Agricultural Humus Management Using High Quality Composts

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Abstract
Compost being a „multifunctional product“ has many uses. It is mainly used to improve the soil and as plant nutrition. A balanced humus soil is however the basic requirement for soil fertility and sustainable agriculture. The humus balance of a crop rotation can be calculated according to a concept compiled by the German Agricultural Investigation and Research Association (VDLUFA). The span between the extreme values for humus requirement i.e. humus balance result from the specific local factors that influence the humus needs. The different organic manures are also different in their effectiveness to reproduce humus. This depends firstly on the stability of the organic fractions of the material as well as the application rate which could be given by good practical use. Compost is very suitable for the humus reproduction in soil because it contains a high percentage of stable humus. For soils having insufficient organic substances, humus will have to be added over a longer period of time to regenerate the humus content.

Introduction
Currently about 800 composting plants in Germany treat approx. 8 million tons of biowaste to produce about 4 million tons of compost. A special field for the application of compost is agriculture. Just 3 to 4 % of the arable land in Germany could be served with the actually produced amount of compost. On account of this fact agriculture seems to be a potential customer for the recycling of compost and other secondary raw material fertilisers.

Compost is mainly used to improve the soil (soil fertilizer), as plant nutrition (plant fertilizer) as well as a blending compound in the production of potting soils (top soils, growing media).

Due to intense competition and specializing in the field of agriculture, large areas of agricultural crop lands are increasingly becoming poor in humus. A balanced humus soil is however the basic requirement for soil fertility and sustainable agriculture.

Suitable measures for producing humus are:
- Crop rotation management
- Crop residues management
- Organic fertilization with manure and soil improvers from separate collected biowaste

Causes for the present humus needs are:
- Intensive crop cultivation (monocultures with humus-depleting plants like maize and sugar beet)
- Export of crop residues (straw for material utilization and burning)
- Increased cultivation of renewable „energy plants“(such as corn)

Method
The requirements for good agricultural environmentally sound management are laid down in the German Ordinance on Direct Payments (Direktzahlungen-Verpflichtungenverordnung, DirektZahlVerpflV, 2004). The humus degraded from husbanded areas will have to be put back into the soil. Agricultural farms will therefore have to compile a humus balance record. If the humus balance is negative after a crop rotation, organic substances will have to be added to the soil. The humus balance is calculated on a concept (table 1) developed by the German Agricultural Investigation and Research Association (VDLUFA 2004).

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Table 1: Principle of humus balance

<table>
<thead>
<tr>
<th>Humus demand</th>
<th>Humus reproduction</th>
<th>Humus balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop specific changes in humus reserves</td>
<td>+ humus-reproduction of organic materials</td>
<td>Amount of organic materials</td>
</tr>
<tr>
<td>[kg ha⁻¹ a⁻¹ humus-C]</td>
<td>[(kg humus-C) (t substrat)]⁻¹</td>
<td>[t ha⁻¹ a⁻¹]</td>
</tr>
<tr>
<td>Humus balance</td>
<td>[kg ha⁻¹ a⁻¹ humus-C]</td>
<td></td>
</tr>
</tbody>
</table>

Important for the calculation of the humus balance is the humus demand of the specific crops (fig. 1).

Figure 1: Humus reproduction of arable crops

Source: VDLUFA 2004

In addition the different organic materials are also different in their effectiveness to reproduce humus (table 2). This depends firstly on the stability of the organic fractions of the material as well as the application rate which could be given by good practical use.

Table 2: Humus production efficiency of different fertiliser

<table>
<thead>
<tr>
<th>Organic matter¹</th>
<th>Organic carbon²</th>
<th>humus-C³</th>
<th>Humus-C reproduction⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost</td>
<td>35 %</td>
<td>20 %</td>
<td>51 %</td>
</tr>
<tr>
<td>Manure</td>
<td>75 %</td>
<td>43 %</td>
<td>21 %</td>
</tr>
<tr>
<td>Straw</td>
<td>85 %</td>
<td>49 %</td>
<td>21 %</td>
</tr>
<tr>
<td>Sugar beet leaves, Green manure</td>
<td>90 %</td>
<td>52 %</td>
<td>14 %</td>
</tr>
</tbody>
</table>

¹) determined by loss of ignition; ²) C organic (LOI/1,72); ³) Percentage of humus reproducible carbon of TOC (reproduction index); ⁴) Humus reproduction by suitable application rates: compost 21 t dm/ha*³a, liquid manure (pig) 2 t dm *²a), straw 7 t dm/ha*³a and green manure 8 t dm/ha*³a; Source BGK/FAL 2005

Results

Compost is very suitable for this since it contains a high percentage of stable humus. For soils having insufficient organic substances, humus will have to be added over a longer period of time to regenerate the humus content in it. As an example 46 % of the farmland in Saxony shows a negative or strongly negative humusbalance. Since changing the cultivation structure or animal stocks is hardly possible, other humus sources such as composts will have to be used more and more.

References

