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Is agroecology the most **sustainable** approach for all organic farming systems?

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NJF Seminar 461: 'Organic farming systems as a driver for change', Bredsten (DK), 21.8.2013

The objectives of Agroecology

- Challenge to mainstream **agronomic model** based on high external input use
- Challenge to mainstream **ecological model** separating biodiversity protection from food production (land sparing)
- Challenge to mainstream **economic model** pointing towards globalisation of (food) production and markets

Agroecological principles

- Biomass recycling, OM supply, optimisation of biogeochemical cycles
- Reduction of dependency on external inputs
- Conservation of limiting natural resources (soil, water)
- Valuing of non limiting natural resources (solar radiation)
- Conservation of genetic diversity (crops and livestock)
- Yield optimisation and stability (not maximisation)
- Exploitation of positive interactions between agroecosystem components
  - Mixed crop-livestock systems
  - Agroforestry and agrosylvopastoral systems
  - Conservation biological control of crop pests (e.g. semi-natural areas)

FUNCTIONAL AGROBIODIVERSITY

arc 2020 agricultural & rural convention

IFOAM EU GROUP

TPorganics Technology Platform

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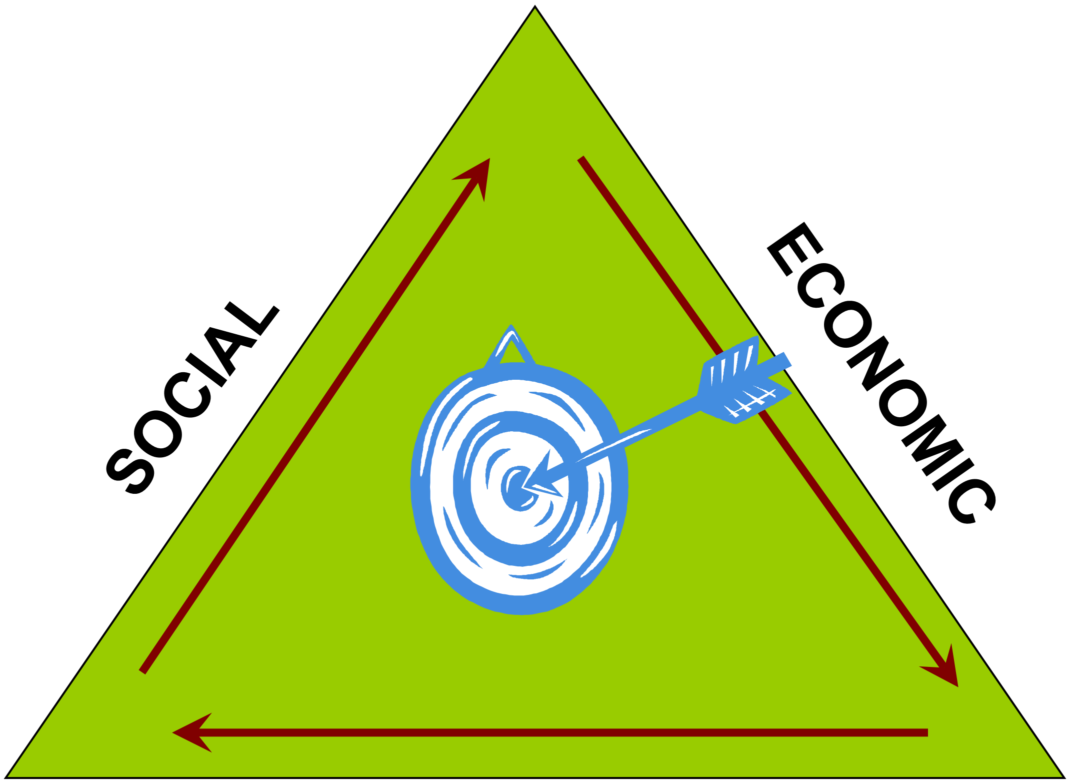
Agro-ecological Innovation Network
http://agro-ecoinnovation.eu

What is sustainability?



Do environmental, economic and social sustainability have the same weight in all organic farming production models?

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The different organic farming production models

‘MULTIFUNCTIONAL’ model
- Small-scale farms
- Diversification of cropping/farming systems
- Strong link with local territory
- Short/very short supply chain

‘SPECIALISED’ model
- Medium to large farms
- Semplification of cropping/farming systems
- Weak link with local territory
- Supermarkets and export

← **AGROECOLOGICAL APPROACH**

INPUT SUBSTITUTION APPROACH →

Bàrberi (2010). Strategie per l'evoluzione dei sistemi agricoli e zootecnici biologici. In: Le strategie per lo sviluppo dell’agricoltura biologica. Risultati degli Stati Generali 2009. Ed. INEA, Roma, IT (modified).

The different organic farming models

Agriculture and Human Values (2008) 25:95–106
DOI 10.1007/s10460-007-9073-1

Organic agriculture and the conventionalization hypothesis: A case study from West Germany

Henning Best
Institute for Applied Social Research, University of Cologne, Cologne, Germany

Agron. Sustain. Dev. 30 (2010) 67–81
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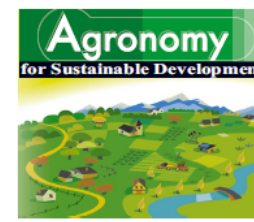

Review article

Conventionalisation of organic farming practices: from structural criteria towards an assessment based on organic principles. A review

Ika DARNHOFER*, Thomas LINDENTHAL, Ruth BARTEL-KRATOCHVIL, Werner ZOLLITSCH

BOKU - Univ. of Natural Resources and Applied Life Sciences, Vienna, Feistmantelstr. 4, 1180 Vienna, Austria

(Accepted 8 April 2009)

Sustainability – case study #1 'Multifunctional' model

FERTORTOMEDBIO Project (MiPAAF, 2005-2009)

Improvement of soil fertility management in organic vegetable systems

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The management systems (spinach)

PWC = System based on physical weed control

PWC+LM = Physical weed control + living mulch

PWC

PWC +LM

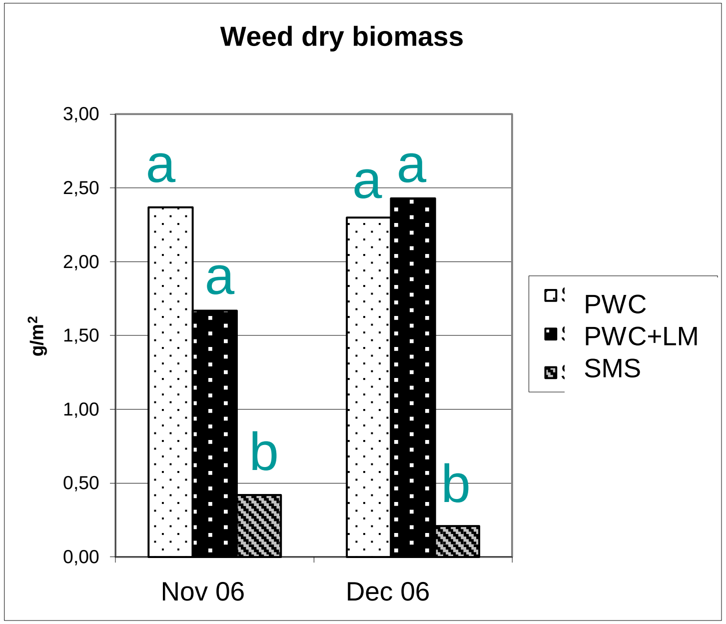
- Precision sowing (55 seeds m^{-2})
- Rolling harrow
- Flame weeding
- Hand-steered hoe

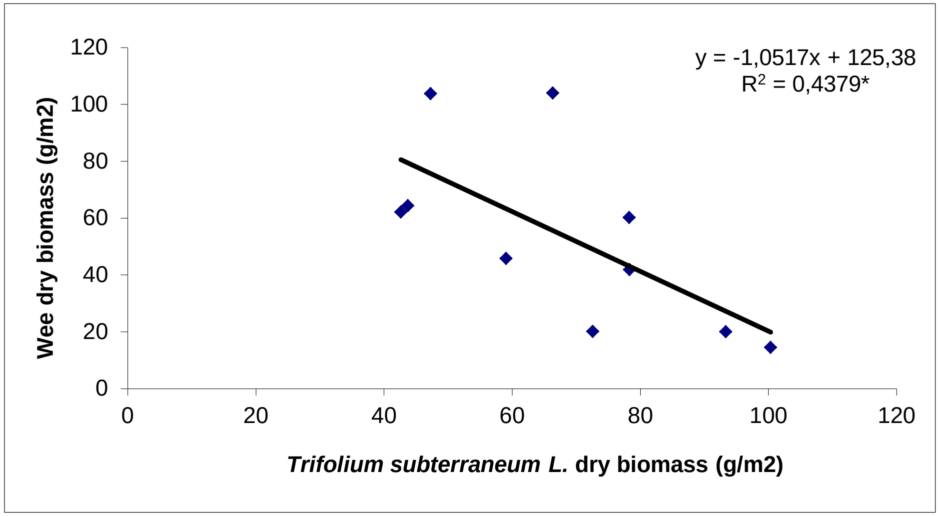
- Living mulch sown in rows:

Trifolium subterraneum

SMS = Standard Management System: manual transplanting on plastic mulch

Spinach:
weed and subclover biomass





Living mulch: 20 kg N ha^{-1}

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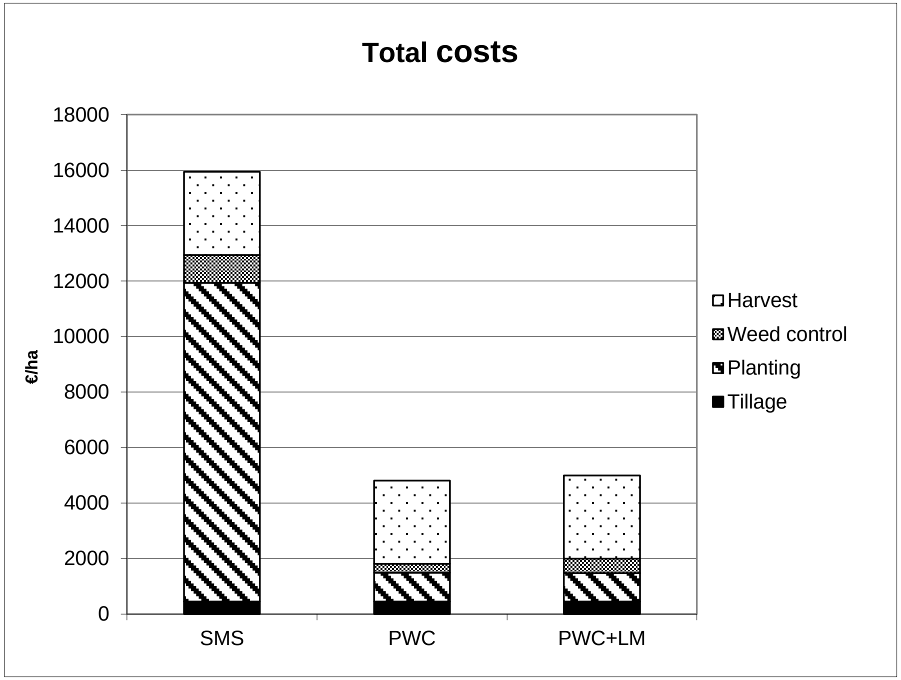
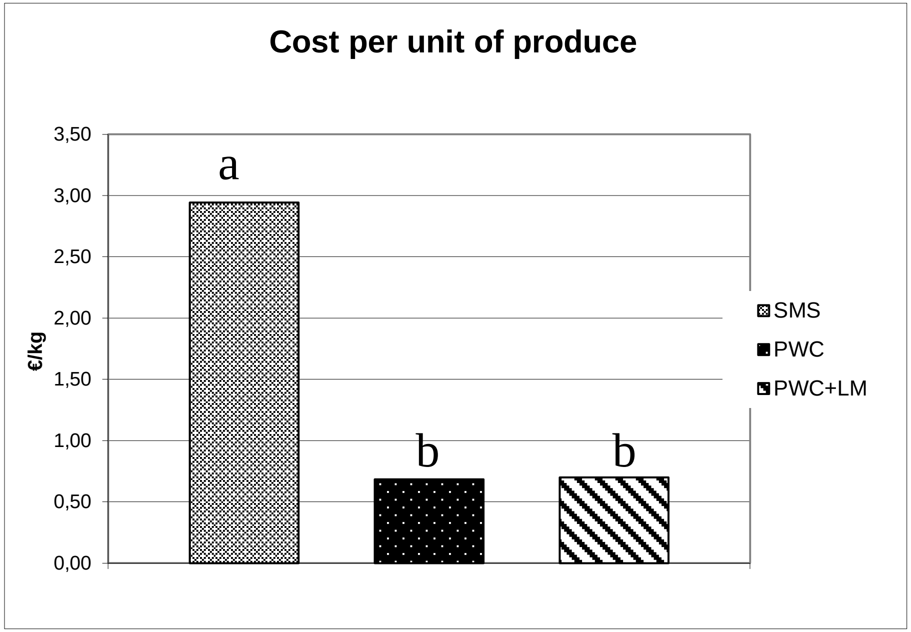
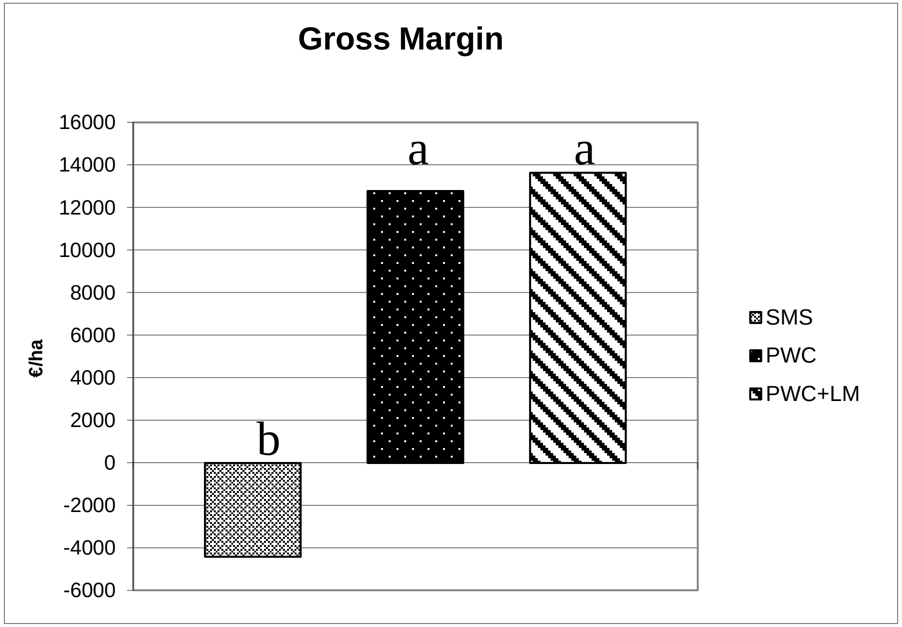
Spinach: costs and gross margin







What does not work in the SMS?

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Sustainability – case study #2
'Specialised' model

Agri-environmental indicators in 12 organic vegetable farms

Agri-environmental indicator	*Unit of measure*	*Optimum value*	*Mean of 12 farms*
Soil cover/year	% months	x > 50	**89.5**
Soil cover in critical period	% months	x > 60	**78.3**
SOM	%	x ≥ 2.5	2.03
Soil total N	‰	x > 1.5	1.22
Soil C/N	-	9 < x < 12	9.71
Soil assimilatable P	mg kg^{-1}	35 < x < 25	**81.3**
Soil exchangeable K	mg kg^{-1}	150 < x < 200	**359.8**
Potential N leaching (N-NO_3^-)	kg/ha	x < 70	**408.0**

Sustainability – case study #2
‘Specialised’ model
Agri-environmental indicators in 12 organic vegetable farms

Agri-environmental indicator	***Unit of measure***	***Optimum value***	***Mean of 12 farms***
Woodland	% TAL	x > 10	**3.99**
Field adjacency	-	x = 1	**0.45**
Field size	ha	1 < x < 5	**5.92**
Field length/width	-	1 < x < 4	**4.91**
Field density	Number ha^{-1}	Max	3.62
Cultivar richness	Number	x > 20	**45.0**
Local cultivar richness	Number	x > 2	**3.6**
Index of ecological infrastructures	% AUL	x > 5	**16.7**
Richness of ecological infrastructures	Number	x > 35	**56.3**
Diversity of ecological infrastructures	Number	x > 2	**3.4**

Sustainability – case study #2
‘Specialised’ model
Agri-environmental indicators in 12 organic vegetable farms

Agri-environmental indicators	***Unit of measure***	***Optimum value***	***Mean of 12 farms***
Duration of rotation	Year	x ≥ 6	6
Similarity between crops	Number	x = 0	0
Crop species share	% tot.	x ≤ 0.167	**0.07**
Crop group share	% tot.	x ≤ 0.33	**0.18**
Energy budget (Outputs-Inputs)	kg	x > 0	**-4,704.37**

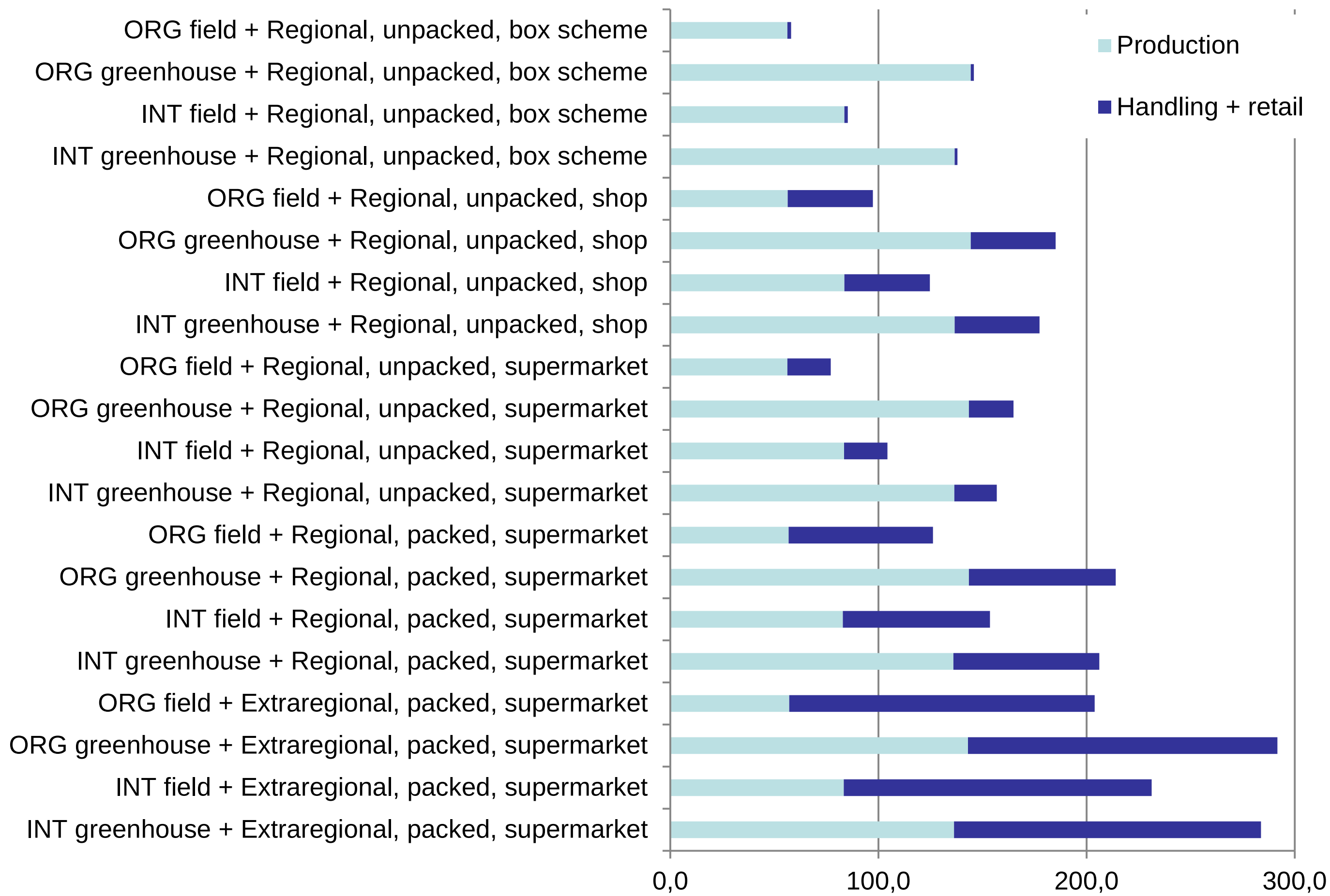
Sustainability – case study #3
ARIA & SATREGAS projects (Region Tuscany)

- Aim: to analyse the **environmental sustainability** of integrated and organic production and retail systems
- Example (tomato for fresh consumption):
  - Estimated unit emissions (kg CO_2 kg prod.$^{-1}$) as based on LCA analysis for 20 tomato systems
  - 4 production systems x 5 retail systems (including both ‘multifunctional’ and ‘specialised’ systems)

CO_2 emissions (kg/kg produce)

4 production systems x 5 handling & retail systems

TOMATO – FRESH CONSUMPTION



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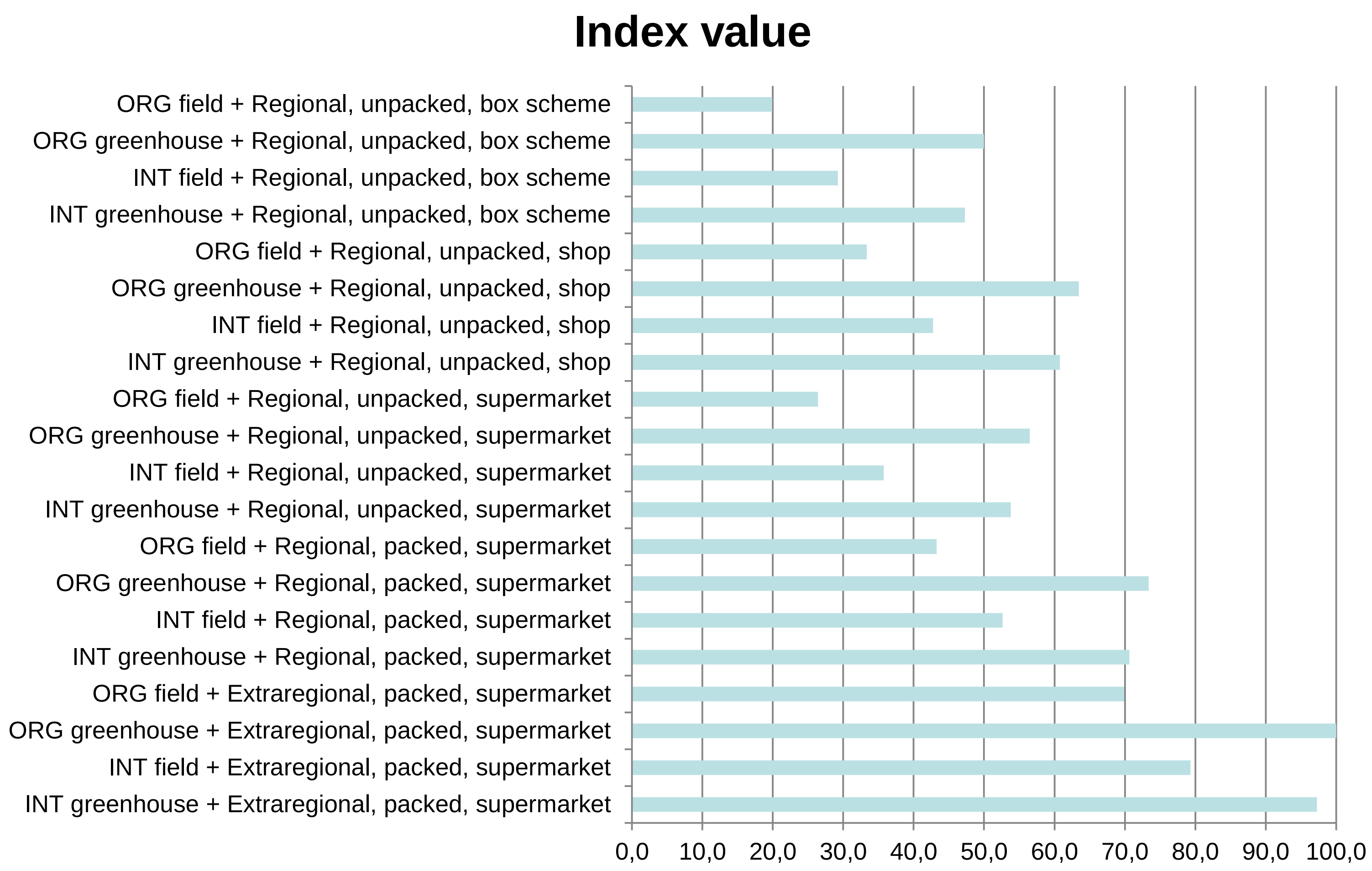
Courtesy of Prof. Marco Mazzoncini (University of Pisa, Italy)

CO_2 emissions (kg/kg produce)

4 production systems x 5 handling & retail systems

TOMATO – FRESH CONSUMPTION



Courtesy of Prof. Marco Mazzoncini (University of Pisa, Italy)

Conclusions

- In all organic farming systems sustainability can be largely improved
  - ‘Multifunctional’ model: crop production optimisation (⇨ < costs)
  - ‘Specialised’ model: mitigation of input substitution approach
- Organic farming systems must have **clearly higher goals** than integrated farming systems
  - EU Directive on sustainable pesticide use
  - CAP greening
- Valuing functional agrobiodiversity and short supply chains: the future?