International Symposium

Organic Matter Management & Using Compost in Horticulture

4-7 April 2011, University of Adelaide, Australia

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Research Institute of Organic Agriculture
Forschungsinstitut für biologischen Landbau
Institut de recherche de l'agriculture biologique

Compost: quality management and use to improve plant growth and health

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Introduction

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Introduction

- Green waste compost production in Switzerland
  - Payment for taking over the green waste cover nearly the production costs of compost with minimal quality
  - Costs for production of higher quality have to be cover with the sale of the compost
- Composting / biogas production / burning
  - Concurrence between energy production and compost for soil fertility management is from day to day stronger
- Motivations for composting
  - Waste management ? Soil fertility improvement ?

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Introduction

- Compost users
  - Some users (among other horticultural producers) are convince from the advantage of compost and use them to improve the fertility of their soils and to support the production of their plants.
  - Other users still consider compost as a waste product and are not willing to pay for it. Compost producer have to cultivate the relationship to these user to convince him from the positive effect of compost on soil and plant.

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Compost production and use in Switzerland

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Compost production and use in Switzerland

- Each year, more than 100 kg green material per inhabitant is collecting to be composted or methanized (total: about 1'000'000 tonnes)
- About 1/3 of this material is methanized, 2/3 composted. The part of methanization rise significantly in the past years
- About 70% of the produced compost or digestate are used in agriculture

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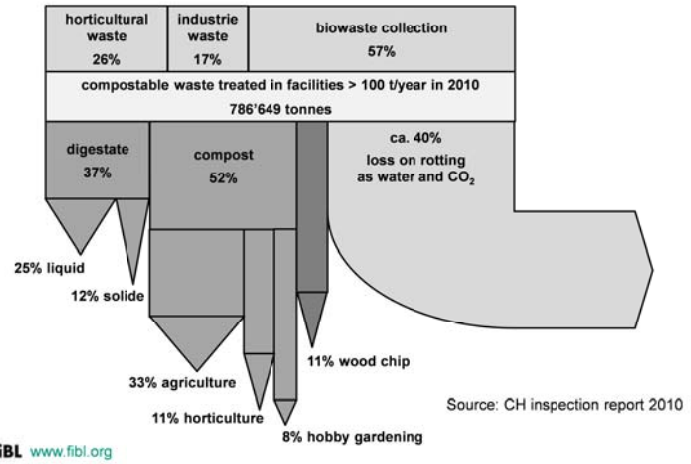
Compost production and use in Switzerland



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Compost production and use in Switzerland

- **Composting systems in 2010**
- Field edge composting (~6%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Windrow composting (~43%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Windrow composting (~43%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Box composting (~7%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Hall composting (~6%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Methanisation (~32%)

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Compost production and use in Switzerland

- **Composting systems in 2010**
- Co-methanisation (~6%)

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Compost quality management

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Compost quality management

- **Minimal quality: Swiss Legislation**
  - FAC guidelines 1995
  - Heavy metals, impurities, hygienisation: ORRChim
  - **Objective: no negative impact for environment**
- **Swiss compost and digestate guidelines 2010**
  - Voluntary from compost trade elaborated
  - To avoid any problem in relation to utilization of digestate and compost
  - To improve the beneficial effects of digestate and compost
  - **Support to choose the appropriate product depending on the utilization**

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Compost quality management

- **Swiss compost and digestate guidelines 2010**
  - Five products classes
    - Digestate liquide for agricultural use
    - Digestate solide for agricultural use
    - Compost for agricultural use
    - Compost for field horticulture
    - Compost for covered cultures

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Compost quality management

- **Swiss compost and digestate guidelines 2010**

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquide	Digestate solide	Compost	Compost for field horticulture	Compost for covered cultures
DM (dry matter) [% FM]	X	X	X	*> 50 %*	*> 55 %*
OM (organic matter) [% DM]	X	X	X	*< 50 %*	*< 40 %*
pH	X	X	X	**< 7.8**	**< 7.5**
Particle size [mm]		X	X	*< 25*	*< 15*
Coulor of extract		(X)	< 1.0	**< 0.5**	**< 0.2**
Salinity [g KCleq/kg DM]	X	X	X	**< 20**	**< 10**

Minimal requirements; *recommendation*; X: has to be mentioned; (X): mention recommended

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Compost quality management

› **Swiss compost and digestate guidelines 2010**

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquide	Digestate solide	Compost	Compost for field horticulture	Compost for covered cultures
Total nitrogen [g/kg DM]	X	X	X	*> 10*	*> 12*
Ammonium ($N\text{-}NH_4$) [mg/kg DM]	*> 3'000*	**> 600**	**< 600**	**< 200**	**< 40**
Nitrate ($N\text{-}NO_3$) [mg/kg DM]			X	**> 80**	**> 160**
Nitrite ($N\text{-}NO_2$) [mg/kg DM]			(X)	*< 20 mg/kg DW*	*< 10 mg/kg DW*
Nmin. [mg/kg DM]	*> 3'000*	*> 600*	*> 60*	*> 100*	*> 160*
$N\text{-}NO_3$/Nmin.			(X)	**> 0.4**	**> 0.8**

Minimal requirements; *recommendation*; X: has to be mentioned; (X): mention recommended

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Compost quality management

› **Swiss compost and digestate guidelines 2010**

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquide	Digestate solide	Compost	Compost for field horticulture	Compost for covered cultures
Biotest cress open				**> 50% from control**	**> 75% from control**
Biotest cress closed			(X)	**> 25% from control**	**> 50% from control**
Biotest lettuce				*> 50% from control*	**> 70% from control**

Minimal requirements; *recommendation*; X: has to be mentioned; (X): mention recommended

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Compost quality management

› **Training program**
- › Basic module
  - › general overview of biowaste management
  - › grounding in the legal basics
  - › biological basics of composting
  - › aspects of management of a composting plant


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Compost quality management

- **Training program**
  - Quality module
    - process and quality control
    - simple chemical and plant tests
    - analysis and interpretation of results
    - installation from a simple laboratory on the plant to assure quality


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Compost quality management

- **Quality management: from collecting the green manure until compost use**
  - **Quality of the green manure**
  - **Composition of the start mixture**
  - **Management of composting process**
  - **Compost storage**
  - **Choice of the adequate compost for each utilization**
  - **Compost application strategy**

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Disease control with quality compost

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Disease control with quality compost

- **Influence of compost on plant health and vitality**
  - **Indirect:**
    - supply of macro and micro nutrients
    - soil structure
    - humus quantity and quality
    - water regulation
  - **Direct:**
    - influence of soil microflora through compost and compost microflora

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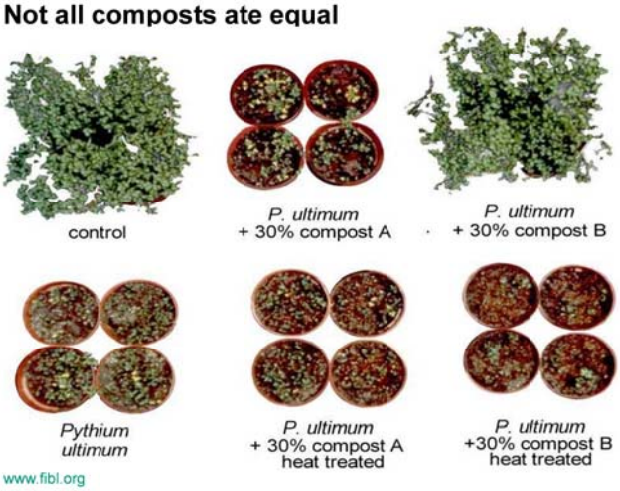
Disease control with quality compost

- **Not all composts ate equal**



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Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 1: Compost in culture substrate**

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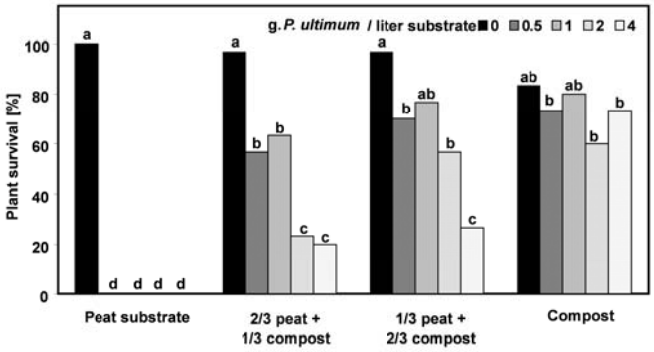
Disease control with quality compost

› **Quality compost as plant protection agent in practice**

› **Example 1: Compost in culture substrate**



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Disease control with quality compost

› **Quality compost as plant protection agent in practice**

› **Example 1: Compost in culture substrate**

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Disease control with quality compost

› **Quality compost as plant protection agent in practice**

› **Example 1: Compost in culture substrate**

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Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 1: Compost in culture substrate**
    - Buffers the system microbiologically
    - Prevents pathogen invasion
    - Reduces disease incidence drastically
    - Secures plant production

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Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 2: Compost after soil steaming**

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Disease control with quality compost

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Disease control with quality compost

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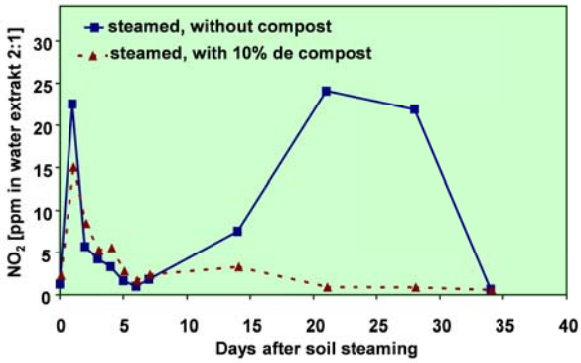

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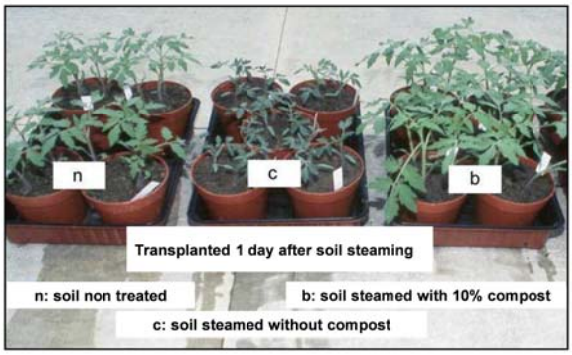
Disease control with quality compost

› **Quality compost as plant protection agent in practice**

› **Example 2: Compost after soil steaming**



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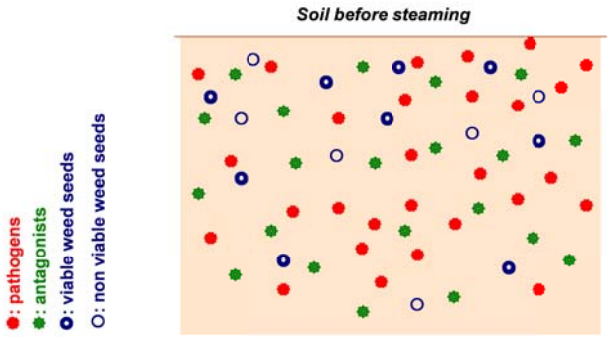

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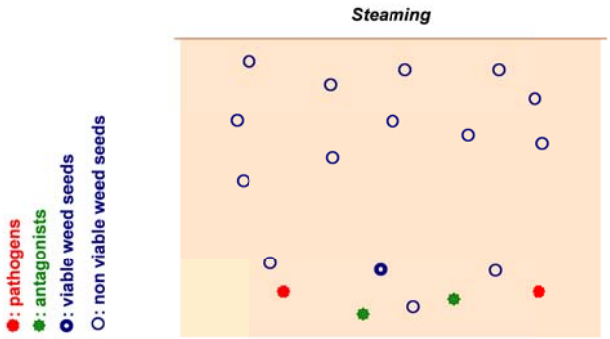

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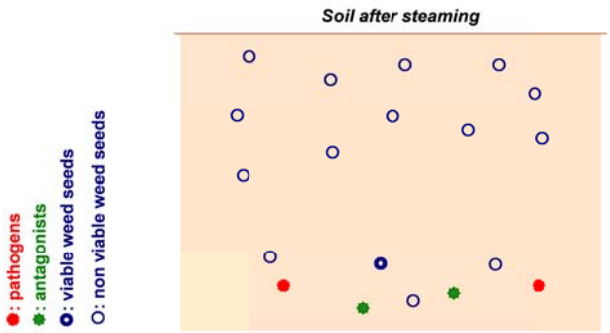

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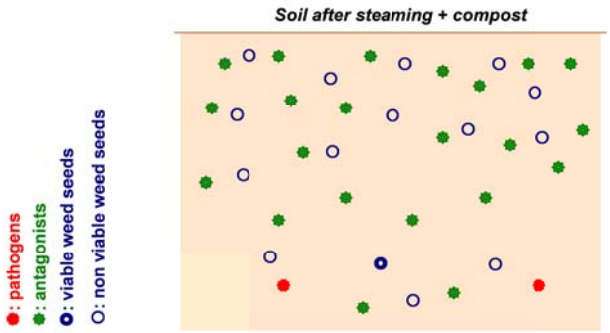

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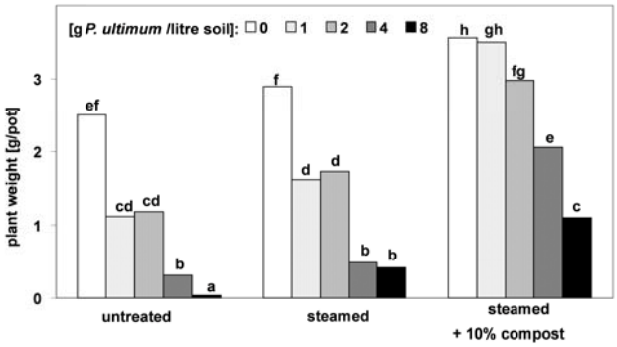
Disease control with quality compost

- Quality compost as plant protection agent in practice
  - Example 2: Compost after soil steaming



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Disease control with quality compost

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Disease control with quality compost

- Quality compost as plant protection agent in practice
  - Example 2: Compost after soil steaming
    - Detoxification of the soil
    - Allows earlier planting of seedlings
    - Prevents soil re-colonisation with pathogens
    - Allows sustainable soil steaming

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Disease control with quality compost

› **Quality compost as plant protection agent in practice**

› **Example 3: Compost in the field**

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Disease control with quality compost

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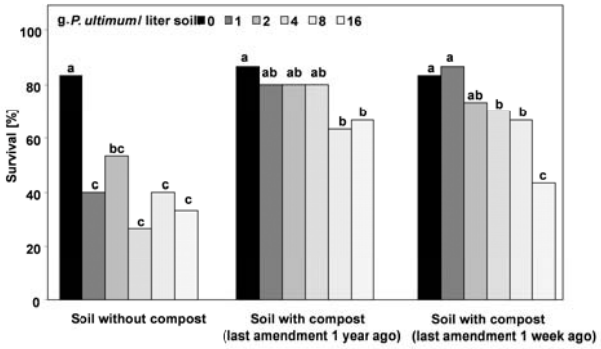

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Disease control with quality compost

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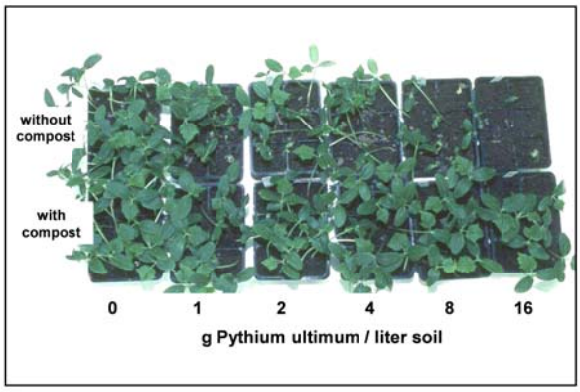

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Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 3: Compost in the field**
    - Reduces disease incidence
    - The more intensively the field is cultivated, the more evident is the positive effect of compost on plant health

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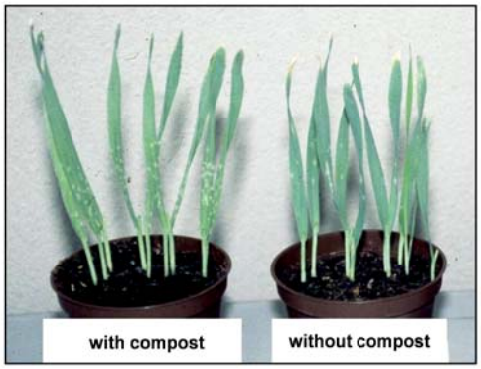
Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 4: Compost effect on the whole plant**



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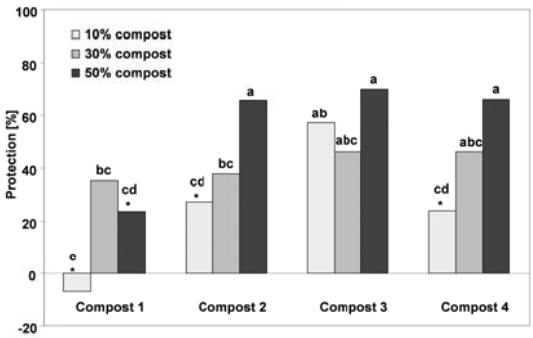
Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 4: Compost effect on the whole plant**



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Disease control with quality compost

- **Quality compost as plant protection agent in practice**
  - **Example 4: Compost effect on the whole plant**
    - Reduces disease incidence without direct contact with the pathogen
    - Efficacy varies greatly from compost to compost

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Conclusions

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Conclusions

- Quality compost can improve soil fertility and plant growth and health
- Quality management is the key for a successful production and use of compost
- Training and experience are necessary to assure the production and utilization of quality compost
- The choice of the right product and application strategy is decisive to obtain the desired impact
- The relation between compost producer and compost user has to be improved to assure the future of composts

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Thank you very much for your attention …

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