Soil fertility management in organic greenhouse:
an analysis of the European context

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- Estimated area and distribution
- Soil fertility management: constraints and bottlenecks
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Statistics on organic greenhouse in Europe (estimated values)
The debate in Europe

Expert Group for Technical Advice on Organic Production

EGTOP

Final Report On Greenhouse Production (Protected Cropping)

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What is organic farming?

It is not just “farming without agrochemicals” (Lampkin, 1990)

Input substitution concept

“Organic farming defines itself by what it is doing, and not by what it is avoiding” (Speiser and Tamm 2011)
“Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects…” (IFOAM, 2008)

“More than a system of production that includes or excludes certain inputs” (IFOAM, 2002)
Organic management practices

Source: Reganold and Wachter, 2016
Soil fertility management in OGH

“It is obvious that organic greenhouse production must comply with the existing regulations regarding organic production, Reg (EC) No 834/2007 (EC, 2007) and Reg. (EC) No 889/2008 (EC, 2008)…” (Tittarelli et al., in press)

Main tools for soil fertility building

- Soil tillage practices,
- Crop rotations,
- Organic fertilisers and amendments,
- Agro-ecological service crops (ASC)
Agroecological Service Crops

Different terms used so far for crops having a role other than yield:

- catch crops;
- cover crops,
- complementary crops
- green manure
- ......

- NOT consistent terminology: connected with i) a specific purpose OR ii) a position in the rotation OR ii) a termination strategy;
- each single term is NOT always appropriate in any situation or broad enough to comprehend all the crops having agro-ecological functions
First Field

2012 - 2013

- Bare soil/ASC (Jun–Jul’12)
- Tomato (Sept’12–Jan’13)
- Green Bean (Feb-May’13)

2013 - 2014

- Bare soil/ASC (Jun–Jul’13)
- Strawberry (Sept’13–May’14)

2014 - 2015

- Bare soil/ASC (Jun–Jul’14)
- Brassica Rapa (Sept’14–Jan’15)
- Lettuce (Feb–May’15)

2015 - 2016

- Bare soil/ASC (Jun–Jul’15)
- Valerian (Feb-May’16)
- Cucumber (Sept’15–Jan’16)

Second Field

2014 - 2015

- Bare soil/ASC (Jun – Jul’12)
- Strawberry (Sept’12–May’13)
- Tomato (Sept’13–Jan’14)
- Green Bean (Feb-May’14)

2015 - 2016

- Bare soil/ASC (Jun – Jul 2014)
- Cucumber (Sept’14–Jan’15)
- Lettuce (Feb-May’16)
- Valerian (Feb-May’15)
- Brassica Rapa (Sept’15–Jan’16)

Bare soil/ASC (Jun–Jul’12)

2014 - 2015

- Bare soil/ASC (Jun–Jul’15)
Main challenges and constraints in OGH

- High investment costs;
- High organic matter turnover (Voogt, 2014);
- High nutrient demands with high risk of unbalanced fertilizations (Cuijpers et al. 2008, Voogt et al. 2011, Zikeli et al. 2014);
- High soil health problems due to low crop diversification (Miller, 2015);
- High salinity risk due to imbalanced element input-output relationships (Voogt et al. 2011);
- Short time to cultivate ASCs (Mihreteab et al. 2014);
- High irrigation water needs (Voogt et al. 2016).

Source: Tittarelli et al, in press
Figure 3 | Hypothetical nitrogen stocks and flows of two contrasting cropping systems. a, b, Cropping systems relying mainly on mineral nitrogen inputs (a) have relatively higher nitrogen losses to air and water than cropping systems with emphasis on biological N fixation, manure and other organic matter amendments, cover crops and perennial crops, and low reliance on mineral N fertilizer, such as organic and integrated systems (b). The width of the arrows is relative to the size of the nitrogen flux; boxes representing nitrogen stocks are not scaled to the pool size. Figure adapted from ref. 100, © 2015 The National Academies®. Arrows represent nitrogen inputs (green), losses (orange) and transformations (blue).
High risk of unbalanced fertilization

High levels of production mean that large amounts of plant nutrients are exported out of the greenhouse and have to be replaced.

High amount of fertilizer inputs can lead to strong nutrients imbalances.
Knowledge Gaps

Diversification of cropping systems – Introduction of ASC in the rotation – Estimation of ASC rate of mineralization

Nutrients imbalances and design of more balanced systems

Assessment of N mineralization rate of different N sources

Influence of soil fertility management on GHG emission

Source: Tittarelli et al, in press
CONSUMER PERCEPTIONS

The future of organic agriculture will depend, to a large extent, on consumer demand (Yiridoe et al, 2005)

“Current consumers of organic food, both regular and occasional, are confused on many fronts” (Hughner et al., 2007)

Some skepticism about the true attributes of organic and organic labels may hold some consumers back from purchasing organic.
More efficient use of external inputs to maintain the public trust in the sustainability of organic greenhouse production (EGTOP, 2013)

NO SHORTCUT IN OGH PRODUCTION
5.6 ECOLOGICAL SUPPORT IN SPECIALISED AND INTENSIVE PLANT PRODUCTION SYSTEMS

SPECIFIC CHALLENGE

Fruit tree orchards, vineyards and greenhouses are highly specialised, and therefore simplified, cropping systems. Their management requires the intensive use of energy, water and other inputs, and the use of functional biodiversity is still limited. The challenge is to find practical ways to develop more resilient agro-ecosystems for perennial and protected crops.

Knowledge/Innovation (Source: Canali, 2015 modified)

Organic "input substitution" (IPM, INM, IWM ..IQS)

Organic by agroecological approach (EPM, ENM, EWM, ERD, EFSD..)

Area of "sustainable ecological intensification"

Sustainability

Conventional

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Thank you for your attention
Who are organic food consumers

Table 2. Themes identified among buyers and non-buyers of organic food

<table>
<thead>
<tr>
<th>I. Consumers’ purchasing motives</th>
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<tbody>
<tr>
<td>Theme 1. Health and nutritional concern</td>
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<td>Theme 2. Superior taste</td>
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<tr>
<td>Theme 3. Concern for the environment</td>
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<tr>
<td>Theme 4. Food safety, lack of confidence in the conventional food industry</td>
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<td>Theme 5. Concern over animal welfare</td>
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<td>Theme 6. Support of local economy</td>
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<td>Theme 7. More wholesome</td>
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<td>Theme 8. Nostalgia</td>
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<td>Theme 9. Fashionable/Curiosity</td>
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<th>II. Deterrents</th>
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<tr>
<td>Theme 10. High price premiums</td>
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<td>Theme 11. Lack of organic food availability, poor merchandising</td>
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<td>Theme 12. Skepticism of certification boards and organic labels</td>
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<td>Theme 13. Insufficient marketing</td>
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<td>Theme 14. Satisfaction with current food source</td>
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<td>Theme 15. Sensory defects</td>
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Source: Hughner et al., 2007