



Presentation at the International Symposium

Organic Matter Management & Using Compost in Horticulture

Compost: quality management and use



Quality management concept to secure the benefits of compost use for soil and plants

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Konrad Schleiss, UMWEKO GmbH

Biophyt Ltd, Dr. Jacques G. Fuchs, April 2011

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4-7 April 2011, University of Adelaide, Australia

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Compost: quality management and use



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Compost: quality management and use



Quality management concept to secure the benefits of compost use for soil and plants

- ⊗ Aspect of compost quality
 - ⊗ Quality of Swiss composts and digestates
 - ⊗ Chemical and biological characteristics
 - ⊗ Influence in nitrogen mineralization in soil
 - ⊗ Influence on plant growth and health
 - ⊗ Swiss compost and digestate guidelines 2010
 - ⊗ Swiss guidelines 2010 in the practice
 - ⊗ Conclusions

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Compost: quality management and use



Aspects of compost quality



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Compost: quality management and use



Aspects of compost quality

- ⊗ *Compost can have a positive impact on soil fertility and plant growth and health*
- ⊗ *Compost can have a negative impact on soil fertility and plant growth and health*
- ⊗ *The compost production and the compost use strategies both influence the impact of compost on soil fertility and plant growth and health*

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Importance of compost production strategy

- ⊗ *Content of nutrients, salts, pH*
- ⊗ *Availability of nutrients*
- ⊗ *Stability of organic matter*
- ⊗ *Phytotoxicity, disease suppressivity, ...*
- ⊗ *Content in heavy metals, plastics, organic pollutants, ...*

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Importance of compost use strategy

- ⊗ *Choice of the right compost for the desired use*
- ⊗ *Quantity used*
- ⊗ *Period of compost application*
- ⊗ *Distribution of compost in crop*
- ⊗ *Combination with other agronomic measures*

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Compost ≠ compost, need ≠ need

⊗ ***For a successful use of compost, it is necessary***

- *To know the quality characteristics of the compost*
- *To know the needs of the crop depending of the situation and the desired effects*

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Compost: quality management and use



Quality of Swiss composts and digestates



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Compost: quality management and use



Quality of Swiss composts and digestates

⊗ ***Chemical characteristics: great variation between composts***

⊗ *Contents of nutrients and pollutants depend mainly on the input materials (feedstocks)*

⊗ *Contents and stability of organic matter depend mainly on the maturity of the product*

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Compost: quality management and use



Chemical characteristics of Swiss composts

	Digestate for agricultural use	Compost for agricultural use	Compost for horticultural use	Compost for covered cultures
salt content [mg KCl/100g FM]	970	862	787	660
median (minimum; maximum)	(704; 1384)	(361; 1580)	(173; 2657)	(328; 1539)
pH	8.5	8.2	8.1	7.9
median (minimum; maximum)	(8.0; 8.8)	(7.5; 8.7)	(7.6; 8.7)	(7.2; 8.5)
density [g/l]	468	556	609	715
median (minimum; maximum)	(321; 631)	(412; 851)	(434; 836)	(631; 904)
dry matter [% FM]	53.1	50.8	56.7	56.3
median (minimum; maximum)	(45.4; 75.2)	(28.2; 73.4)	(40.8; 71.1)	(32.2; 64.5)
organic matter [% DM]	50.3	47.7	38.1	30.6
median (minimum; maximum)	(28.9; 73.4)	(17.0; 80.1)	(23.9; 54.7)	(20.9; 52.8)
total N [g/kg DM]	15.3	16.6	14.6	15.1
median (minimum; maximum)	(9.4; 20.3)	(8.7; 26.0)	(9.2; 27.6)	(8.6; 25.2)
total P [g/kg DM]	3.6	3.0	3.0	3.3
median (minimum; maximum)	(2.0; 8.0)	(1.7; 6.1)	(1.3; 12.7)	(2.1; 8.8)
total K [g/kg DM]	12.5	12.0	11.6	10.7
median (minimum; maximum)	(6.4; 20.8)	(5.7; 25.2)	(2.2; 20.7)	(5.5; 27.8)
total Mg [g/kg DM]	6.8	4.8	6.5	6.5
median (minimum; maximum)	(3.7; 9.7)	(3.6; 10.3)	(4.4; 10.7)	(4.4; 13.3)
total Ca [g/kg DM]	46.6	53.1	64.0	44.5
median (minimum; maximum)	(23.0; 57.8)	(24.0; 83.7)	(35.0; 91.5)	(69.4; 29.5)
Fe [mg/kg DM]	8.9	8.8	10.1	12.0
median (minimum; maximum)	(3.7; 12.3)	(2.9; 16.7)	(5.4; 14.7)	(6.1; 15.8)

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Compost: quality management and use



Quality of Swiss composts and digestates

⊗ Influence on the mineralized nitrogen content of soils



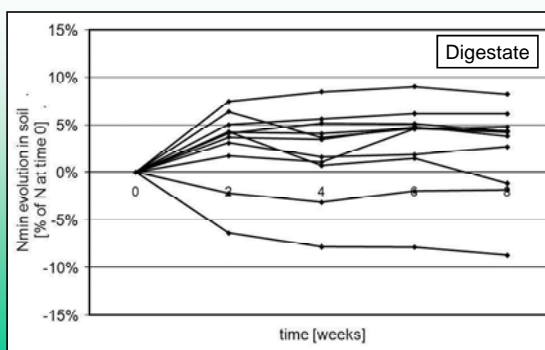
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Compost: quality management and use




Quality of Swiss composts and digestates

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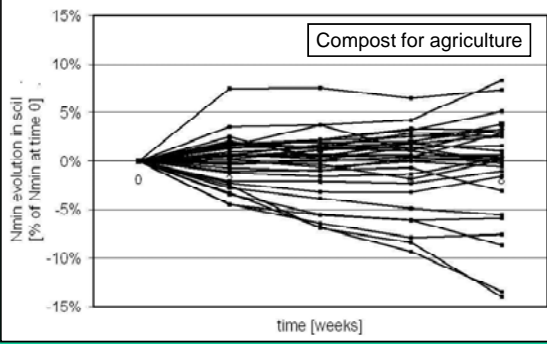
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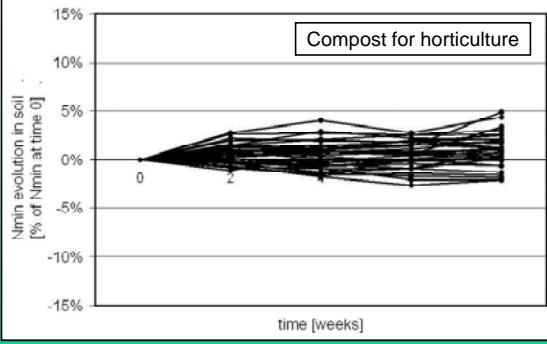


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Compost: quality management and use 

Quality of Swiss composts and digestates

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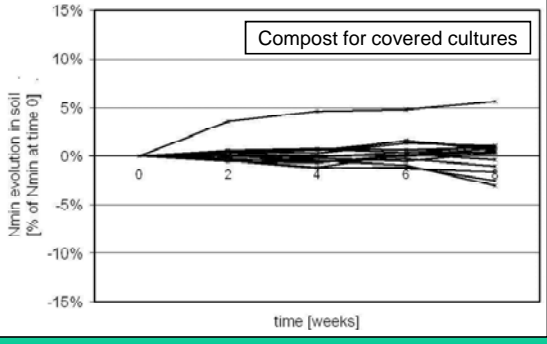


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Compost: quality management and use 


Quality of Swiss compost and digestates

⊗ Influence on the mineralized nitrogen content of soils



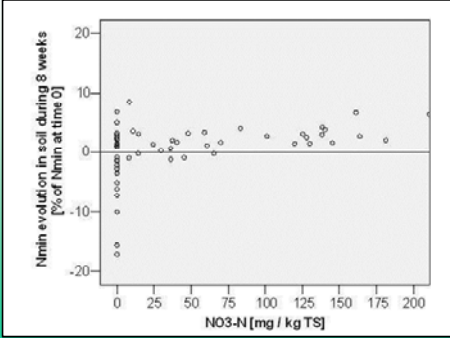
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Compost: quality management and use 

Quality of Swiss composts and digestates

- ⊗ Influence on the mineralized nitrogen content of soils



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Compost: quality management and use 

Quality of Swiss composts and digestates

- ⊗ Influence on the mineralized nitrogen content of soils
 - ⊗ **Digestates:** contain high amounts of mineralized nitrogen (mainly as ammonia). If post-production treatment of the digestate is inappropriate, this N can be released and the digestate cause then nitrogen immobilization in the soil !
 - ⊗ **Composts:** the degradation of ligneous compounds in the soil by **young composts** can leads to a momentary immobilization of the available nitrogen
 - ⊗ **Nitrate** content is easy to analyze and gives a good prediction of the risk of nitrogen immobilization.
 - ⊗ **The management of the composting process and the storage of product** can considerably influence the content and stability of the organic matter

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Quality of Swiss composts and digestates

- ⊗ Influence on plant growth and health



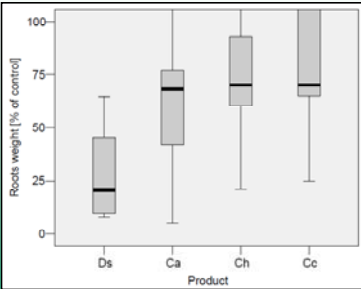
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Quality of Swiss composts and digestates

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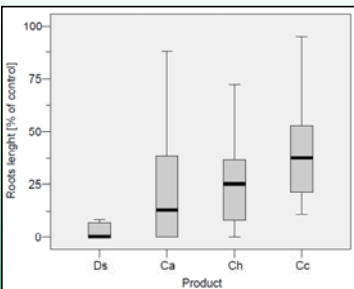
Open cress test

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Quality of Swiss composts and digestates

⊗ Influence on plant growth and health



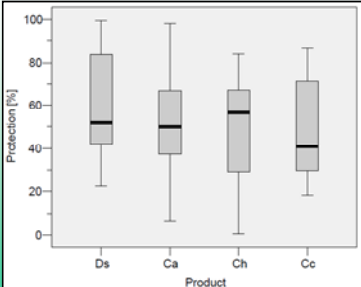
Closed cress test

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Quality of Swiss composts and digestates

⊗ Influence on plant growth and health



Cucumber-Pythium ultimum Test

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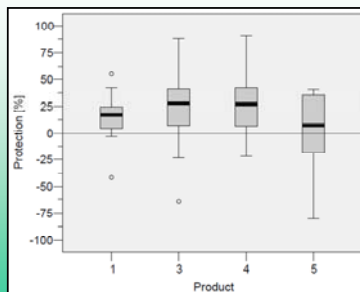


Compost: quality management and use



Quality of Swiss composts and digestates

⊗ Influence on plant growth and health



Basil-Rhizoctonia solani Test

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Quality of Swiss composts and digestates

⊗ Influence on plant growth and health

⊗ **Digestates:**

are generally less compatible with plant growth than composts

⊗ Plant growth compatibility is better in more mature composts

⊗ There is considerable variations within a product class.

⊗ **Management of the composting process and product storage are at least as important for the biological quality as the maturity of the compost**

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Swiss compost and digestate guidelines 2010

⊗ ... to avoid all problems in relation to use of digestate and compost

⊗ ... to improve the beneficial effects of digestate and compost

⊗ Help with the choice of the appropriate product depending on its use

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Swiss compost and digestate guidelines 2010

- ⊗ Five products classes
- ⊗ Liquid digestate for agricultural use
- ⊗ Solid digestate for agricultural use
- ⊗ Compost for agricultural use
- ⊗ Compost for field horticulture
- ⊗ Compost for covered cultures

⊗ Heavy metals and impurities contents, sanitation:
according to Swiss Law (FAC 1995 and Ordinance SR 814.81)

⊗ 2010 Guidelines: voluntary from compost trade elaborated

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Swiss compost and digestate guidelines 2010

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquid	Digestate solid	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
Color 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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Swiss compost and digestate guidelines 2010

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquid	Digestate solid	Compost	Compost for field horticulture	Compost for covered cultures
Total nitrogen [g/kg DM]	X	X	X	> 10	> 12
Ammonium (N-NH ₄) [mg/kg DM]	> 3'000	≥ 600	≤ 600	< 200	< 40
Nitrate (N-NO ₃) [mg/kg DM]			X	≥ 80	≥ 160
Nitrite (N-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-NO ₃ /Nmin.			(X)	≥ 0.4	≥ 0.8

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

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Swiss compost and digestate guidelines 2010

Criteria	Composts and digestates for agricultural use			Compost for horticultural use	
	Digestate liquid	Digestate solid	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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Swiss compost and digestate guidelines 2010

- ⊗ Digestate and compost differ primarily in their content in ammonium
 - ⊗ Digestate: important risk of phytotoxicity
 - ⊗ Solid digestate for agricultural use (so not for horticultural use)
 - ⊗ Liquid digestate: careful choice of application technique and strategy to avoid ammoniac losses
 - ⊗ Compost for agricultural use: measures to avoid nitrogen immobilization

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Swiss 2010 guidelines in practice

- ⊗ Guidelines do not make sense if not applied in practice!
 - ⊗ The application of guidelines requires some effort!
 - strict control and analyses of composts
 - quality management concept on the composting plant
 - compost producer must improve his knowledge of product use
 - relationship between compost producer and user must be strengthened
 - ⊗ Implementation of demonstration field trials in collaboration between scientists, compost producers and compost users

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Conclusions

- ⊗ *Digestate and compost have an important potential to improve soil fertility and plant health and growth*
- ⊗ *The quality of the products and the choice of the appropriate product are essential for a successful use of digestate and compost*
 - ⊗ *Swiss guidelines 2010: basis for good use practice*
 - ⊗ *Along with showcase experiments, they can ensure successful application of these products and help plant growers maintain the fertility of their soils*

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Acknowledgements

- ⊗ *For their financial support:*
 - *Swiss Federal Office for the Environment (FOEN)*
 - *Swiss Federal Office of Energy (SFOE)*
 - *Canton Zürich*
- ⊗ *For their technical support*
 - *Swiss Federal Office for Agriculture (FOAG)*
 - *Association of Swiss Compost and Methanisation Plants (ASCP)*

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