Composting and Quality Assurance in Germany

Part 2: Quality Assurance for Compost and Digestate

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Bundesgütegemeinschaft Kompost e.V.
Development of the QAS

The RAL quality assurance for compost was established in Germany in 1991.

The RAL quality assurance for digestate residuals was established in 2000. Revision in 2007.

The RAL quality assurance for sewage sludge compost was established in 2003.
RAL Quality Compost and Digestate Products in Germany

Compost products (RAL-GZ 251):
- fresh compost
- mature compost
- compost for potting soil

Digestate products from biowaste (RAL-GZ 245):
- solid and liquid digestates

Digestate products from renewable energy crops (RAL-GZ 246):
- solid and liquid digestates

Composted sludge products (RAL-GZ 258):
- sludge-based mature compost
- sludge-based fresh compost
State of Quality Assurance in Germany

RAL-GZ 251
427 plants

RAL-GZ 245
59 plants

RAL-GZ 246
3 plants

RAL-GZ 258
13 plants
Benefits of BGK

- Quality assurance system (QAS)
- Product standards
- Legal safety
- Information service
- Local consideration
## Benefits of participation in BGK QAS

<table>
<thead>
<tr>
<th>QAS</th>
<th>Produkt Standards</th>
<th>Legal safety</th>
<th>Information Service</th>
<th>Regional Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conferring of quality labels</td>
<td>Regulations for quality and examination</td>
<td>Monitoring of legislation regulations</td>
<td>Journal „Humus &amp; KomPost“</td>
<td>Local considerations</td>
</tr>
<tr>
<td>Organisation of QAS</td>
<td>Product declaration (i.e. for fertilizer regulations)</td>
<td>Assistance with the realisations</td>
<td>Application recommendations and advertising material for members</td>
<td>Authority contacts</td>
</tr>
<tr>
<td>Documentation and certificates</td>
<td>Influence on product standards</td>
<td>Representation of the concerns of practice</td>
<td>Consideration in individual cases</td>
<td>Exchange of experience</td>
</tr>
<tr>
<td>ZAS (central evaluation station)</td>
<td>Coordination of market demands</td>
<td>Questions of product liability</td>
<td>Contact for institutes, administration etc.</td>
<td>Special events</td>
</tr>
<tr>
<td>HBPS (hygiene modular construction system)</td>
<td>Continuing progression</td>
<td>Qualification of raw materials</td>
<td>Expert questions</td>
<td>Representation of special local concerns</td>
</tr>
<tr>
<td>Lab recognition, methods book</td>
<td>Statistical examinations</td>
<td>Certificates for authorities</td>
<td>Internet presence</td>
<td></td>
</tr>
</tbody>
</table>

**Bundesgütegemeinschaft Kompost e.V.**
Targets of quality assurance

- Specification of products with a guaranteed homogenous quality
- Enhancement of product quality and operation quality
- Guarantee for a successful use of the products
- Deregulation and recognition of certified products by legal authorities, in agricultural systems and by food processing industry
- Promotion of the re-use of waste "from waste to product"
Advantages of Quality Assurance

Without Quality Assurance

- §§ BioAbfV
- Hygienic harmlessness § 3
- Amount of heavy metals § 4
- Application requirements §§ 6, 7, 8
- Soil investigations § 9
- Official control §§ 3, 4
- Documented evidence of utilization § 11

With Quality Assurance

- §§ BioAbfV
- Hygienic harmlessness § 3
- Amount of heavy metals § 4
- Application requirements §§ 6, 7, 8

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Application Areas of BGK QAS

- Implementation of the RAL- quality assurance systems
- Information for operators and production plants
- On-site inspection and consultation by an independent quality manager
- Recognition of test laboratories (implementation of ring tests)
- Recognition of sample taker (courses for sample taking)
- Elaboration of application requirements for good practical use
Contents of Quality Assurance System

- Process requirements and suitable input materials
- Independent analysis and declaration of the product quality
- Documentation and application requirements
Course of Quality Assurance System

2-Step Quality Assurance System

Recognition Procedure
single

Supervision Procedure
continuous
# Contents of Quality Assurance System

<table>
<thead>
<tr>
<th>Suitable Input Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>• in accordance with the biowaste ordinance and fertiliser regulation.</td>
</tr>
<tr>
<td>• operation control by plant visits of independent quality managers.</td>
</tr>
<tr>
<td>• control by independent sample takers and by declaration in analysis report.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent analysis and declaration of the product quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 4 - 12 times a year according to the quality guidelines, depends on the amount of input material.</td>
</tr>
<tr>
<td>• control and sanctions by an independent quality committee.</td>
</tr>
<tr>
<td>• certification with product declaration according to the fertiliser regulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>• application requirements based on the biowaste ordinance and fertiliser regulation.</td>
</tr>
<tr>
<td>• application requirements due to good practical use.</td>
</tr>
</tbody>
</table>
Recognition of Laboratories

Qualification possibilities for laboratories

1. Inter-laboratory trial organised by BGK
2. Participation at another inter-laboratory trial which is accepted by BGK
3. Single qualification
Sample Taking and Analysis

- According to the methods book of the BGK
- Accomplishment only by the ordered and recognised lab
- Independancy and education of the sample taker
- Samples have to supply a representative sample
- Samples must only be taken from goods ready for sale
Documentation and Record System

- Analysis records
  Analysis results of one batch

- Quality certificate
  Results and evaluation of analysis of the last year

- Documentation overview
  Summary report of all analysis results for the operator and the quality assurance committee for control and sanctions
Analysis report

Page 1

- Name of composting or digestion plant
- Name of laboratory
- Name of sample taker
- Type of Product
- Grain size
- Proof of temperature protocoll
- Date of sampling
Analysis report

Page 2

Analysis results:
- Physical parameter
- Biological parameter
- Chemical parameter
- Plant nutrients
- Soil improving parameters
- Heavy metals
Declaration and conformity sheet:

- Conformity proof of legislation
- Declaration according to the Fertiliser Ordinance
- Input materials
- Fit for purpose
- Application requirements
- Nutrient amount
- Fertilising calculation
- Hygienic proof
## Documentation of Analysis Results

### Production Plant 9599

<table>
<thead>
<tr>
<th>Product</th>
<th>Fertig-K</th>
<th>Fisch-K</th>
<th>Molk-K</th>
<th>Substrat</th>
</tr>
</thead>
<tbody>
<tr>
<td>22%</td>
<td>17%</td>
<td>33%</td>
<td>17%</td>
<td>99%</td>
</tr>
</tbody>
</table>

### Analysis Method

<table>
<thead>
<tr>
<th>Method</th>
<th>Probe 1</th>
<th>Probe 2</th>
<th>Probe 3</th>
<th>Probe 4</th>
</tr>
</thead>
</table>

### Parameters

- **Temperatur** (% TH)
- **Gefüge** (% TH)
- **Farbe** (% TH)
- **Form** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)
- **Gefüge** (% TH)

### Additional Parameters

- **pH-Wert**
- **Wassergehalt**
- **Schwermetalle**

### Notes

- **Hygiene:** 1 = Temperature protocol at probe measurement is not covered, 2 = Temperature protocol at probe measurement is covered, 3 = Not available

### Stand

28.02.2003
Documentation of Analysis Results

- Data and facts of the compost plant
- Products and their proportion
- Demonstration of the median values
- Recording of missing examinations
- Recording of labs defaults (delayed reports)
- Designation of exceeded values
- Designation of implausible values
  > Quarterly overview of the analysis results
  > Document for producers for internal survey
  > Document for quality committee for external survey
Annual Report

• Documentation of the concrete quality attributes
• Product declaration for fertiliser regulations
• Accordance with current legislations and regulations
• Median values of valuable ingredients and the spectrum of the expected variance (tolerance)
• Calculation base for fertilization account and counselling
• Application recommendations for horticulture, agriculture and landscaping
Annual report

- Quality assurance system
- Legal conformity
- Product declaration
- Further specifications
Application Recommendations

Application recommendations are based on the analysis results of the last year and are included in the annual quality certificate.

Contents of the Annual Quality Certificate

- Product type
- Agreement with legislation and specific regulation (water retention areas)
- Declaration according to fertiliser regulation
- Quality criteria and analysis results with variation range
- Calculation of application rate and application recommendations according to good practical use
Verleihungsurkunde

Die Bundesgütergemeinschaft Kompost e.V.
verleiht hiermit
auf Grund des oben Gesagten dem folgenden Prüfbericht
der Firma
Kompost GmbH
Kompogebäude
Mietenhäusen (BGK-Nr. 9999)

Hof Nr. 354/95 Mietenhäusen

das vom Deutschen Institut für Erkennung und Kontrolle e.V. (DIAK)
angebotene und durch Vertrag mit der Bundesgütergemeinschaft
erteilte Gütezeichen für den Fertigkompost

RAL-Gütezeichen Kompost

Sindes Produkt
Fertigkompost

Die Erteilung des Gütezeichens setzt voraus, dass die Einhaltung
aller Vorschriften und Prüfbestimmungen überwacht wird.

Elze, den 17. Mai 2006
Bundesgütergemeinschaft Kompost e.V.

Der Vorstands
der Bundesgütergemeinschaft

Der Obmann
des Bundesgütergemeinschaft
Process Requirements for Composting Plants

are characterised by
- suitable input materials,
- operation conditions for sanitization (55 °C for two weeks or 65°C (60°C in closed plants) for one week,
- hygiene model type system (HBPS),
- good plant management (reduction of odour emissions, effective separation of impurities).

is proved by
- regular plant inspections.
# Product Analysis of Compost Products for Recognition and Monitoring

<table>
<thead>
<tr>
<th>Input Amount (t/a)</th>
<th>Recognition procedures</th>
<th>Monitoring procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2.000</td>
<td>4</td>
<td>&lt; 8000 t input material per year 4 analysis</td>
</tr>
<tr>
<td>(\geq 2.001)</td>
<td>6</td>
<td>(\geq 8.000) t input material one analysis for every 2.000 t input material per year but as maximum 12 analysis per year</td>
</tr>
<tr>
<td>(\geq 6.001)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>(\geq 12.001)</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Differentiation of the RAL quality for Digestate Products

**Input materials**
- Biowaste
  - organic municipal waste, residues from the food and animal feed industry
- Renewable Energy Crops
- Manure

**Relevant Legislation**
- Biowaste Ordinance (BioAbfV)
- EG-VO 1774/2002 (TierNebV)

**Fertiliser legislation**

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## Process Requirements and Input Materials for Digestation

<table>
<thead>
<tr>
<th>Input materials</th>
<th>Process requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biowaste from separate collected organic municipal waste, residues from the food and animal feed industry</td>
<td>Sanitization at 70 °C for at least 1 h or thermophilic fermentation at &gt; 55° for 24 h and a dwell time of 20 days</td>
</tr>
<tr>
<td>Renewable energy crops, Manure, slurry, dung, straw</td>
<td>Treatment at &gt; 37 °C for a dwell time of 20 days</td>
</tr>
</tbody>
</table>

- Salmonella not traceable
- Operation control by plant visits of independent quality managers
- Control by independent sample takers and by declaration in analysis report
# Product Analysis of Digestate Residues for Recognition and Monitoring

<table>
<thead>
<tr>
<th>Quality label/Quality assurance</th>
<th>Recognition procedures</th>
<th>Monitoring procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestate product from biowaste (RAL-GZ 245)</td>
<td>one analysis for every 1.500 t input material per year</td>
<td>one analysis for every 2.000 t input material per year</td>
</tr>
<tr>
<td></td>
<td>min. 4, max. 12 per year</td>
<td>min. 4, max. 12 per year</td>
</tr>
<tr>
<td>Digestate product from renewable energy crops (RAL-GZ 246)</td>
<td>one analysis for every 1.500 t input material per year</td>
<td>one analysis for every 8.000 t input material per year</td>
</tr>
<tr>
<td></td>
<td>min. 4, max. 8 per year</td>
<td>min. 2, max. 4 per year</td>
</tr>
</tbody>
</table>
Product quality

Valuable criteria
- Decomposition degree (compost)
- Degree of fermentation (digestate)
- Bulk density
- pH-value, salt content
- Plant nutrients
- Carbonats
- Organic matter content
- Plant response

Precautionary environmental criteria
- Hygienic aspects (salmonellae)
- Viable weeds and plant parts
- Impurities
- Potential toxic substances (heavy metals)
- Degree of pollution (visible content of impurities)
# Product Quality – valuable criteria

<table>
<thead>
<tr>
<th>Quality criteria</th>
<th>Parameter</th>
<th>Compost fresh / mature</th>
<th>Digestate solid / liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organic matter</strong></td>
<td>Loss on ignition [M. %]</td>
<td>≥ 30 / ≥ 15</td>
<td>≥ 30 / ≥ 40</td>
</tr>
<tr>
<td><strong>Dry matter</strong></td>
<td>Dry matter [M.-%]</td>
<td>≥ 55</td>
<td>&gt; 15 / ≤ 15</td>
</tr>
<tr>
<td><strong>Nutrients</strong></td>
<td>N\textsubscript{4}O\textsubscript{5}, K\textsubscript{2}O, MgO, S [% / dm]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td><strong>Alkaline effective matter</strong></td>
<td>CaO [% / dm]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td><strong>Nitrogen soluble</strong></td>
<td>NH\textsubscript{4}-N+NO\textsubscript{3}-N [mg/l FM]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td><strong>Salt content</strong></td>
<td>Salt content [g/l FM]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td><strong>pH-value</strong></td>
<td>pH-value</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td><strong>Rotting degree / Fermentation degree</strong></td>
<td>°C / Organic acids [mg/l]</td>
<td>60 – 40,1 / ≤ 40</td>
<td>- / &lt; 4000</td>
</tr>
</tbody>
</table>
# Precautionary Environmental Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities &gt; 2 mm [% dm]</td>
<td>≤ 0.5</td>
<td></td>
</tr>
<tr>
<td>Degree of pollution [cm² / l FM]</td>
<td>≤ 25</td>
<td>Only determinable, if impurity content exceed 0.1 M.-%</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>100</td>
<td>If the content of Cu and Zn is referred to manure etc., plausible higher values in digestate are allowed.</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Viable seeds and sprouting plant parts</td>
<td>2 seeds / l</td>
<td></td>
</tr>
</tbody>
</table>
Compost from Biodegradable Waste

Currently about 50% of German households are involved in the separate collection of biowaste (bio-bins/bio-containers).

Approximately 8 million tons of biowaste are treated in 800 composting plants to produce 5 million tons of compost.

70% of the produced compost is labelled with the quality label RAL-GZ 251.
Composting and Digestion Plants

Production plants in the Quality Assurance System

Composting plants 427

Digestion plants 62
## Compost and Digestate Products in 2007

**Input amounts in 2007**

<table>
<thead>
<tr>
<th>RAL-GZ 251</th>
<th>Compost</th>
<th><strong>5.933.510</strong> t/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAL-GZ 245</td>
<td>Digestate product from biowaste</td>
<td><strong>1.716.000</strong></td>
</tr>
<tr>
<td>RAL-GZ 246</td>
<td>Digestate product from renewable energy plant</td>
<td><strong>144.000</strong></td>
</tr>
</tbody>
</table>
## Compost Quality – valuable criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average of 2006</th>
<th>Average of 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{OM}_{\text{LOI}} , [%]$</td>
<td>38.9</td>
<td>39.1</td>
</tr>
<tr>
<td>$N_t , [% / \text{dm}]$</td>
<td>1.39</td>
<td>1.40</td>
</tr>
<tr>
<td>$\text{P}_2\text{O}_5 , [% / \text{dm}]$</td>
<td>0.66</td>
<td>0.67</td>
</tr>
<tr>
<td>$\text{K}_2\text{O} , [% / \text{dm}]$</td>
<td>1.16</td>
<td>1.15</td>
</tr>
<tr>
<td>$\text{MgO}_t , [% / \text{dm}]$</td>
<td>0.71</td>
<td>0.70</td>
</tr>
<tr>
<td>$\text{CaO} , [% / \text{dm}]$</td>
<td>4.08</td>
<td>3.80</td>
</tr>
<tr>
<td>$\text{NH}_4-\text{N}+\text{NO}_3-\text{N} , \text{[mg/l FM]}$</td>
<td>255</td>
<td>242</td>
</tr>
<tr>
<td>Salt content $\text{[gl FM]}$</td>
<td>4.62</td>
<td>4.64</td>
</tr>
<tr>
<td>pH-value</td>
<td>7.60</td>
<td>7.60</td>
</tr>
</tbody>
</table>
## Compost - Environmental Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ø 2006</th>
<th>Ø 2007</th>
<th>90&lt;sup&gt;th&lt;/sup&gt; Percentile</th>
<th>Min - Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities &gt; 2mm [% dm]</td>
<td>0.09</td>
<td>0.08</td>
<td>0.38</td>
<td>0.00 – 2.98</td>
</tr>
<tr>
<td>Stone &gt; 5mm [% / dm]</td>
<td>1.36</td>
<td>1.32</td>
<td>3.32</td>
<td>0.00 – 17.95</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>37.0</td>
<td>36.0</td>
<td>65.5</td>
<td>4.0 -166.0</td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>0.42</td>
<td>0.42</td>
<td>0.72</td>
<td>0.00 – 2.00</td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>21.1</td>
<td>21.2</td>
<td>32.0</td>
<td>3.72 – 307.0</td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>45.8</td>
<td>43.3</td>
<td>77.0</td>
<td>2.20 – 1004.0</td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>13.1</td>
<td>13.1</td>
<td>23.0</td>
<td>1.76 – 87.9</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>169.0</td>
<td>168.0</td>
<td>249.0</td>
<td>22.0 – 835.0</td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>0.11</td>
<td>0.11</td>
<td>0.22</td>
<td>0.00 – 0.97</td>
</tr>
</tbody>
</table>
## Compost - environmental criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Green-waste</th>
<th>Bio-waste</th>
<th>Green/Bio-waste</th>
<th>Limit values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples</td>
<td>947</td>
<td>288</td>
<td>1.519</td>
<td></td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>32.6</td>
<td>41.4</td>
<td>38.0</td>
<td>Type 1 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 150</td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>0.40</td>
<td>0.45</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 1 1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 1.0</td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>19.5</td>
<td>23.0</td>
<td>21.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 1 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 100</td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>36.7</td>
<td>53.8</td>
<td>50.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 1 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 100</td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>12.3</td>
<td>13.3</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 1 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 50</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>148.0</td>
<td>193.0</td>
<td>177.0</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>Type 1 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 400</td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 1 0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2 1.0</td>
</tr>
</tbody>
</table>
Marketing Structure

- Substrate industry: 50.6%
- Market gardening: 13.5%
- Hobby gardening: 12.1%
- Landscaping: 10.8%
- Special cropping systems: 5.1%
- Municipalities: 3.4%
- Divers: 1.8%
- Agriculture: 2.8%
QAS as an important marketing tool

In several food processing industries only quality assured compost products are allowed:
- Sugar beet industry
- QAS of cropping systems
- Organic farming system
  (157 composting plants are listed in the official input material list of the organic farming organisation)

In environmental conventions of potential risk areas:
- Water protection areas
Information

Publications
Quality assurance guidelines for composts and digestate products
Methodbook for the analysis of organic fertiliser, soil improver and substrates
Humuswirtschaft & Kompost - printed version 2 times a year
Humuswirtschaft & Kompost Aktuell – online version monthly

Application brochures (4 pages) -
Hobby gardening, market gardening, landscaping etc.

Comprehensive brochures (20 – 30 pages) -
Organic fertilising in cropping systems,
Compost application in landscaping

Website www.kompost.de