TILMAN-ORG Interim Meeting
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Contents
Background
Outcomes of the on-going activities
  — OrWeeds
  — BioGreenhouse
  — InterVeg

Ecological service providing crops (ESCs)
in organic vegetable production systems

Stefano Canali
Consiglio per la Ricerca e la sperimentazione in Agricoltura
Centro per lo studio delle relazioni tra pianta e suolo
(CRA – RPS, Roma – Italia)
Service providing crops

crops introduced in the agro-ecosystems:
- to enhance (ecological, spatial and temporal) diversification
- thus (re)generating and maintaining the biotic interactions
- and – in turn – providing ecological services
  (Kremer and Miles, 2012)

Ecological services providing crops (ESCs)

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).

Not directly aimed at yield.

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

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

(Masiunas, 1998)

Inter-rotated ESCs: place in the rotation

Continental areas:
- warm season reserved for the yielding crop(s)
- ESCs mainly grown in the cold season
- no (or limited) conflict between YCs and ESCs

Mediterranean areas:
- YCs grown all the year around
- ESCs often in conflict with YCs (direct cost + yield loss)
- ESCs are (preferably) introduced
  - in the (relatively) cold season in semi-Mediterranean areas
  - in summer, in the fully Mediterranean areas (protected organic vegetable production systems)
Including ESCs in (diversified, vegetable) cropping systems

1. As ecological infrastructures (not in the rotation)
2. Within the rotation
   1. ESC is grown between subsequent yielding crops (YCs) of the rotation (*inter-rotated ESCs*)
   2. ESC is grown intercropped within the yielding crop: *living mulch*

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

(Masiunas, 1998)

**Differences between living mulch and intercropping (sensu stricto)**

- **Intercropping**
  - two (or more) YCs are cultivated simultaneously at the same area
  - full complementarities in the resource utilisation patterns

- **Living mulch**
  - a YC is cultivated simultaneously at the same area with a ESC
  - the ESC occupies the ecological niche(s) left available from the YC
  - most of system resources should remain available for the YC, then,
  - system management should aim at
    1. reducing competition between the YC the ESC
    2. optimizing the ecological services provided by the ESC within the field/farm

(Theriault et al., 2009; Bath et al., 2008; Vanek, 2005; Cerni et al., 2004; Swenson et al., 2004)
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
- similar or higher produce quality
- lower environmental impact (i.e. reduction of potential risk of N leaching)
- higher profitability (i.e. reduction of costs due to off-farm inputs reduction)

**The project is aimed** to evaluate the effect (advantages and disadvantages) of introduction of living mulch in terms of:

- yield and produce quality
- weed management
- nutrient management (N, P and K, specifically) and their effect on crop growth
- pest/beneficial insect interactions
- not-renewable energy consumption
- production costs

InterVeg Consortium

Partners from 4 CORE countries

<table>
<thead>
<tr>
<th>Institutions</th>
<th>People</th>
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</table>
| Consiglio per la ricerca e la sperimentazione in agricoltura (2 Research Centers: RPS and ORA) - IT | Stefano Canali  
Fabio Tittarelli  
Gabriele Campanelli  
Corrado Ciaccia |
| Associazione Italiana Agricoltura Biologica (AIAB) - IT | Livia Ortolani  
Cristina Micheloni |
| Università di Bologna - IT | Giovanni Burgio |
| University of Kassel - DE | Peter von Fragstein und Niemsdorff |
| Aarhus University - DK | Hanne L. Kristensen |
| University of Maribor - SLO | Franci Bavec |
### InterVeg Activities

<table>
<thead>
<tr>
<th>WP</th>
<th>Title</th>
<th>Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordination</td>
<td>Stefano Canali</td>
</tr>
<tr>
<td>2</td>
<td>Experimental sites establishment, management and harvest quality evaluation</td>
<td>Hanne L. Kristensen</td>
</tr>
<tr>
<td>3</td>
<td>Reduction of off-farm inputs for fertility management</td>
<td>Fabio Tittarelli</td>
</tr>
<tr>
<td>4</td>
<td>Functional biodiversity and beneficial insect population management</td>
<td>Giovanni Burgio</td>
</tr>
<tr>
<td>5</td>
<td>Weed management and energy saving</td>
<td>Stefano Canali</td>
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<tr>
<td>6</td>
<td>Stakeholders involvement and dissemination</td>
<td>Livia Ortolani</td>
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### InterVeg Kick off

CRA-ORA, Monsampolo del Tronto (IT)
14 Sept 2011
InterVeg, so far

1. Activities officially started on the 5th of September 2011
2. The kick off meeting held Sept. 2011 in Monsamplo (IT)
3. Year 1 IT experimental sites activities (cauliflower and artichoke) concluded
4. Year 1 DE, DK and SLO experimental sites activities (cauliflower and leek) almost done
5. Dissemination activities (press release etc.) in all 4 countries
6. WP4 – WP5 joint workshop held Feb. 2012 in Maribor (SLO)
7. Joint meeting Feb. 2013 planned in Witzenhausen (GE)
Cauliflower 2012 - cultivars and fertiliser
preliminary

Leek 2012 - cultivars and mulch sowing date
preliminary
IT Cauliflower _ year 1_ total yield

![Chart showing yield comparison for early and late sowing]

- **Early Sowing - Mix**: Bar a
- **Early Sowing - Solo**: Bar a
- **Late Sowing - Mix**: Bar a
- **Late Sowing - Solo**: Bar a

Source: Bavec and Robacer, 2012

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S.L.O. Bavec and Robacer, 2012
2/1/2013

Cower crop – mix

Cower crop – solo

Leeks on the foil

SLO, Bavec and Robacer, 2012

Microlysimeters in cauliflower (cower crop late sowign

SLO, Bavec and Robacer, 2012