

Short description of project funded by CORE Organic II partners in the first call of CORE Organic II

<p>Project short name and title</p> <p>TILMAN-ORG: Reduced tillage and green manures for sustainable organic cropping systems</p>
<p>Project summary</p> <p>Reduced tillage and green manures for sustainable organic cropping systems</p> <p>TILMAN-ORG seeks to enhance the ecosystem services that organic farming systems provide through the maintenance of soil quality and biodiversity. Conservation techniques, such as reduced tillage and improved use of green manures can intensify soil functions like nutrient cycling, soil carbon build-up, and biological nitrogen fixation. Weed management is the greatest challenge in reduced tillage systems, when herbicides are omitted.</p> <p>The project is structured as follows:</p> <ol style="list-style-type: none"> i. Farmers' experiences and perceptions about reduced tillage and green manures will be assessed in semi-structured interviews. Existing data from medium and long-term trials on reduced tillage and green manures provided by the consortium and the published existing peer reviewed and grey literature will be evaluated with respect to yield stabilisation, soil quality and biodiversity. ii. Experimental Case Studies on soil quality and greenhouse gas emissions, weed management and functional biodiversity, and improved nutrient management will be carried out, and carbon stocks under reduced tillage compared to ploughing will be measured. Data from long-term tillage trials across Europe will be exploited to calibrate a decision support tool to predict soil organic carbon and nitrogen fluxes in the soil - plant system. iii. Design of optimised cropping systems by modelling approaches based on results from the literature and case studies. This will also involve the preparation of guidelines focused on helping farmers to address weed management challenges, and temporary shortages of nitrogen supply in order to improve yields and yield stability, thus improving both the environmental and economic sustainability of organic farming systems. <p>The project's dissemination activities will target farmers, advisors, and the scientific community, but also the agricultural support industries and policy makers. The main innovative strategy of the project is to adapt conservation agriculture approaches to organic farming drawing on existing field experiments across Europe.</p>
<p>Aim, objectives and hypotheses</p> <p>The over-all aim of this project is to develop robust and sustainable arable crop production systems <i>via</i> the introduction of reduced tillage techniques combined with a strategic use of green manures in organic crop rotations, while maintaining and improving soil quality and crop productivity parameters.</p> <p>The specific objectives of the project are to:</p> <ol style="list-style-type: none"> i) Summarise existing knowledge and experiences on reduced tillage and green manures in organic systems in a wide range of soils and climates across Europe.

- ii) Stimulate bio-geochemical processes governed by soil microorganisms and soil carbon build-up *via* reduced tillage and strategic integration of green manures into organic rotations.
- iii) Improve weed control by integrating management techniques such as green manures, mechanical weeding and crop diversification, while evaluating impacts on weed diversity and their functional role in agro-ecosystems.
- iv) Increase the efficiency of nutrient use by green manures, including N₂-fixing legumes, thereby reducing off-farm inputs.
- v) Calibrate the NDICEA model (Nitrogen Dynamics In Crop rotations in Ecological Agriculture) (used to assess the effects of reduced tillage options and green manuring on N cycling and C pools; and
- vi) Design viable organic cropping systems applying reduced tillage and green manures at the farm level for major European regions.

Hypotheses include:

- Reduced tillage and green manures as key elements of conservation agriculture, combined with technological innovations in weed control, will maintain/increase and stabilise productivity, while increasing soil organic C stocks and reducing GHG emissions from soils in organic crop production systems.
- Reduced tillage and green manures will increase nutrient and energy use efficiency, while minimising the use of external (off-farm) inputs, in particular those representing non-renewable resources such as fuel (synthesis of N fertilisers) and mineral P fertilizers.
- Reduced tillage and green manures will also increase biodiversity and resilience compared to more traditional organic cropping systems, or to conventional agriculture.

Expected results and their impact/application

The main result/impact of the project will be the adaptation of conservation agriculture principles to organic crop production systems and the quantification of their potential to preserve and improve soil fertility and crop performance based on case studies. These studies will contribute to overcoming farmer concerns about the agronomic and economic viability of conservation agriculture systems, which is a major barrier to the wider adoption of reduced tillage and green manuring practices.

1. TILMAN-ORG will contribute to **stopping degradation of European agricultural soils** by identifying sustainable soil management and agronomic practices from organic farming and conservation agriculture. The combination of elements of organic and conservation agriculture will appeal to a broad range of farmers and stakeholders and should increase the area of sustainably cultivated land in Europe.

2. TILMAN-ORG will **provide new strategies for increasing yields** while maintaining soil quality. **TILMAN-ORG** will use a combination of basic and applied research to secure increased yields, restore soil fertility, promote biodiversity and enhance nutrient cycling.

3. TILMAN-ORG will **contribute to increased biodiversity** in arable cropping systems at the below- and above-ground level as a result of the integration of less invasive soil tillage, strategic use of green manures and innovative crop rotations.

4. TILMAN-ORG will result in **more resilient cropping systems** with higher yields and yield stability in the context of more variable and extreme weather patterns as predicted by the IPCC (www.ipcc.ch). This will result from the additional improvements in soil fertility, nutrient supply patterns and water holding capacity by application of the recommended practices.

5. TILMAN-ORG will **enhance the C sequestration and storage potential** of arable soils. The current extreme loss rates of C from soils in Europe 31 will be dramatically reduced under sustainable soil management practices. Considering that about 45% of European soils have low organic matter content, according to current estimates, conservation tillage could sequester between 50 and 100 million tonnes of C annually in European soils.

6. TILMAN-ORG will **contribute to better estimates** of how reduced tillage systems under organic farming management can mitigate climate change. Trials will generate data on both soil C sequestration and GHG emissions (CO₂, N₂O and CH₄) from soils; this is a **major scientific innovation** since such data-sets are extremely scarce for agricultural systems in Europe.

7. TILMAN-ORG will deliver scientifically validated decision-support tools, and guidelines on most suitable agronomic practices and approaches, techniques and technologies adapted to different crop production systems/rotations and pedo-climatic conditions found in Europe.

8. TILMAN-ORG will also contribute to the economy of the European community, since it has recently been estimated that *“soil degradation could cost up to € 38 billion a year”* in Europe (COM (2006)231, 22.9.2006).

Coordinator, partners and countries involved

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Countries involved

Austria, Belgium, Estonia, France, Germany, Italy, Luxembourg, Netherlands, Spain, Switzerland, United Kingdom