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Evaluation of the quality of the products

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Evaluation of the quality of the products

- Characteristics of composts and digestates
- Evaluation of the product quality: parameters of the composting process
- Evaluation of the quality with own senses
- Evaluation of the quality with simple analyses
- Evaluation of the quality with biotests
- Conclusions

Characteristics of composts and digestates

Characteristics of composts and digestates

› Fertilizer value from composts and digestates

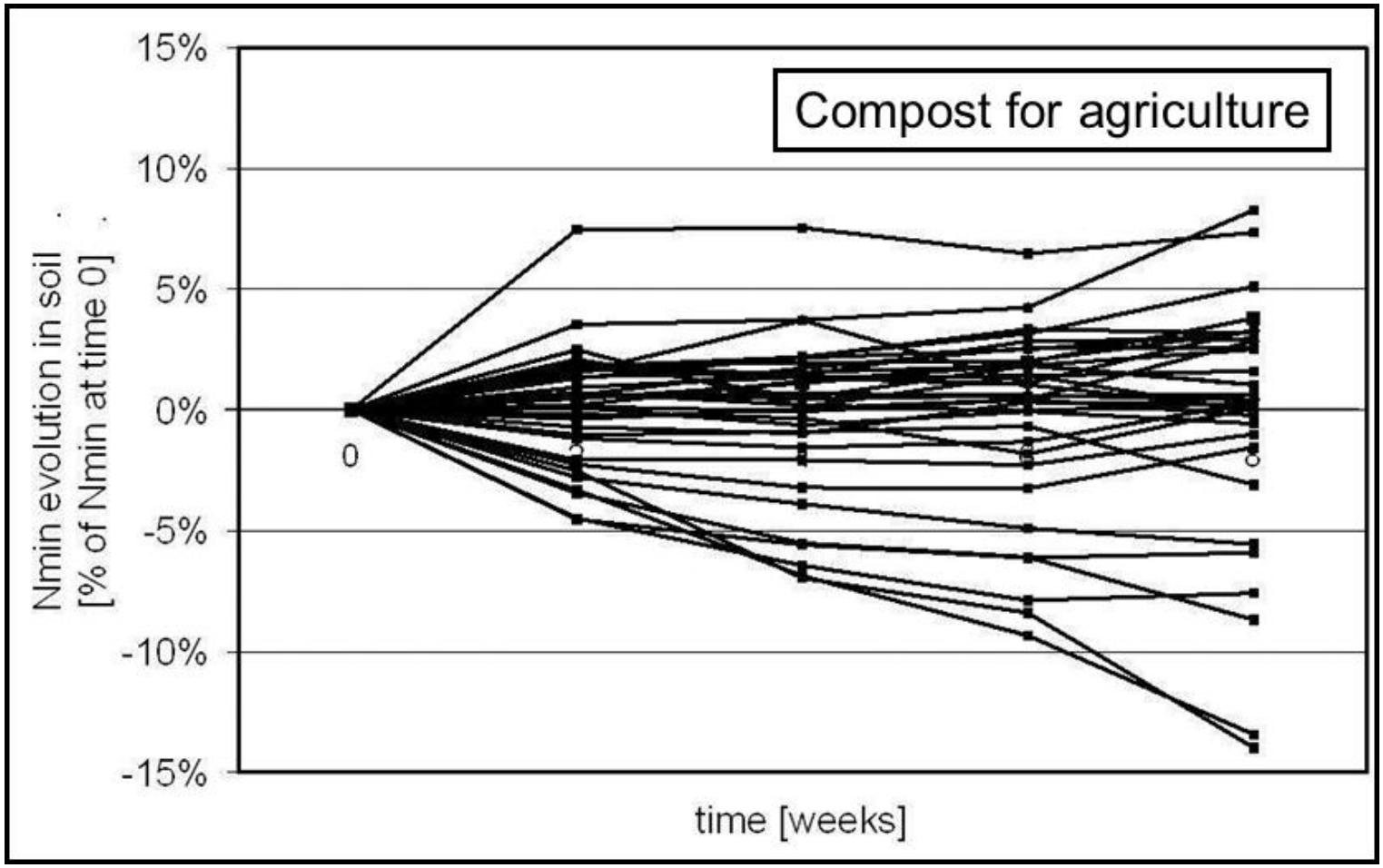
Nutriment [kg/m^3]		Liquid digestate	Solid digestate	Compost
Total nitrogen	N_{tot}	4 (2-8)	3.5 (2.3-4.1)	4 (2.6-6.5)
Soluble nitrogen	N_{min}	2 (0.75-5)	0.7 (0.2-0.7)	0.1 (0-0.4)
Phosphorus	P_2O_5	1.5 (0.95-3)	0.35 (0.2-0.4)	1.7 (1.1-2.9)
Potassium	K_2O	4.1 (2-8.3)	2.8 (1.9-3.5)	3.6 (2-6.2)
Magnesium	Mg	0.9 (0.6-1.6)	1.5 (1-1.9)	2.1 (1.4-3.9)
Calcium	Ca	5.4 (2.7-7.8)	25.5 (10-37)	22.8 (11-25)
Sulfure	S	0.3 (0.1-0.5)	0.4 (0.2-0.5)	0.5 (0.3-0.7)
Organic matter	MO	50 (44-56)	133 (106-210)	133 (86-224)
Source: Swiss Directive 2010 on the quality of copost and digestate				

Characteristics of composts and digestates

- Fertilizer value from composts and digestates
  - The fertilizer value of compost and digestate vary depending of the input materials used.
  - The nitrogen availability from digestates is higher than that from composts.
  - The post-treatments of digestates (separation, drying, post-composting, …) influence its fertilizer value (especially nitrogen).
  - The fertilizer value from digestates is similar to slurry or manure. However, the ammonium content and the pH-value from digestates are higher.
  - Dry matter content plays an essential role in the content of fertilizers per volume, especially for liquid digestate!

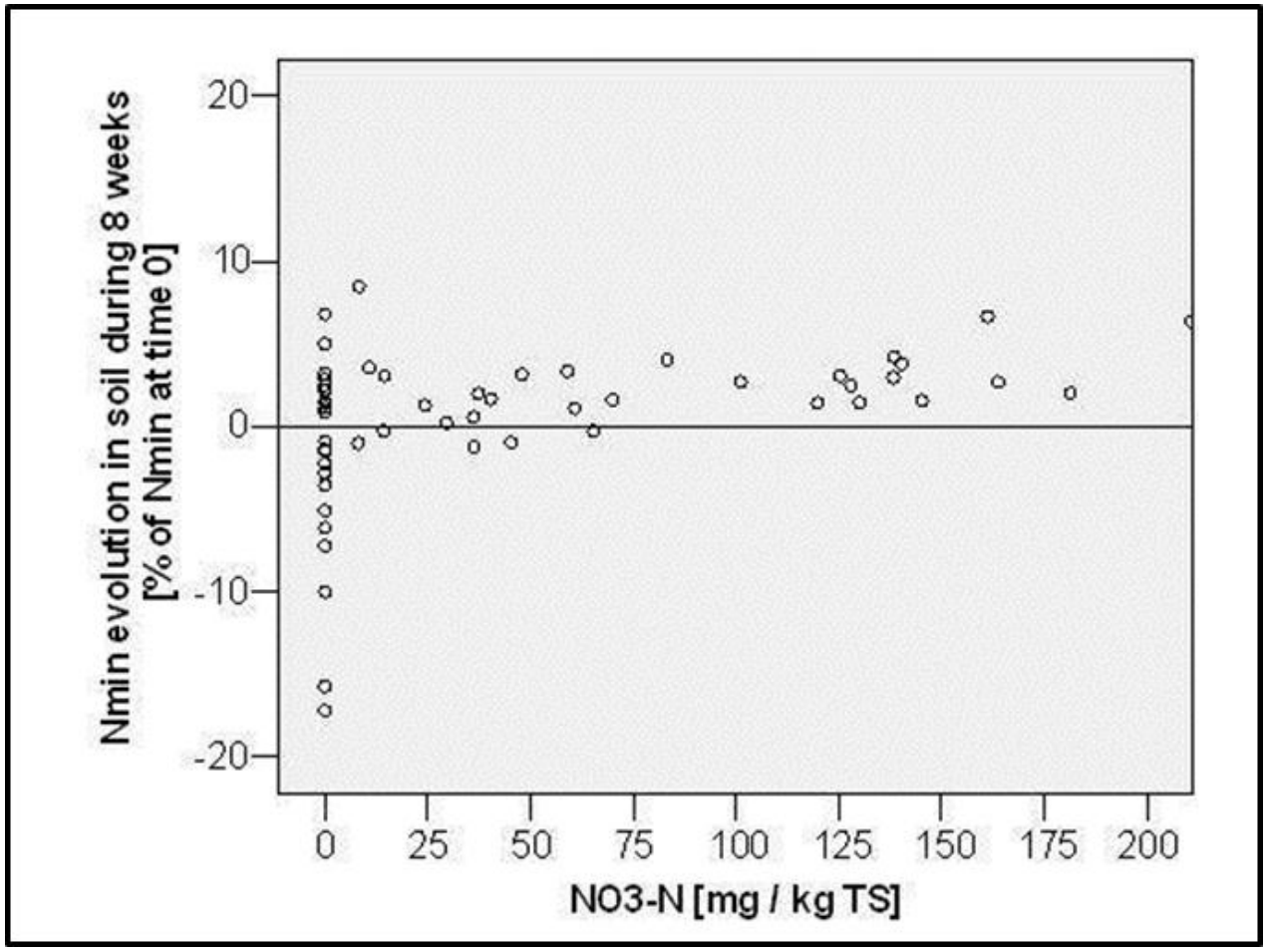
Characteristics of composts and digestates

› Compost: evaluation of nitrogen immobilization risks



Characteristics of composts and digestates

› Compost: evaluation of nitrogen immobilization risks



Characteristics of composts and digestates

› Main characteristics of digestates

- Product still not stabilized, biological process ongoing
- Very rich in ammonium (before post-treatment)
- Relatively high salinity
- Relatively phytotoxic
- Qualitatively comparable with animal manure

› Use of digestates

- Only spread in period during which the plant can assimilate the nitrogen
- Good short term fertilizer (before post-treatment)
- Also source of substrate for the soil microorganisms
- Moderate effect on the long term improvement of humus quantity in the soil and on its structure

Characteristics of composts and digestates

- Main characteristics of composts
  - Product relatively well stabilized, process +/- completed
  - Relatively poor in mineralized nitrogen
  - Well compatible for plants (depending on the maturity stage)
  - Organic matter relatively stable

- Use of composts
  - Can be spread +/- during the all year
  - Moderate short-term fertilization
  - Good middle- / long-term effect on humus content of soil and on its structure
  - Especially in spring: pay attention to nitrogen immobilization (choice of the product quality)

Parameters of the composting process

Parameters of the composting process

- Temperature
  - At least 3 weeks with a temperature above 55 °C or at least 1 week with a temperature above 65° C, with several pile turning during this period
- Moisture
  - Enough moisture to allow the microorganisms to work, but not too much so that the circulation of oxygen is not inhibited
- Oxygen level
  - At process start: minimum 3-4 %
  - Provide a good structure in the pile to ensure a homogeneous repartition of the oxygen (avoid lumps formation)

Evaluation of the quality with own senses

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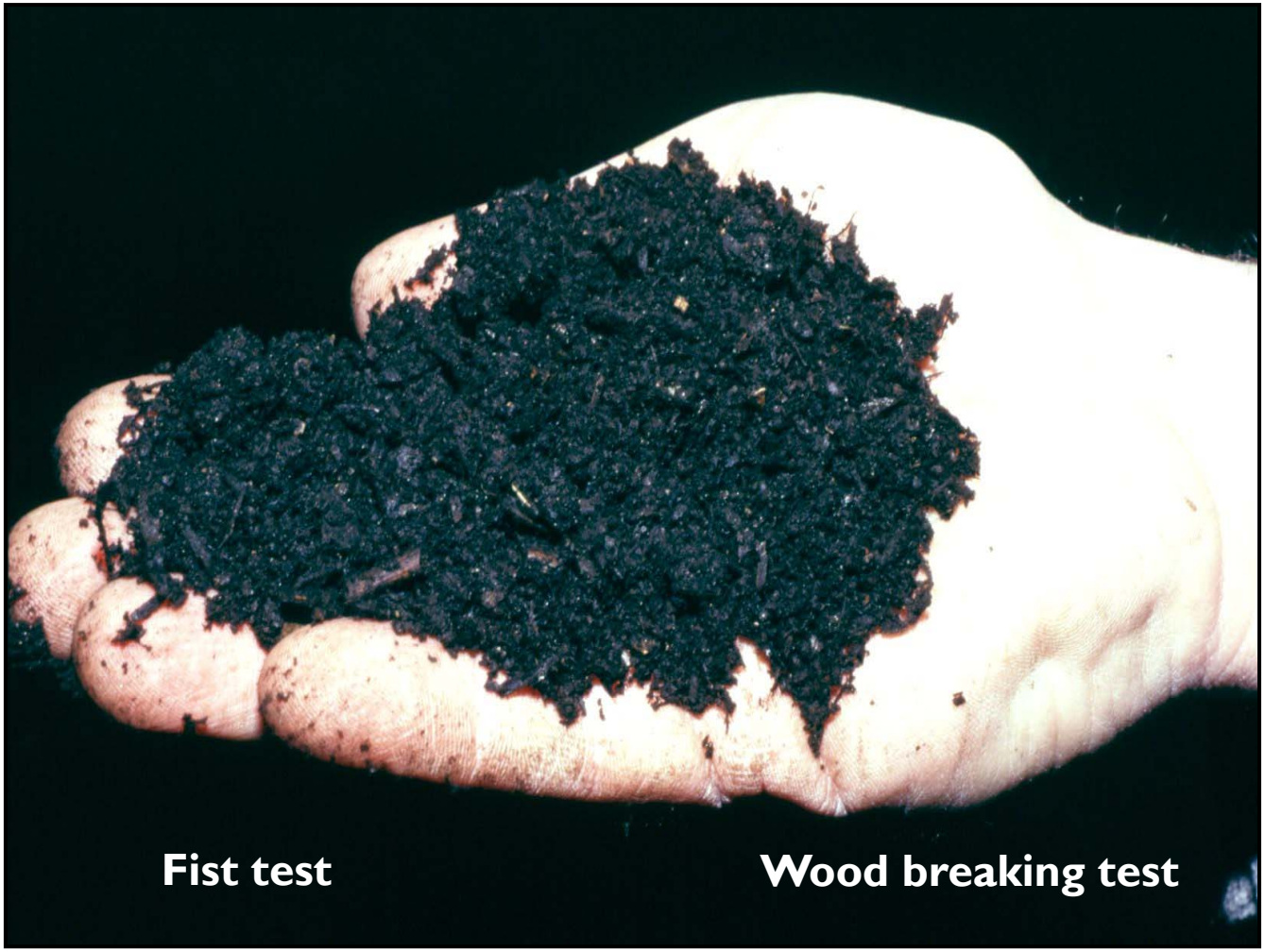

Evaluation of the quality with own senses

› Wood breaking test

Young compost,
in the heat phase.

Wood still hard, white to light-colored, and no degradation signs are observed

Compost at the beginning of the maturation phase.

Wood is slightly tender, darkening at the margins and a little bit greasy

Mature compost.

Wood is tender, the surface of the fracture is dark and the margins black, and water can be easily extruded by pressing the piece of wood

Evaluation of the quality with own senses

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Degree of degradation, structure, compost granularity

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Evaluation of the quality with simple analyses

Evaluation of the quality with simple analyses

- Required conditions for the realization of simple analyses
  - Minimal laboratory
    - Hand auger for compost sampling
    - Oven for the determination of dry matter
    - Stirrer for the realization of extraction
    - pH-meter
    - Electro-conductometer to determine the salinity of the products
    - Scale (sensitivity 0.1 g)
    - Analyzer to determine quantity of mineralized nitrogen (e.g. reflectometer RQ-flex)
    - Various plastic bottles, funnels, pipettes, graduated cylinders, …)

Evaluation of the quality with simple analyses

- Required conditions for the realization of simple analyses
  - Correct sampling

Evaluation of the quality with simple analyses

- Required conditions for the realization of simple analyses
  - Correct sampling
    - At least one elementary sample per 15m3 digestate or compost
    - Mix well the elementary samples to obtain a representative sample of the digestate or compost. Collect the required quantity of digestate or compost: about 1 to 2 liters for chemical analyses, 10 to 12 liters for the biotests

Evaluation of the quality with simple analyses

- Analyses to realize
  - Water extract (1:10 w:w)
    - Salinity
    - Humic number (color of extract)
  - $CaCl_2$ 0.01 M extract (1:10 w:w)
    - pH
    - NH_4-N, NO_2-N, NO_3-N

Evaluation of the quality with simple analyses

› Interpretation of analyses from NH_4-N, NO_2-N, NO_3-N

Presence of the N_{min} form[1]			Interpretation
NH_4-N	NO_2-N	NO_3-N	
-	-	-	No available N. Mixture too rich in carbon, or all NH_4-N was lost because of lack of moisture. If the compost is carbon rich: risk of nitrogen immobilization in the field. Recommendation: mix some N-rich material to the mixture (digestate, lawn, chicken litter, etc.).
++ / +++	-	-	Young compost (or digestate). Nitrification has still not started. Recommendation: keep the mixture moist enough to avoid NH_4-N losses and allow nitrification.
++/+++	++	+ / ++	Nitrification process starting. Recommendations: keep the mixture sufficiently moist to avoid NH_4-N losses; make sure that the oxygen supply to the mixture is constantly sufficient
+	+/++	++/+++	Nitrification process is progressing. Recommendation: make sure that the oxygen supply to the mixture is constantly sufficient
-	-	++/+++	Nitrification process achieved. Recommendation: make sure that the oxygen supply in the mixture is constantly sufficient Compost is mature and ready to be used.
-	++/+++-	++	Oxygen starvation problem. Recommendation: improved aeration of the compost.

1 -: none (< 10 mg N / kg DM); +: low quantity (10-50 mg N / kg DM); ++: medium quantity (50-200 mg N / kg DM); +++: high quantity (> 200 mg N / kg DM)

Source: Handbook for Composting and Compost Use in Organic Horticulture, van der Wurff et al., 2016

Evaluation of the quality with biotests

Evaluation of the quality with biotests

› Plants react to the totality of the compost/digestate quality

› Results from biotests are visible to the naked eye and allow simple evaluation

› By conducting biotests, the compost/digestate producer develops a different relationship to the product

› Biotests are a good tool for public relation activities (demonstration in relation with the product users)

Conclusions

Conclusions

- Quality of composts (and digestates) can greatly very. The two most important points influencing the composts (and digestates) quality are:
  - Input material (start mixture composition)
  - Process management (from collect of organic waste until use of product)
- The evaluation of compost (and digestate) quality can be performed with simple techniques:
  - Control of process parameter
  - Evaluation with own senses
  - Evaluation with simple analyses
- The evaluation of composts (and digestates) quality is the base of successful use of theses products

Information on compost and digestate quality and their correct use
(available only in German / French)

can be downloaded from
www.biophyt.ch

Publication on biology, production quality and use of composts (and digestates)

To be downloaded for free on
www.biophyt.ch

Questions ? Discussion ?

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