management; and improve the incorporation of organic fertilisers into the soil.

The project was implemented at the regional level. Two of the partners are companies with an agricultural profile, which cumulatively exploit an area of over 3 000 ha of agricultural land in an area affected by drought and soil erosion in the south of the country.

One of the companies specialises in the production of vegetables, seed lots and consumer agricultural crops, and has its own vegetable processing unit. The other partner specialises in the production of cereals, oilseed, and other seeds. Both companies are specialised in providing agricultural work services with their own fleet of machines to other farmers in the area.

Objectives

The OG objectives were to:

- Improve soil quality and increase the amount of CO_2 absorbed in the soil as it is being mixed with vegetable remains and carbon from the air. This facilitates the creation of aerobic conditions throughout the worked depth, which has a positive effect on the biology of the soil.
- Reduce the need for natural fertilisers and eliminate chemical fertilisers, given the uniform and complete incorporation of vegetable residues into the worked soil.
- Develop and transfer knowledge and accumulate practical experience.

Activities

Project activities included:

- Activity 1 - developing a prototype of the new technical equipment equipped with curved profiled shovels mounted according to an innovative geometry. This design was the result of project research.
- Activity 2 - constructing a physical prototype equipped with curved profiled shovels.
- Activity 3 - conducting experiments with the new technology. Experimental batches were prepared at two agricultural farms. On these lots, basic ploughing was tested on an experimental control plot, and on another experimental plot, the soil was tested with the new equipment. During this stage, the following qualitative work indices were monitored and comparatively studied the degree of:
  - soil loosening as a criterion for assessing soil fertility. This is because loosening soil increases its mobilisation and potential fertility;
  - soil shredding and settlement as a criterion for assessing the reduction of water loss from the soil and the way of putting the seeds in contact with the soil;
  - plant residue coverage as a criterion for assessing how to improve biological activity by increasing food resources, because of larger amounts of plant residues and less soil processing.
- Activity 4 - preparing demonstration batches at the two farms. Fuel consumption was monitored by the volumetric method. The amount of carbon stored in the soil was also monitored by collecting soil samples and determining the carbon content in the laboratory by the dry combustion method compared to the ploughing work. In the case of ploughing, where aggressive mechanical soil inversion was involved, it led to high losses of organic carbon, disruption of soil biology and wind and water erosion. In the case of work with this new technology, the soil is mixed together with plant residues and carbon from the air facilitating aerobic conditions throughout the worked depth. All of these have a positive effect on soil biology.
- Activity 5 - disseminating project results to multiply their effect through a conference organised by the Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu-Sișești" (A.S.A.S.). The demonstrations took place at partner farms and during courses held by the researchers (who are also teaching staff).

Main results

- The prototype achieved a much better tillage compared to that performed by conventional ploughing. Better qualitative indices were achieved, and a uniform, homogeneous and well-ventilated soil was obtained. Plant residues were homogeneously mixed over the entire surface, which will lead, through their decomposition over time, to an increase in soil fertility.
- The new technology achieved an increase in production of approx. 10-20%, due to the increased soil fertility, and a reduction of costs by approx. 40%. This increased the farm's income by approx. 10%.
- Thanks to the new technology, carbon sequestration and conservation increased by approx. 25%.

Key lessons and recommendations

- An interesting advantage of the technical equipment with curved profiled slitters, as compared to classic ploughing, is the fact that plant residues are not buried at the base of the furrow but are mixed in the mass of the land, which allows them to decompose and increase soil fertility.
- This example is especially useful for small farmers who cannot afford expensive technologies.
- Innovation and cooperation support from the CAP can help identify concrete solutions like this that solve problems faced by farmers.

"An essential benefit compared to traditional ploughing is that it mixes the soil layer over the entire surface, increasing soil fertility over time".

Vlăduț Nicolae-Valentin

Additional information:

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