Reduced tillage and green manures for sustainable organic cropping systems
TILMAN-ORG (2011-2014)

Introduction

Coordinator: Paul Mäder
Co-Coordinator: Christophe David

www.tilman-org.net
“The TILMAN-ORG project’s overall goals are to design improved organic cropping systems with:

– enhanced *productivity* and *nutrient use efficiency*,
– more efficient *weed management* and increased *biodiversity*, but
– lower *carbon footprints* (in particular increased carbon sequestration and lower GHG emissions from soils).”

15 partners of 11 countries: Switzerland, France, Germany, Netherlands, Belgium, Luxemburg, United Kingdom, Estonia, Italy, Spain, Austria

Disciplines: Agronomy, plant, soil, weed sciences, molecular ecology, plant nutrition, modeling, sociology

Dissemination: Peer reviewed and farmers press articles, leaflets, videos, field days, conferences, workshops, web page
TILMAN-ORG project structure

WP1: Trial overview (reduced tillage under OF in Europe)

WP2: Meta analyses (trial data, literature)
Farmer interviews

WP3: Carbon sequestration
Greenhouse gas emissions

WP4: Weed management
Ecosystem services

WP5: Nutrient management
N modelling (NDICEA)

WP6: Prototyping improved organic cropping systems and multi-criteria assessment (MASC)
Main results, added value at EU level

› Main results

– In Europe, two main groups of organic farmers using conservation techniques: Soil conservationists, and agro-technically challenged
– More weeds and higher biodiversity in reduced tillage systems, but yields rarely reduced, new methodology for assessing eco-functionality of weeds
– Soil organic carbon and soil biological activity higher under reduced tillage
– NDICEA suitable in some trials to model N dynamics, further calibration
– New trials established in a co-ordinated manner combining reduced tillage x green manure
– Prototyping started for different agro-climatic zones (with knowledge from literature review, farmers’ interviews, expert knowledge)
– MASC for multi-criteria assessment improved (weed algorithm)

› Added value at EU level

– Data compilation of existing long-term trials and grey literature across Europe
– Transnational knowledge exchange of farmers and researchers
– Pooling expert knowledge in different disciplines (capacity building)
– Standardisation of methods
Role of ecological services providing crops (ESCs)

Not directly aimed at yield

To provide ecosystem services (examples)

- nutrients supply and management (i.e. fertility building crop)
- water holding capacity
- weed control
- disease and pest control (different mechanisms);
- pollination services
- C sequestration
- resilience to (extreme and severe) weather conditions
- ……..

ESCs contribute to reduce negative externalities of agriculture (i.e. environmental and/or social costs)

(Foley et al., 2011; Kremer and Miles, 2012; Thorup Kristensen et al., 2012; )

Enhancing multifunctional benefits of cover crops – vegetables intercropping

- InterVeg -
Introduction of ESCs in vegetable cropping systems

1. As ecological infrastructures (not in the rotation)

2. Within the rotation (complementary crops)
   i. ESC is grown between subsequent yielding crops (YCs) of the rotation (inter-rotated ESCs)
      i. place in the rotation
      ii. management (termination)
   ii. ESC is grown intercropped within the yielding crop (living mulch)

**InterVeg**

Complementary (not alternative) strategies, contributing to temporal and spatial in-system diversification

(Masiunas, 1998)

*Enhancing multifunctional benefits of cover crops – vegetables intercropping - InterVeg -*
InterVeg research hypothesis and aims

The main hypothesis of the research is that the introduction and the proper management of living mulch in vegetable production systems (in comparison to the sole cropping systems) would allow:

- comparable yields and similar produce quality
- lower environmental impact (i.e. reduction of potential risk of N leaching)
- effective weed management
- favorable pest/beneficial insect interactions
- not-renewable energy consumption and production costs reduction

InterVeg consortium

<table>
<thead>
<tr>
<th>Institutions</th>
<th>People</th>
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<tbody>
<tr>
<td>Consiglio per la ricerca e la sperimentazione in agricoltura (2 Research Centers: RPS and ORA) – IT</td>
<td>Stefano Canali Fabio Tittarelli Gabriele Campanelli Corrado Ciaccia</td>
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<tr>
<td>Associazione Italiana Agricoltura Biologica (AIAB) - IT</td>
<td>Livia Ortolani Cristina Micheloni</td>
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<td>Università di Bologna - IT</td>
<td>Giovanni Burgio</td>
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<td>University of Kassel - DE</td>
<td>Peter von Fragstein</td>
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<td>Aarhus University - DK</td>
<td>Hanne L. Kristensen</td>
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<td>University of Maribor - SLO</td>
<td>Franci Bavec</td>
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<tr>
<th>WP</th>
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<th>Leader</th>
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<tr>
<td>1</td>
<td>Coordination</td>
<td>Stefano Canali</td>
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<td>2</td>
<td>Experimental sites establishment, management and harvest quality evaluation</td>
<td>Hanne L. Kristensen</td>
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<td>3</td>
<td>Reduction of off-farm inputs for fertility management</td>
<td>Fabio Tittarelli</td>
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<td>4</td>
<td>Functional biodiversity and beneficial insect population management</td>
<td>Giovanni Burgio</td>
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<td>5</td>
<td>Weed management and energy saving</td>
<td>Stefano Canali</td>
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<td>6</td>
<td>Stakeholders involvement and dissemination</td>
<td>Livia Ortolani</td>
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Exploitation of natural resources to increase soil health: BIO-INCRORP, a project on organic fruit tree cropping systems

Luisa M. Manici*, CRA – Consiglio Italiano per la Ricerca e Sperimetazione in Agricoltura (Italy)

G. Baab (Germany), R. Canet (Spain), S. Kaymak (Turkey), M. Kelderer (Italy), A. Naef (Switzerland), H. Pinar (Turkey), T. Rühmer (Austria), H. Insam & I. Whittle (Austria)
BIO-INCROP project is a multidisciplinary project based in the hypothesis that the response of soil microbial communities toward agro-management practices may be the means for solving replant disorders or soil fertility decline of fruit tree orchards and permanent crops.

**Research Actions** based on the exploitation of two categories of natural resources

1. Biological resources *indigenous* to soil system of the orchards
2. Natural resources *exogenous* to orchards (waste-deriving material, bio-formulates, cover crops)
Main objectives

1. Developing innovative cropping techniques aimed at:
   i) increasing soil microbial **biomass and diversity**, ii) increasing **indigenous** beneficial microbial species; iii) reducing the **impact** of soil borne fungal **pathogen** on fruit trees.

2. To support **critical adoption** by farmers of organic amendments and bio-products available on the marked as suitable for organic agriculture.

3. To increase **awareness** of stakeholders that **biodiversity** has not only an impact on the environment’s safety, but it is also an important resource for developing innovative technologies for organic and sustainable agriculture.
VineMan.org

Integration of plant resistance, cropping practices, and biological control agents for enhancing disease management, yield efficiency, and biodiversity in organic European vineyards
Aim

develop innovative cropping systems for managing organic vineyards
able to:

- improve control of key plant diseases
- enhance grape production
- reduce mycotoxin contamination
- increase microbial biodiversity
- minimize the environmental impact

How

through a design-assessment-adjustment cycle
The innovative cropping systems based on:

- Biocontrol agents
- Plant resistance
- Disease models
- Canopy management
Targeted precision biocontrol and pollination enhancement in organic cropping systems

CO2 Amsterdam 15.5.2013
General objective of BICOPOLL:
  to improve the yield and quality of organic fruit and berry production via efficient, innovative plant protection and improved pollination

Specific objectives:
• to provide a pan-European case study on protecting organic strawberry cultivations from its most important disease, the grey mould, using bee vectored biocontrol and improved pollination
• to improve the efficiency of the entomovector technology via gap filling research on manipulation of bee behavior, components of the cropping system, and on the plant-pathogen-vector-antagonist-system
• to improve inoculum dispensers and carrier materials
• to investigate possibilities of expanding the use of the entomovector concept into other organic berry and fruit growing systems
Significant achievements in the first year:

• excellent field results obtained in first trials in Estonia, Italy, and in the UK, besides the commercial success in Finland

• several points for improving the entomovectoring system have been identified, and will be tested in 2013

• rapid and reliable monitoring methods for the biocontrol fungus have been developed (qPCR), for evaluating the efficiency of vectoring and the safety of the method to consumers and bees

• plenty of publicity to the project!
Background:

European tarnished plant bug 
(*Lygus rugulipennis*)

Strawberry blossom weevil 
(*Anthonomus rubi*)

Raspberry beetle 
(*Byturus tomentosus*)

Cause large losses in yield (10 - >80%) and quality of organically grown strawberry and raspberry

**Objective:** By exploiting natural semiochemical mechanisms of sexual and host plant attraction, to develop effective traps for these insect species or repealing them from the field.
Softpest Multitrap

WP 0 Project management
   (Coordinator: Atle Wibe, BPO)

WP 1 Chemical analysis of plant volatiles
   (WP leader: Anna-Karin Borg-Karlson, KTH)
   • collecting and quantification of host plant volatiles
   • analyzing volatile samples using GC-MS

WP 2 Pest insects in strawberry
   (WP leader: Nina Trandem, BFP)

WP 3 Pest insects in raspberry
   (WP leader: Catherine A. Baroffio, ACW)
   • overwintering sites and seasonal distribution
   • studying host plant volatiles for synergism to the sex pheromones
   • determine if volatiles from unhealthy/dying host plants acts as repellents
   • Conduct large-scale field experiments

WP 4 Trap design and lure development
   (WP leader: Jerry Cross, EMR)
   • optimise trap designs and method for pest insect mass trapping
   • determine whether the same trap design can be used for all insect species
WP1: potential volatile repellents identified, lures developed, will be tested in 2013

WP2: different distribution of strawberry blossom weevils

WP3: trap height matter

WP4: Currently most effective traps is a green cross vane bucket trap with no grid (without attracting bees)

Some preliminary results:

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Total Catches</th>
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<tbody>
<tr>
<td>0</td>
<td>A (0.00)</td>
</tr>
<tr>
<td>2</td>
<td>A (0.75)</td>
</tr>
<tr>
<td>4</td>
<td>B (1.50)</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
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<td>18</td>
<td></td>
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<tr>
<td>20</td>
<td></td>
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WP3: SBW catches by height

- SBW male
- SBW female

Young Tunnel Old Forest Boundary

WP2: Strawberry blossom weevils

Softpest Multitrap
Laying hens: **2nd most important species after cattle in organic husbandry!**

**Challenges in organic egg production:**

- Free range: Parasites, sufficient use, (patchy) nitrogen input
- Aim: 100% organic feed / restrictions concerning protein feed
- No beak trimming
- Day light
- Alternative medical treatments
HealthyHens

Epidemiological approach with cross sectional design

- 9 project partners in 8 countries
- 107 organic layer flocks
  - 2 farm visits
  - slaughterhouse visits for 70 flocks

October 2011 to September 2014
HealthyHens

WP0: Common cross sectional design

Husbandry
Feeding
Hygiene
other Management
(Genetics)

WP1: Parasite infestation
WP2: Use of free range
WP3: Feather and injurious pecking
WP4: Other health problems (e.g. keel bone and foot lesions)

Laying performance
Mortality
Body weight
Improved contribution of local feed to support 100% organic feed supply to pigs and poultry

An ERA- net project with 13 partners/10 countries
1/10- 2011- 30/9 - 2014

John E Hermansen, Dept. of Agroecology, Aarhus University
Expected output: New validated systems that are economical viable as well as animal welfare - and environmental friendly and adapted to local agro-ecological conditions

- Improved knowledge of availability and nutritional value of new organic feed ingredients - focus on local feed resources

- Improved understanding of the possible benefits of roughage inclusion in relation to nutritional and behavioural needs as well as its impact on health and welfare

- Understanding how direct foraging in the outdoor area can contribute to meeting the animals nutritional needs

- Assessing the economic and environmental consequences of increased reliance on local organically produced feed
The Results

The research and development will result in appropriate feeding strategies established for organic farming with 100% organic feed, which are profitable, have low environmental impact and high animal welfare.

Follow the progress of the project and learn the results on these websites:
www.europeanfarmersnetwork.org/
www.thepoulsrysite.com
www.thepigsite.com

For more information in the UK please contact:

Dr Jo Smith or Rebecca Nelder at
The Organic Research Centre, Elm Farm, Hamstead Marshall, Newbury RG20 0HR
01488 658298
www.theorganicresearchcentre.com

OR
Ruth Clements BVMS MRCVS
FAI Farms Ltd of The Field Station, Wytham, Oxford. OX2 8QJ.
01865 790880
www.faifarms.co.uk

ICOPP

ICOPP is a CORE Organic II project
www.coreorganic2.org
Introduction

Farm specific strategies to reduce environmental impact by improving health, welfare and nutrition of organic pigs

C. Leeb
Amsterdam, 15th May, 2013
2nd CORE Organic II research seminar
Three Systems

75 farms in 8 countries
To identify
• animal - environment interactions in three systems

Hypothesis
• all systems are able to ensure good welfare and low environmental impact
• when well managed

Indoor with concrete outside run
Partly outdoors
Outdoors

ProPIG Amsterdam, 15.5.2013 Coreorganic2 Research Seminar
Farm specific strategies for improvement

To develop and implement

- **Farm specific strategies** to:
  - reduce environmental impacts
  - by improving health, welfare, nutrition and management of organic pigs

- To **disseminate knowledge** to national advisory bodies and farmers

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ProPIG Amsterdam, 15.5.2013 Coreorganic2 Research Seminar
SafeOrganic:

Restrictive use of antibiotics in organic animal farming - a potential for safer, high quality products with less antibiotic resistant bacteria

Project introduction
Søren Aabo - Coordinator (DTU)

Partner countries:
Denmark (DTU & UCPH), Sweden (SVA), France (ANSES), Italy (IZSVe), Czech Rep. (VRI)

Aim:
To enable slaughterhouses to reduce spread of antibiotic resistant (AR) bacteria and organic farmers to market meat products of higher food safety quality
Objectives - SafeOrganic:

➢ To investigate potential loss of AR levels in organic pigs at the slaughterhouse to display the herd status
➢ To investigate the level of AR cross-contamination at slaughter
➢ To document the certainty of convenient sampling at the slaughterhouse to display the herd status
➢ To investigate if possible a correlation between observed AR and consumption of antibiotics

[Imagery of pigs and antibiotics]
Work packages - SafeOrganic

Core

- AR in Organic & Conv. Herds
  - WP 2.3, ALL
- Transfer of AR between organic and conventional pigs at slaughter,
  - WP 3.1, DK, FR, SE
- Correlation? – AR patterns and antibiotic consumption
  - WP 4.1, DK, IT, ALL

Additional Work Packages:

- Herd factors related to AR
  - WP 2.1 SE, IT
- Convenient testing of herd status
  - WP 2.2, DK
- Difference in genotype diversity between Org & Conv. herds,
  - WP 4.2 FR, DK
- Microbiota and resistance gene analysis
  - WP 4.3 CZ/ALL
Coordinated by Professor Søren Husted
Faculty of Science, University of Copenhagen

Presented by Professor Saskia van Ruth
Wageningen University
Research objectives of “AuthenticFood”

To develop and test a portfolio of analytical techniques for authentication of organic plant foods:

– Ionomics
– Stable isotopes
– Metabolomics
– Pesticide screening

To evaluate the techniques in corporation with European certification and inspection bodies:

– Ecocert - France
– BIOS - Italy
– DVFA - Denmark
Workpackages

- WP1: Project coordination (Søren Husted, UCPH)
- WP2: Sample production and distribution (Cristina Micheloni, AIAB)
- WP3: Multi-elemental analysis (ICP-MS), $^{31}$P (NMR) (Søren Husted, UCPH)
- WP4: Stable isotopes, $\delta^2$H, $\delta^{13}$C, $\delta^{15}$N, $\delta^{18}$O, $\delta^{34}$S, nitrate and sulfate isotopes, $\delta^{15}$N in amino acids (Federica Camin, FEM-IASMA)
- WP5: Metabolomics, phenolic content, volatile analysis, fatty acids, sensory profiles (Saskia van Ruth, RIKILT)
- WP6: Pesticide residues (Cedric Guignard, GL Centre)
- WP7: Chemometrics (Torfinn Torp, Bioforsk)
- WP8: Results dissemination (Johannes Kahl, UniKa)
COBRA: Coordinating Organic Plant Breeding Activities for Diversity

- March 2013 – February 2016
- 41 partners, 18 Countries
  - 31 Full partners
  - 10 Associate partners
  - Industry and research partners
- Total cost >€4M
  - €2.9M from COII
  - €1.2M from other funds
COBRA’s Aims

• To support and develop organic plant breeding and seed production
• Focus on increasing the use and potential of plant material with **High Genetic Diversity**
• Cereals (wheat and barley) and grain legumes (pea and faba bean)
• Coordinating, linking and expanding existing breeding and research
Work plan

• WP0: Management
• WP1: Seed Health & Quality
• WP2: Breeding for Resilience
• WP3: Improving Breeding Efficiency
• WP4: Socio-economics & Legislation
• WP5: Dissemination & Networking
Main rationale of HealthyGrowth:

- That a healthy and sustainable growth in the organic market depends on the ability of market chains to combine volume and marketing with measures that secure integrity and trust based on the organic values and principles,
- and thereby generating a prize premium that can be distributed along the chain.
The main hypotheses:

- Mid-scale value chains operate by a different marketing logic than either small- or large-scale chains, based on different forms of organisations, partnerships and strategies.
- That this enables them to combine growth in volume with a high and growing level of organic values throughout the market chain as a sound foundation for organic integrity and consumer trust.
The aim:

- is to study a range of successful mid-scale food value chains
- and show the fundamental prerequisites for their success in combining volume and values
- in order to support the development of new organic value chains and provide new opportunities for organic actors.
IMPROVE-P
IMproved Phosphorus Resource efficiency in Organic agriculture Via recycling and Enhanced biological mobilization

Coordinators: Kurt Möller & Torsten Müller

Partners: Anne-Kristin Løes, NO; Jürgen-Kurt Friedel, AT; Andreas Kranzler, AT; Astrid Oberson, CH; Paul Mäder, CH; Jakob Magid, DK; Julia Cooper, GB

UNIVERSITÄT HOHENHEIM
WP 0:
Coordination, information and dissemination
Co: K. Möller (UHOH); DCo: T. Müller (UHOH); Dissemination: K. Möller

WP 1:
Compilation of existing knowledge and synthesis
M: J. Cooper (UNEW); DM: A.-K. Løes (Bioforsk)

WP 2:
Evaluation of efficacy and potential environmental impacts of alternative P fertilizers
M: K. Möller (UHOH), DM: A. Oberson (ETHZ)

WP 3:
Improved P mobilization by adoption of agronomic measures and addition of Plant Growth Promoting Rhizobacteria
M: P. Mäder (FiBL CH), DM: J. Magid (UCOP)

WP 4:
Stakeholder perceptions about applicability of alternative P fertilizers in organic farming
M: A.-K. Løes (Bioforsk), DM: S. Hörtenthaluber (FiBL AT)
Aims and objectives

• Improvement of the long term P status of OF soils
• Development of optimized systems of efficient P recycling
• Increased P use efficiency through stimulation of biological soil processes (green manures, crop rotation and PGPRs)
• Assessment of potential environmental issues arising from the use of APF
• Development of recommendations based on results of the experiments and stakeholder inputs