Evaluation of the quality of the products

Jacques G. Fuchs (jacques.fuchs@fibl.org)
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**

<table>
<thead>
<tr>
<th>Nutriment [kg/m³]</th>
<th>Liquid digestate</th>
<th>Solid digestate</th>
<th>Compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nitrogen</td>
<td>$N_{\text{tot}}$</td>
<td>4 (2-8)</td>
<td>3.5 (2.3-4.1)</td>
</tr>
<tr>
<td>Soluble nitrogen</td>
<td>$N_{\text{min}}$</td>
<td>2 (0.75-5)</td>
<td>0.7 (0.2-0.7)</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>$P_2O_5$</td>
<td>1.5 (0.95-3)</td>
<td>0.35 (0.2-0.4)</td>
</tr>
<tr>
<td>Potassium</td>
<td>$K_2O$</td>
<td>4.1 (2-8.3)</td>
<td>2.8 (1.9-3.5)</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg</td>
<td>0.9 (0.6-1.6)</td>
<td>1.5 (1-1.9)</td>
</tr>
<tr>
<td>Calcium</td>
<td>Ca</td>
<td>5.4 (2.7-7.8)</td>
<td>25.5 (10-37)</td>
</tr>
<tr>
<td>Sulfure</td>
<td>$S$</td>
<td>0.3 (0.1-0.5)</td>
<td>0.4 (0.2-0.5)</td>
</tr>
<tr>
<td>Organic matter</td>
<td>MO</td>
<td>50 (44-56)</td>
<td>133 (106-210)</td>
</tr>
</tbody>
</table>

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
Evaluation of the quality with own senses

Fist test  Wood breaking test
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

Odors
Evaluation of the quality with own senses

Degree of degradation, structure, compost granularity
Evaluation of the quality with own senses

Degree of degradation, structure, compost granularity

Fibrous compost

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Evaluation of the quality with own senses

Degree of degradation, structure, compost granularity

Grainy compost
Evaluation of the quality with own senses

Color of water extract
Evaluation of the quality with own senses

Contaminants in compost
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)

› CaCl₂ 0.01 M extract (1:10 w:w)
  › pH
  › NH₄-N, NO₂-N, NO₃-N
Evaluation of the quality with simple analyses

Interpretation of analyses from NH₄-N, NO₂-N, NO₃-N

<table>
<thead>
<tr>
<th>Presence of the N form¹</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₄-N</td>
<td>NO₂-N</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>++ / +++</td>
<td>-</td>
</tr>
<tr>
<td>++/+++</td>
<td>++</td>
</tr>
<tr>
<td>+</td>
<td>+/++</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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 vary. 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 these 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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