Composting and Quality Assurance in Germany

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German Quality Assurance Organisation for Compost - Bundesgütegemeinschaft Kompost e.V. (BGK)

Bundesgütegemeinschaft
Kompost e.V.

Outline

Part 1

- Composting and Digestion Plants in Germany
- Legal Specifications

Part 2

- Quality Assurance and Production of Compost and Digestates in Germany

Part 3

- Sample Taking in Practice

Composting and Quality Assurance in Germany

Part 1: Composting and digestion plants in Germany

Dr. Stefanie Siebert

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Bundesgütegemeinschaft
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BGK and RAL

Bundesgütegemeinschaft Kompost e.V. (BGK) is a self-obligatory measurement of the industry and is recognised by the responsible legal authorities.

BGK was founded in 1989.

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

RAL-quality labels identify a standardised and regularly checked product.

Examples for RAL Quality Labels

RAL mark butter and cheese

RAL-RG 180
Wine label

RAL-GZ 164
Quality mark

RAL-GZ 252
Growing media

RAL-RG 183
Wine cropping region

RAL-RG 163/1
Holiday on farms

State of Quality Assurance in Germany

RAL - GZ 251

433 plants

RAL - GZ 245

99 plants

RAL - GZ 246

8 plants

RAL - GZ 258

14 plants

Compost from Biodegradable Waste

Biowaste is defined as any vegetable or animal waste destined for utilisation that can be degraded by micro-organisms, soil organisms or enzymes.

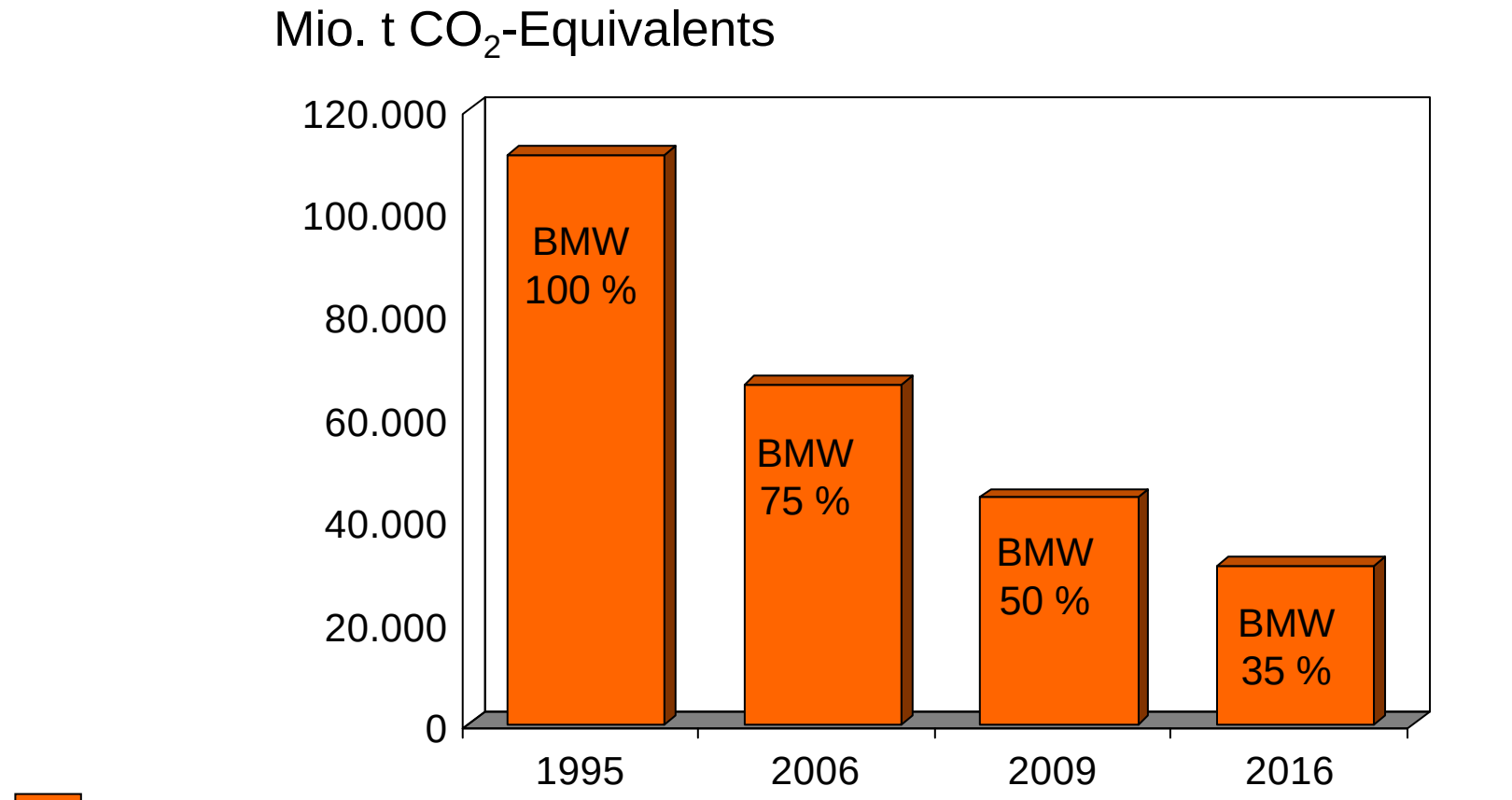
Treated biowaste shall mean

- **biowaste from an aerobic treatment process ⇒ compost**
- **biowaste from an anaerobic treatment process ⇒ digestate products**

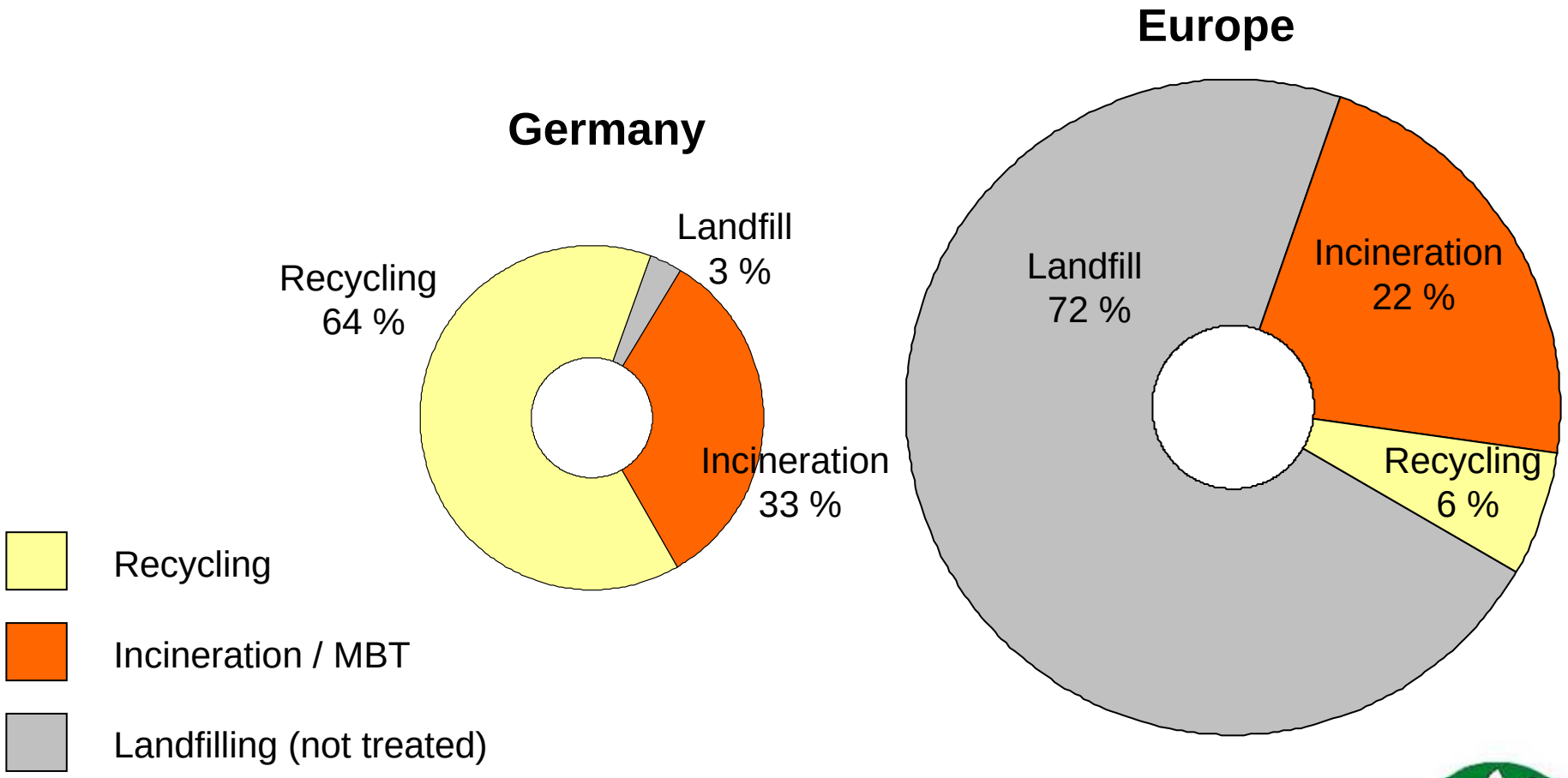
Management of Biodegradable Waste

- **Biowaste is a source for organic fertilising (humus and nutrients).**
- **Biowaste can be used as raw material for biogas production combined with the production of organic fertiliser (power, heat and compost).**
- **The use of biowaste gives a good opportunity for CO_2 reduction.**
- **A separate way for biowastes recycling offers the reduction of landfill consumption.**

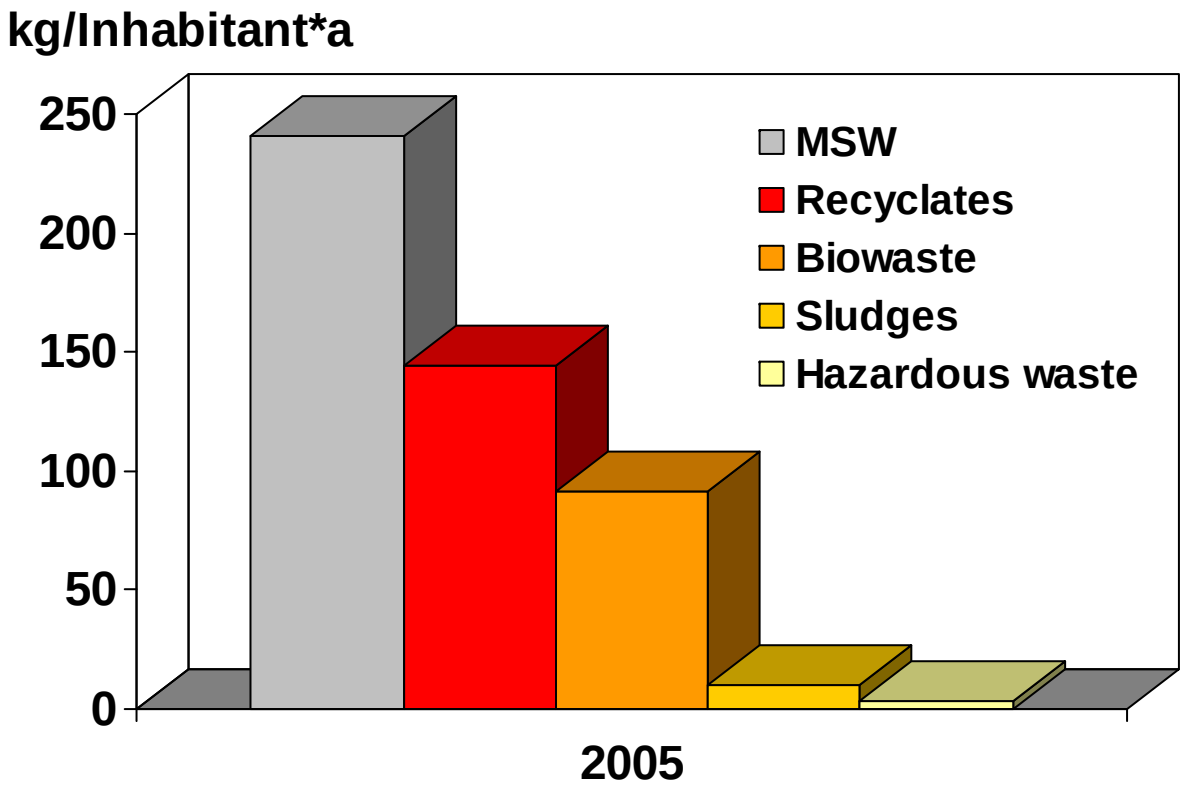
Emissions of CO_2-Equivalents from Landfills



Management of Biodegradable Waste in Germany and Europe

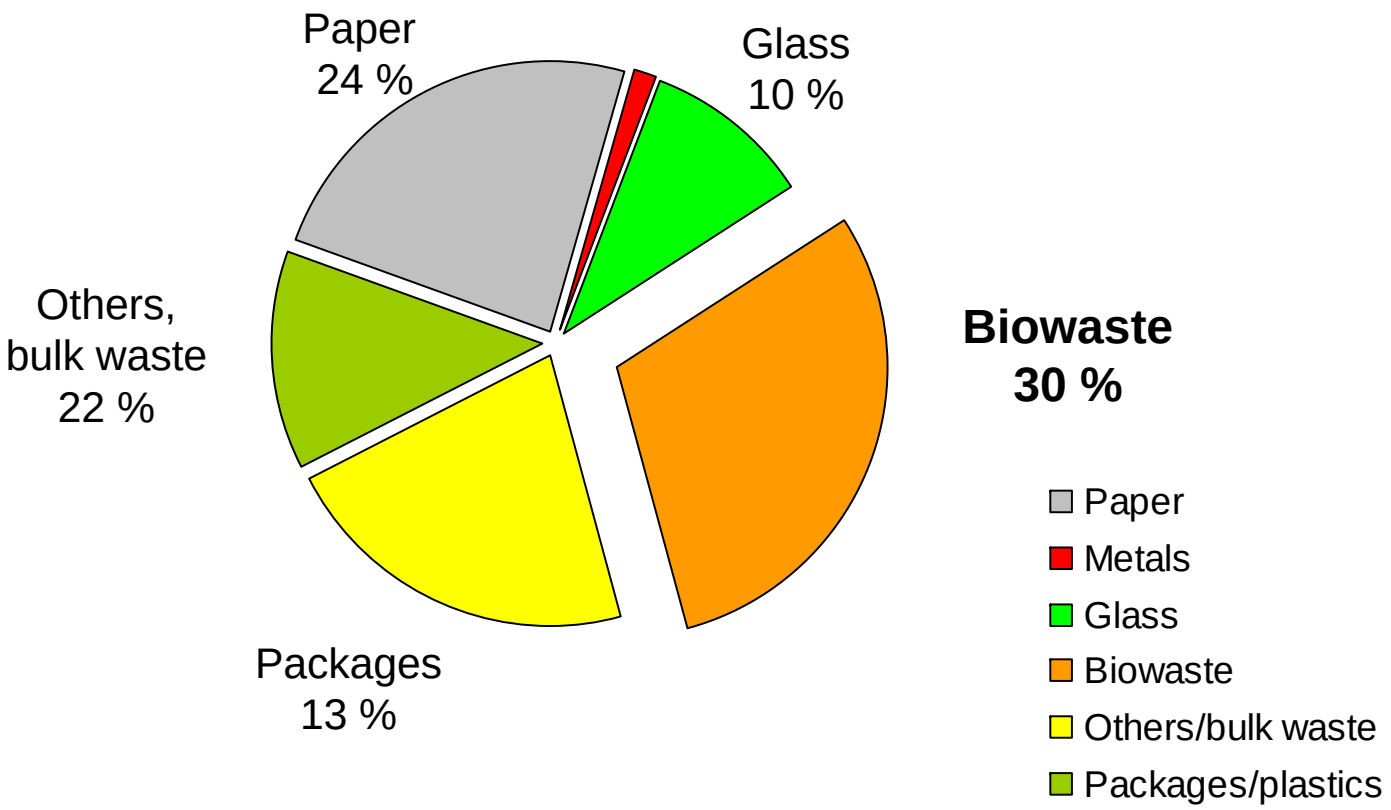


Amount of Different Fractions of Household Waste in Germany 2005

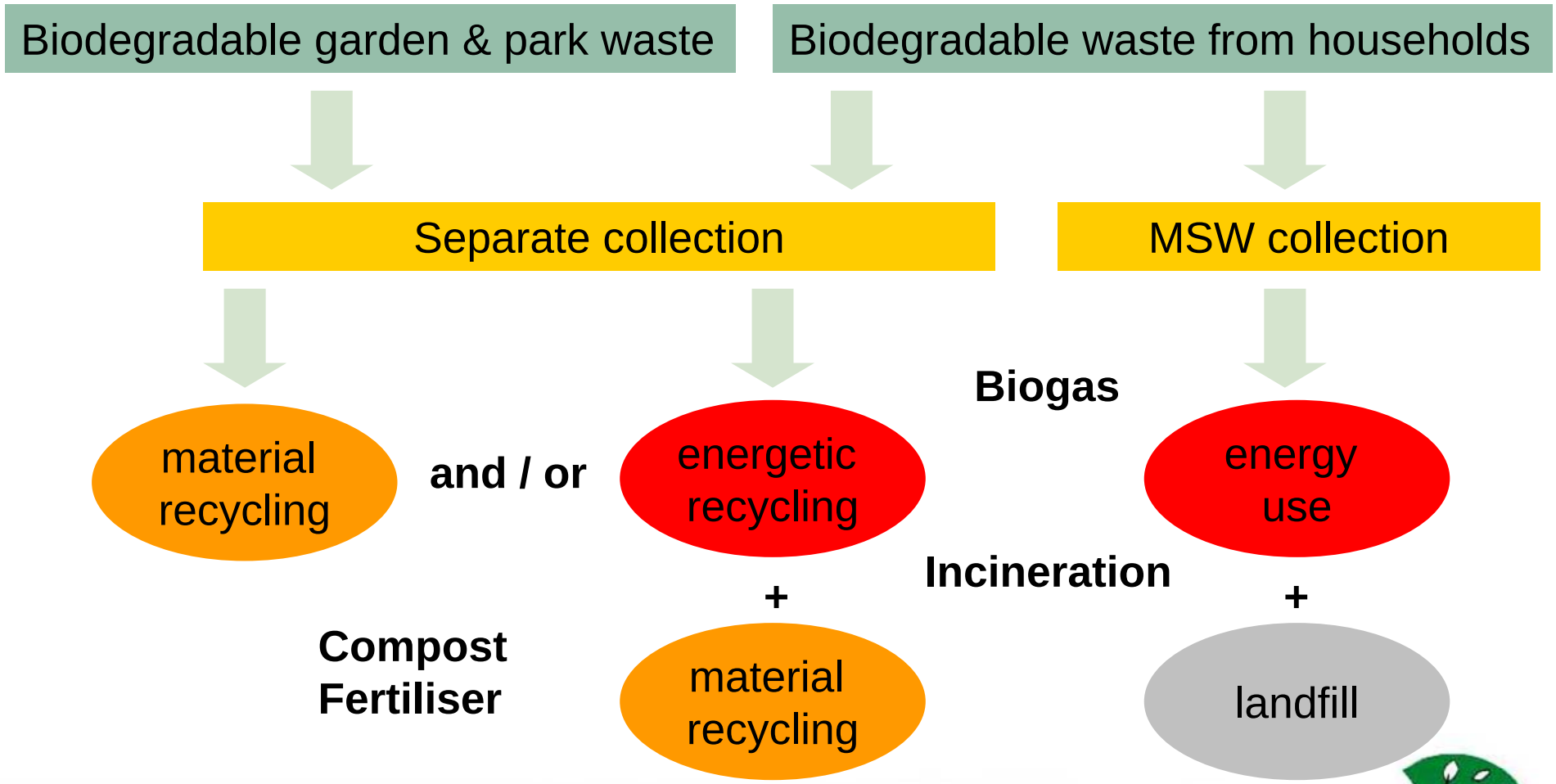


Source: www.umweltministerkonferenz.de / > Umweltinfos der Bundesländer

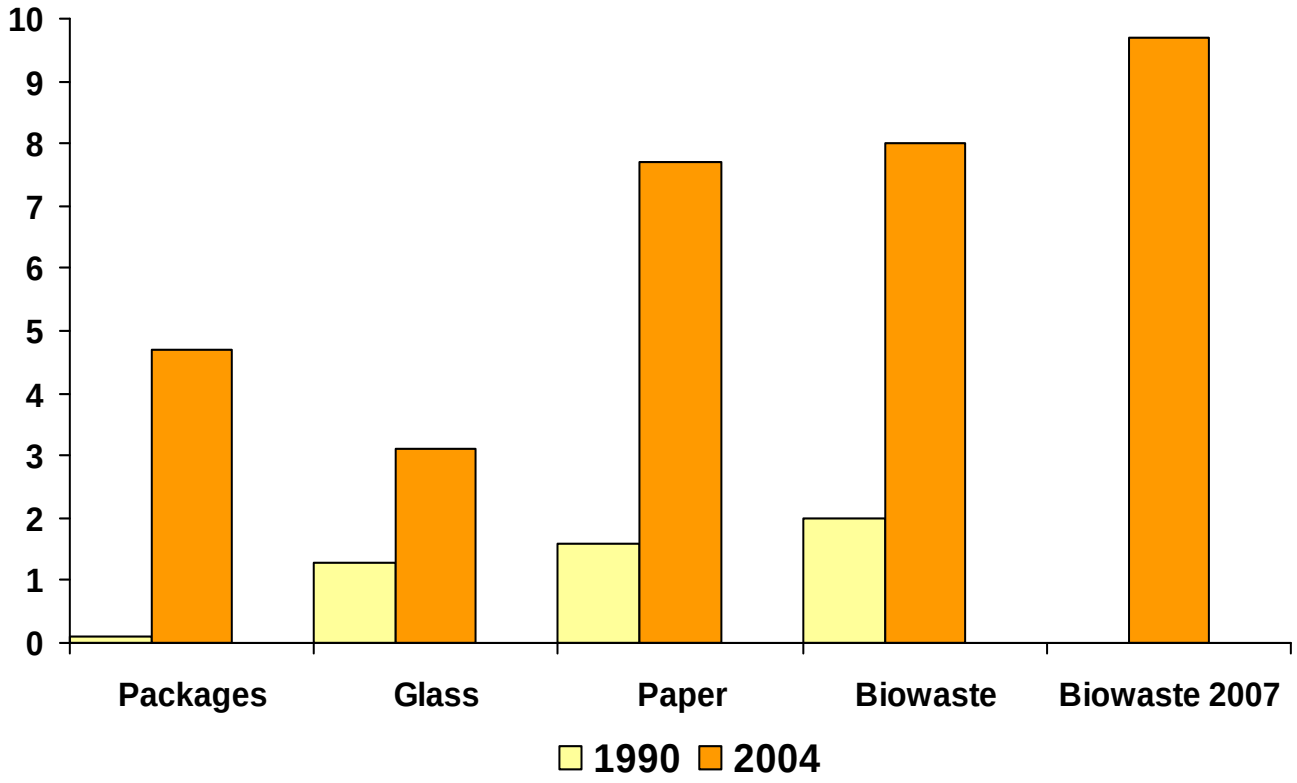
Composition of Household Waste in Germany



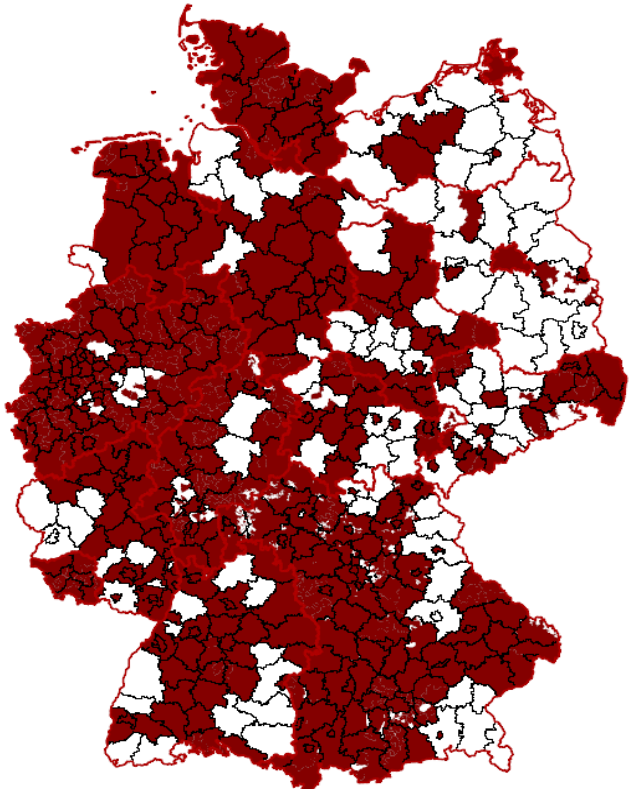
The Ways of Biowaste



Development of Recovery of Recyclates in Germany



Bio-bin Collection System in Germany



Regions with bio-bin

Regions without bio-bin

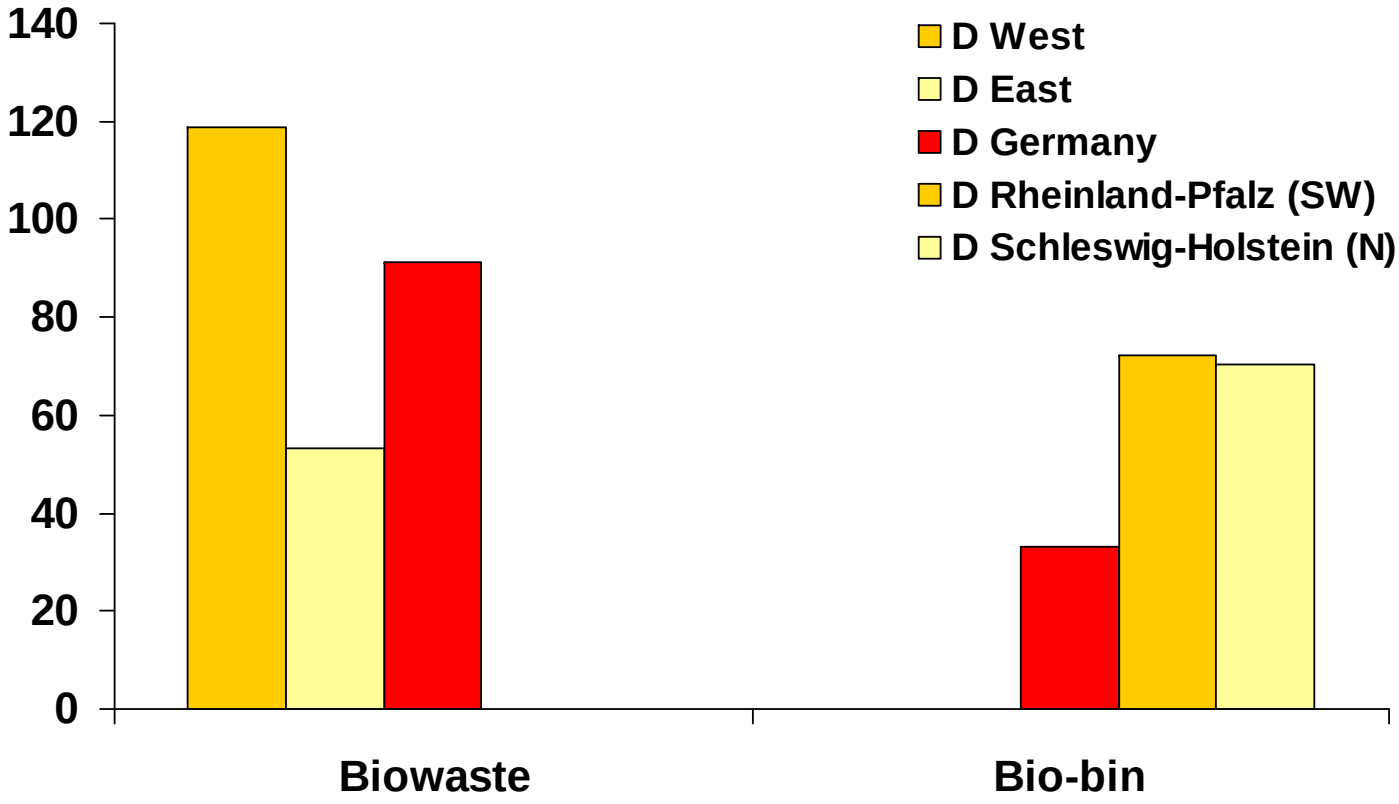
18 % of Germany‘s inhabitants

Participation rate in areas with bio-bin:

60 % inhabitants of these areas

Source: REMONDIS GmbH & Co.KG

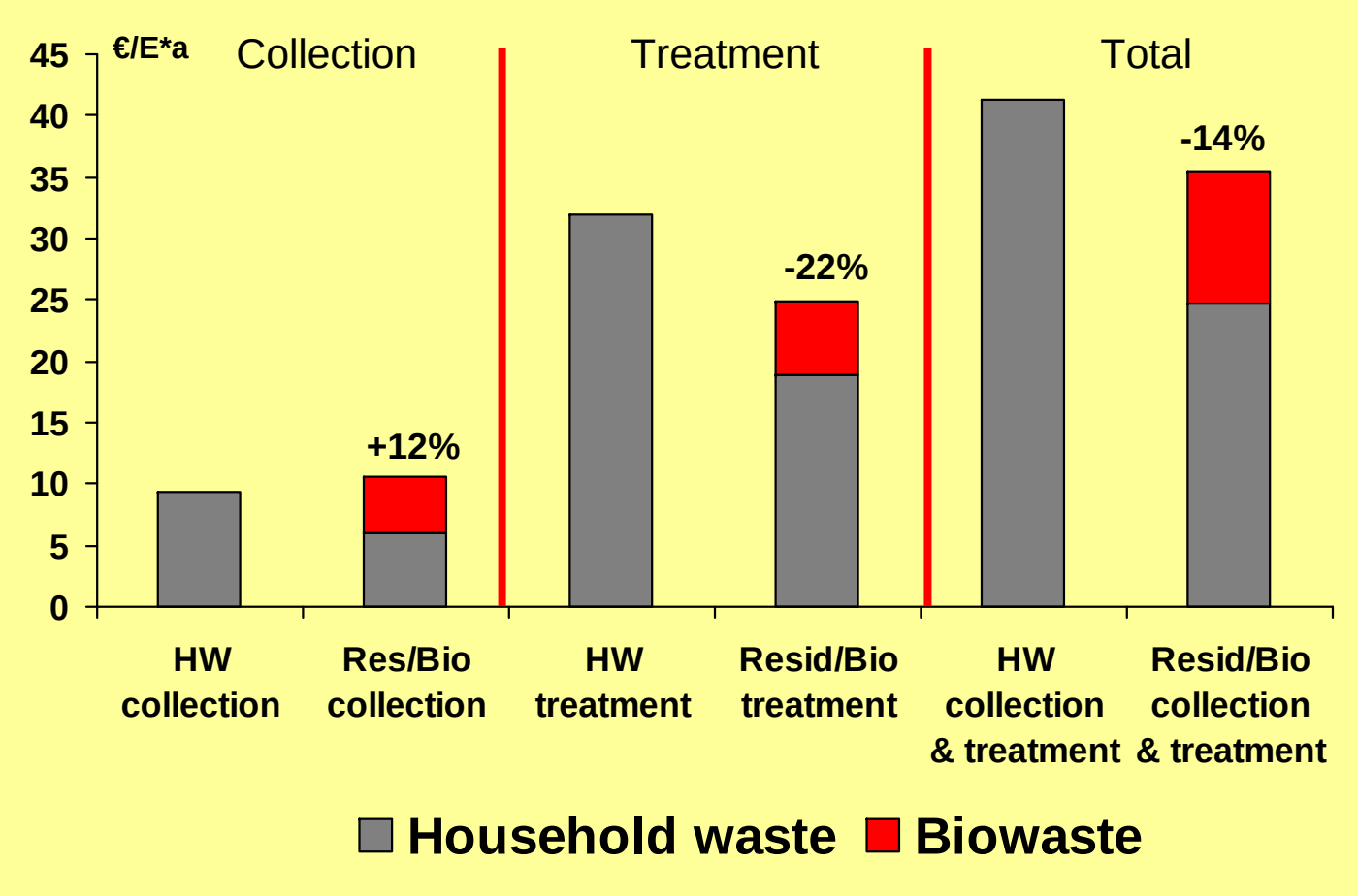
Collection of Biodegradable Waste in Germany 2005



Source: www.umweltministerkonferenz.de / > Umweltinfos der Bundesländer

Costs of separate Collection

- Rural disposal area -



Sustainable Targets with the Management of Biowastes

Targets	Incineration [1)]	Recovery [2)]
Reduction of methane emissions [3)]	++	+
Use of plant nutritients	-	+
Generation of humus fertilisers	-	+
Substitution of peat	-	+
Generation of energy and heat	-	(+)

1) Incineration as pre-treatment prior to landfilling

2) Separate collection and material recycling of biowastes (composting and digestion, proportionate also energy recovery of biowastes rich in calorific values)

3) Reduction of methane emissions, which would arise at the landfilling of not treated urban wastes with fractions of biowastes

Benefit Value of Biowastes
- Treatment Options -

Treatment Options	Compost	Digestion			Incineration
	material solid	energ./ material solid	energ./ material liquid	energ./ thermal dry	energ./ thermal dry
	Material recovery			Energy Recovery	
Humus reproduction	+ + +	+ +	+	-	-
Peat substitution	+ +	+ +	-	-	-
Nitrogen	+	+	+	-	-
Phosphorous	+ +	+ +	+ +	-	-
Other nutrients	+ +	+ +	+ +	-	-
Energy, heat	-	+	+	+ (+)	+ +

Benefit of Material Recovery of Biowastes

Soil nutrition	Plant nutrition	Component in mixtures
Humus supply Humus effective for reproduction	Basic fertilisation P, K, Mg, S and trace nutritients	Growing Media and Substrates Top soils, Culture substrate
Lime supply Alkaline material as CaO	Nitrogen Soluble contents, follow-up supply	

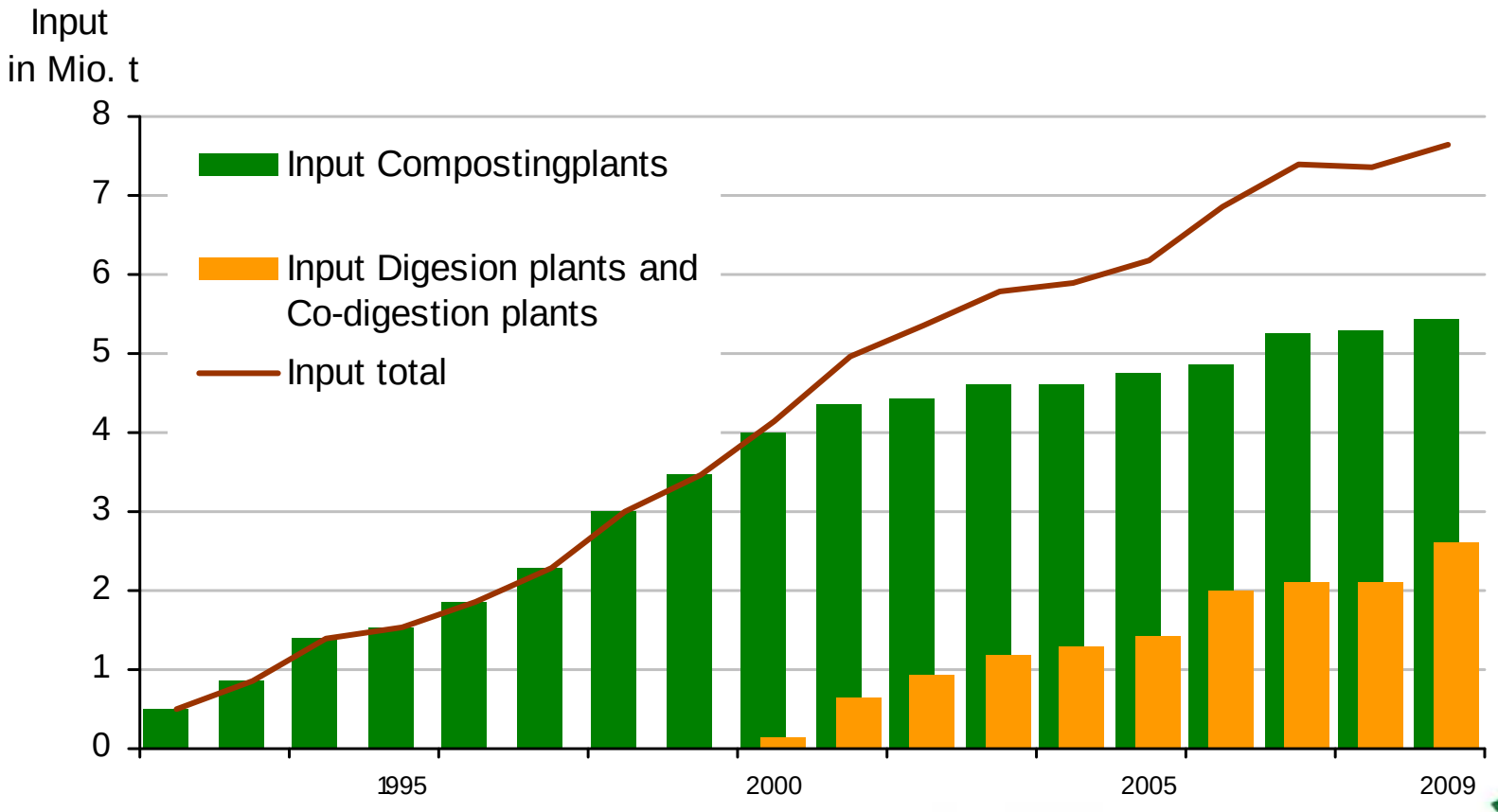
Compost from Biodegradable Waste

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

Separate Collection of Biodegradable Waste

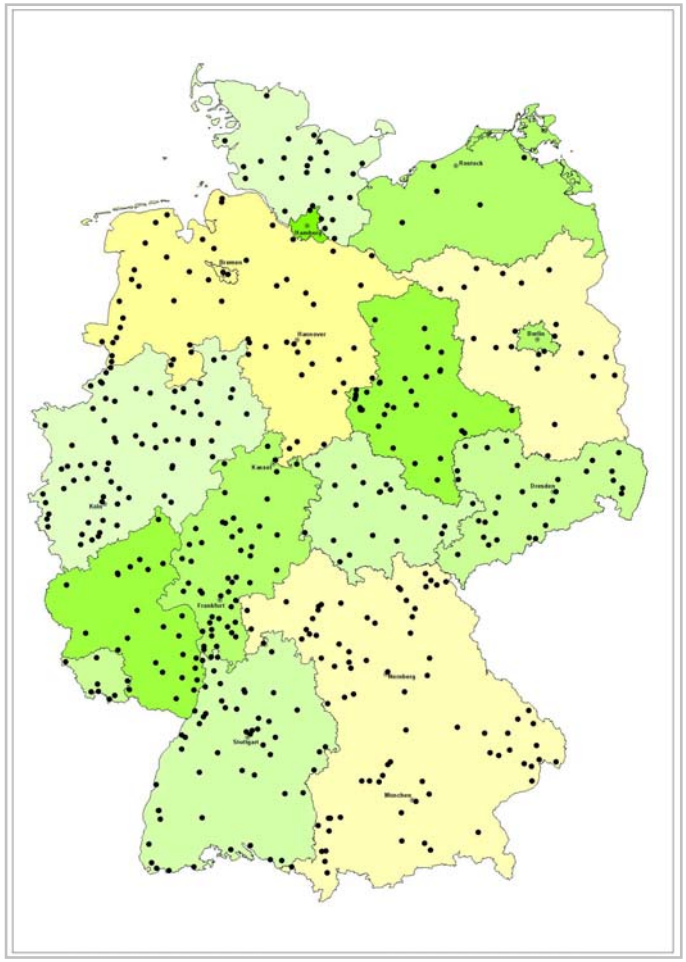


Compost and digestate products in 2009

Input amounts in 2009

		t/a
RAL-GZ 251	Compost	5.800.000
RAL-GZ 245	Digestate product from biowaste	2.070.000
RAL-GZ 246	Digestate product from renewable energy plant	330.000

Composting and Digestion Plants 2009



Production plants in the Quality Assurance System

Composting plants	433
Digestion plants	99

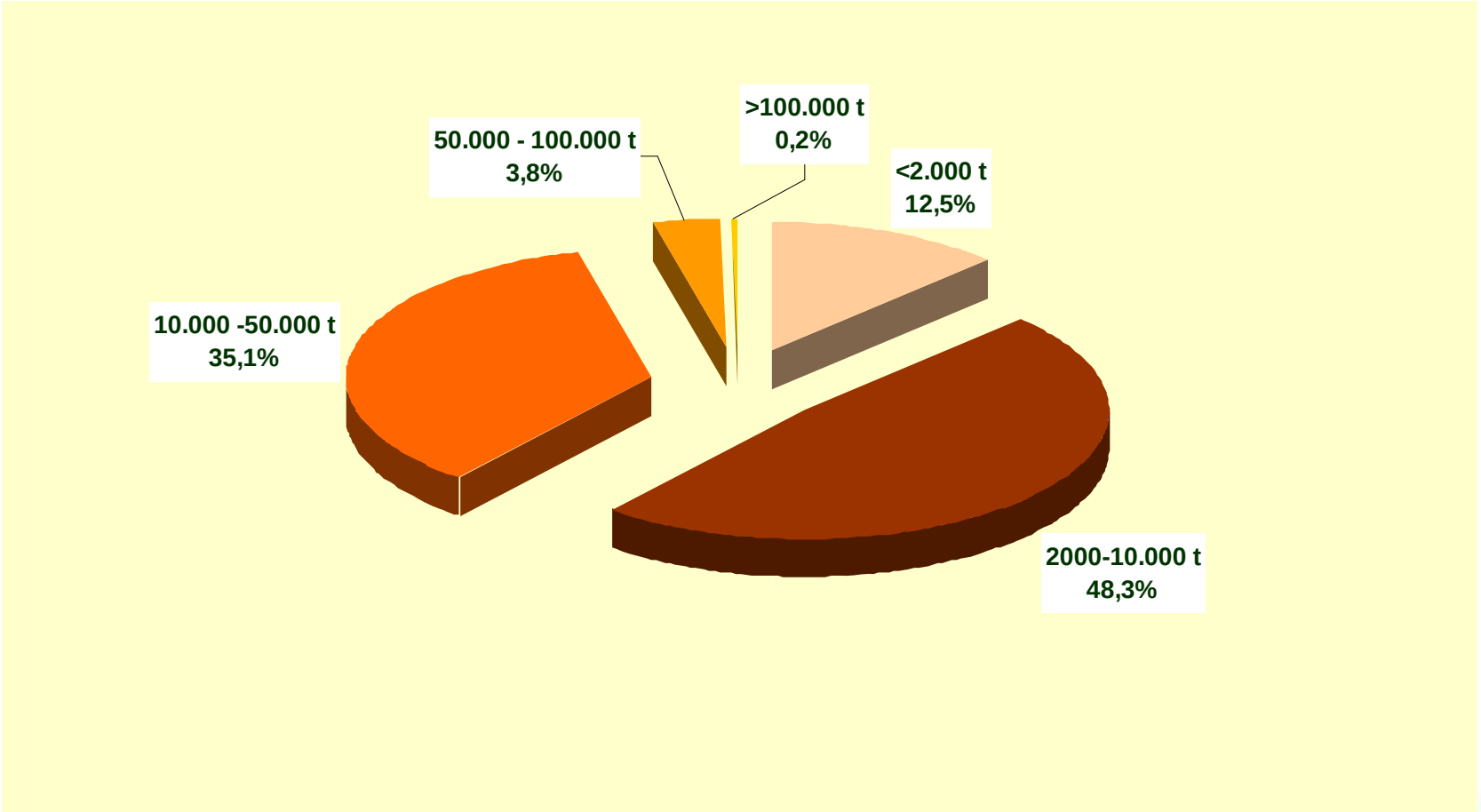
Composting plants

Open windrow composting more or less for park and garden waste, smaller amount of input materials < 10,000 t

Closed composting systems for biowaste from households, often more than > 10,000 t of input materials

- **tunnel systems**
- **box/container systems**
- **bricolare systems**
- **windrow systems**

Input Amount of Composting plants



Composting process

Composting is a natural biological degradation process that is controlled and accelerated at a composting facility.

Composting is the transformation of biologically decomposable material through a controlled process of biooxidation, which results in the production of carbon dioxide, water, minerals and stabilised organic matter (compost or humus).

Composting process in three phases

The composting process can be divided into three phases:

- A degradation phase ⇨ important for sanitisation (weed seeds and pathogens, thermophilic bacteria, actinomycetes and fungi

- A conversion phase ⇨ temperature drops and other bacteria and fungi complete the decomposition

- A maturation phase ⇨ bacterial activity slows down, earthworms, springstails and mites

Organisms involved in composting

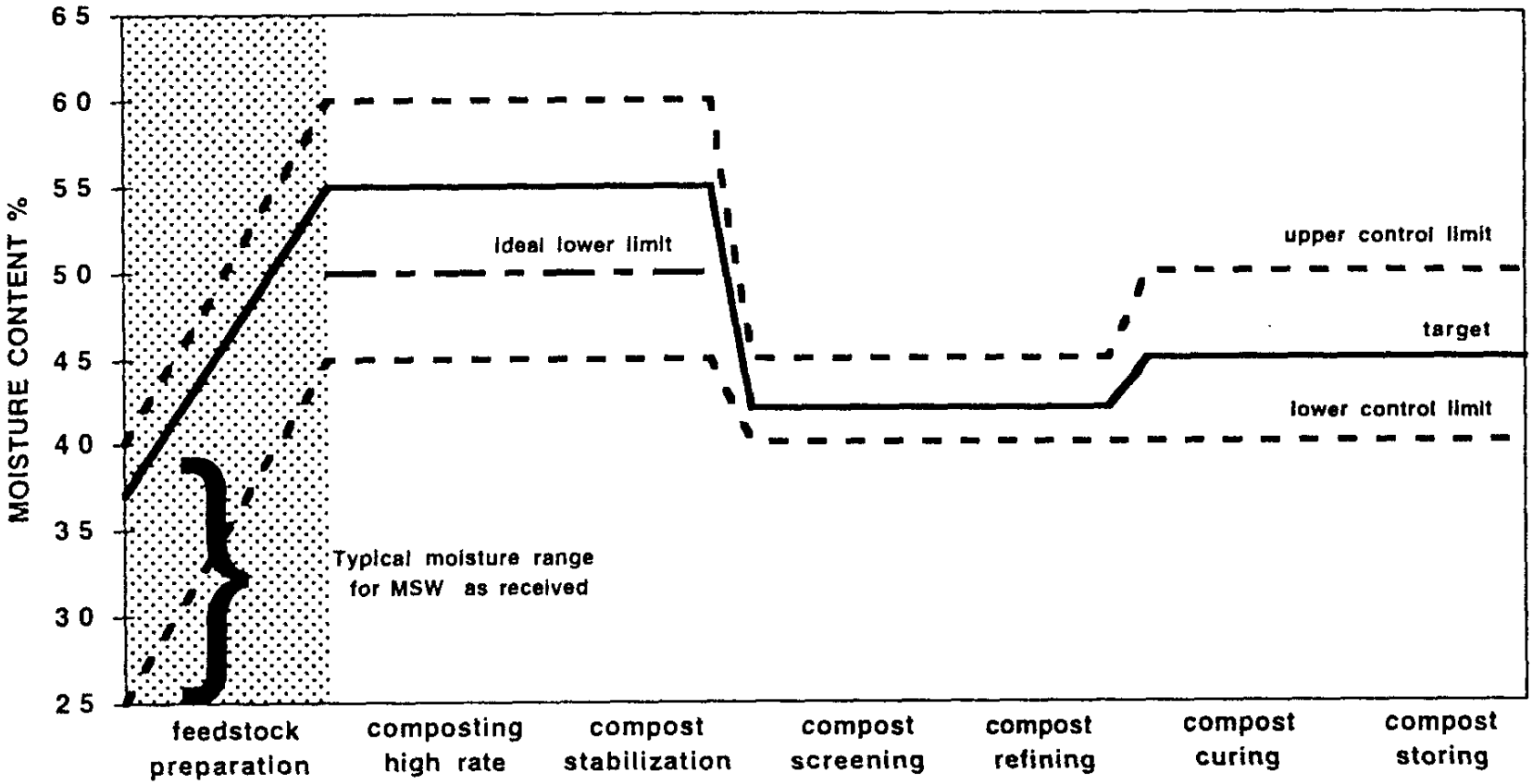
Organisms	Number of organisms per gram of compost		
Bacteria	100 000 000	to	1 000 000 000
Actinomycetes	100 000	to	100 000 000
Fungi	10 000	to	1 000 000
Algae		up to	10 000
Viruses		not known	
Protozoae	10 000	to	100 000
Nematodes			
Ants	Varies greatly, depending on the raw material		
Springtails (Collembola)	and its state of decay.		
Mites			
Earthworms			

Composting process control

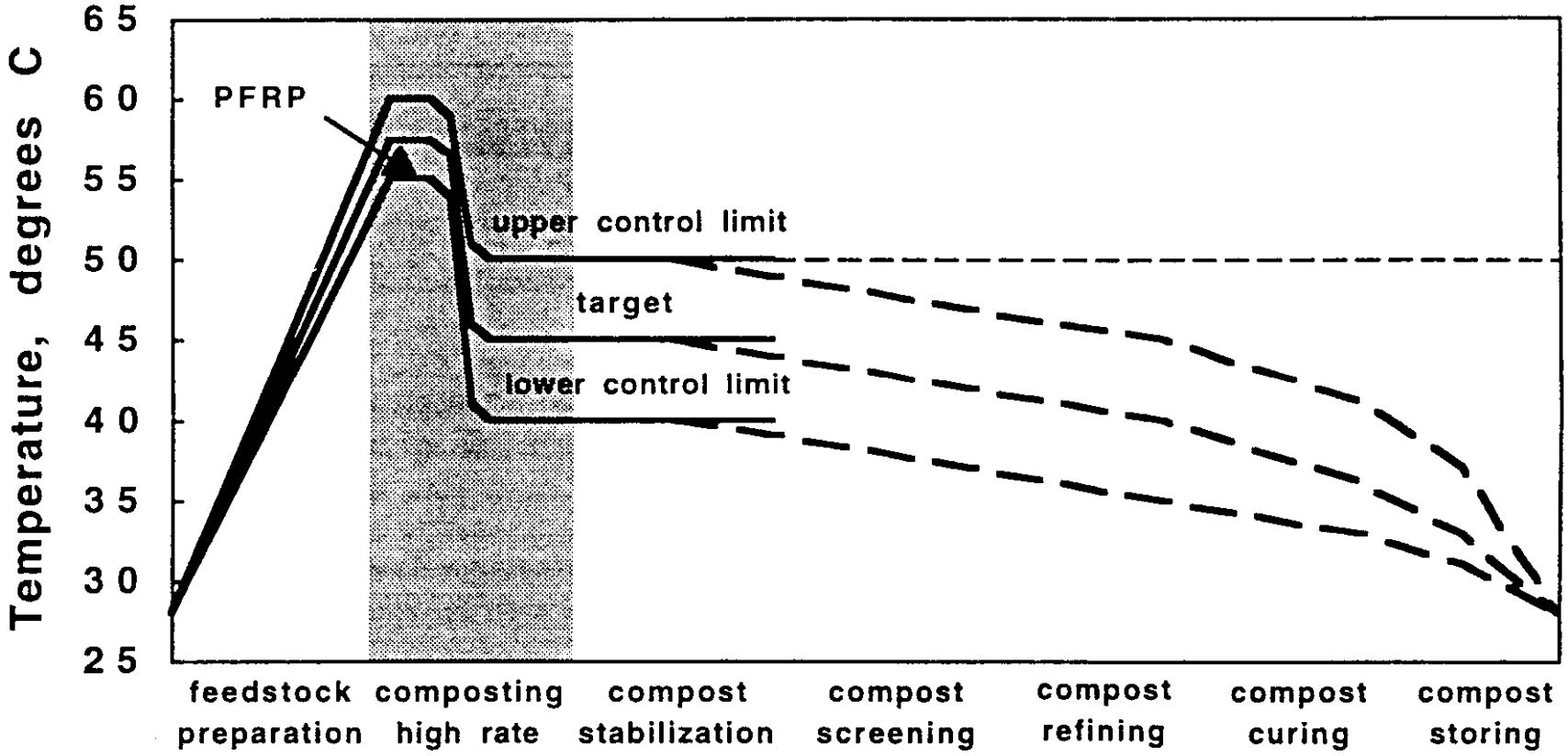
The composting process is regulated by

- **Aeration** to maintain optimum conditions for aerobic mibrobial activity, supply oxygen, immobilize ammonium, remove heat, carbon dioxide and moisture, strip volatile compounds and avoid anaerobic conditions.
- **Temperature control** to maximize the rate of decomposition and reduce pathogens.
- **Addition of make-up water** to maintain moisture content for aerobic conditions, and maximize organic decomposition.
- **Mechanical turning** to produce an uniform product.

Ideal moisture profile



Ideal temperature profile



Operation systems in Germany

Defined composting operations of various producers can be united into specific construction- and plant categories to a „modular construction“ on account of their similar construction and processing methods.

The differences between the single construction types are based on the geometry of the heaps: triangel or table heaps.

Construction categories

Classification of constructional conditions and basic system components in type categories:

Boxes/container systems
Bricolare systems
Tunnel systems
Windrow systems (open/enclosed)

End of presentation

Composting and Quality Assurance in Germany

Part 1a: Legal Specifications

Dr. Stefanie Siebert

German Quality Assurance Organisation for Compost - Bundesgütegemeinschaft Kompost e.V. (BGK)

Bundesgütegemeinschaft
Kompost e.V.

Legal specifications in Germany

- **Ordinance on Biowastes – BioAbfV 1998**

Ordinance on the Utilisation of Biowastes on Land used for Agricultural, Silvicultural and Horticultural purposes

- **Fertiliser regulations**

Fertiliser regulation - DüV 2006
Ordinance for the declaration of fertilisers, soil improving agents, growing media and plant protection agents - DüMV 2003

- **Soil Protection Act - BBodSchG 1998**

Federal Soil Protection and Contaminated Sites Ordinance - BBodSchV 1999

Ordinance on Biowastes (1)

Ordinance on Biowastes (BioAbfV 1998)

- on the utilisation of biowastes on land used for agricultural, silvicultural and horticultural purposes

- is defined for untreated biowastes, aerobically treated biowastes (composts) and anaerobically treated biowastes (digestate residues)

Ordinance on Biowastes (2)

The ordinance on biowastes regulates and includes:

- process requirements
- hygienic and precautionary environmental aspects of the material
- requirements for application

Process Requirements – BioAbfV (1)

As a general rule the producers as well as the parties responsible for waste management have to treat the biodegradable material in such a way that the safety for use in terms of human, animal and plant health is guaranteed.

- Direct process validation (once)
- Indirect process supervision (continous)
- Final product analysis (continous)

Process Requirements – BioAbfV (2)

Operation conditions for sanitization

Composting plants

- 55 °C for two weeks or
- 65°C (60°C in closed plants) for one week

Digestion plants

- 55 °C should be maintained over a period of 24 hours and
- 20 days hydraulic dwell time in the reactor or
- 70 °C for 1 hour

Direct Process Validation - BioAbfV

Procedure degree of efficiency on hygienic aspects

Dumping and retrieval of test and indicator organisms

- Human and veterinary hygienic aspects (salmonellae)

- Phyto hygienic aspects (tobacco mosaic virus (TMV), clubroot (plasmodiophora brassicae) and tomato seed

Indirect Process Supervision - BioAbfV

- Continous temperature management

Every working day or automatically in three representatives zones

- Compliance with necessary treatment temperature

Final Product Analysis

Continous examinations of the final product

- Salmonellae
- Germinative seeds and reproducible plant parts

Environmental Criteria

Parameter	Class Type 1	Class Type 2
Impurities (glass, metals, plastics) % dm	≤ 0,5	≤ 0,5
Lead (Pb) mg/kg dm	100	150
Cadmium (Cd) mg/kg dm	1,0	1,5
Chromium (Cr) mg/kg dm	70	100
Cupper (Cu) mg/kg dm	70	100
Nickel (Ni) mg/kg dm	35	50
Mercury (Hg) mg/kg dm	0,7	1,0
Zinc (Zn) mg/kg dm	300	400

Application requirements

The total amount of biowastes (dry matter) applied per hectare within a period of three years shall not exceed

Type 1	**30 t dm**
Type 2	**20 t dm**

Futher restrictions

Treated separately collected biowaste from households is not allowed for application on permanent grassland.

Fertiliser Regulation

Fertiliser regulation - relevant for agriculture and gardening

- Fertiliser regulation (DüV 2006)
- Ordinance for the declaration of fertilisers, soil improving agents, growing media and plant protection agents (DüMV 2003) ⇒ at this point composted waste turns into a labelled product and is declared as organic (N-P-K)-fertiliser or (P-K)-fertiliser.

Soil protection regulations

Soil protection act (BBodSchG 1998)

- relevant for landscaping

Federal Soil Protection and Contaminated Sites Ordinance (BBodSchV 1999)

- regulates the application amount for specific landscaping purposes

EU Regulations

EC Reg nº 834/2007 –
Regulation on Organic Farming
Specific environmental criteria are described for compost from separate collected household wastes

EU ECO Label for soil improver - promotes the production and reuse of organic waste
(2006/799/EC 03.11.2006 L325/28)

Environmental Criteria on EU-level

Parameter	EC nº 834/2007	EU ECO label
Impurities (glass, metals, plastics) % dm	-	≤ 0,5
Lead (Pb) mg/kg dm	45	100
Cadmium (Cd) mg/kg dm	0,7	1,0
Chromium (Cr) mg/kg dm	70	100
Cupper (Cu) mg/kg dm	70	100
Nickel (Ni) mg/kg dm	25	50
Mercury (Hg) mg/kg dm	0,4	1,0
Zinc (Zn) mg/kg dm	200	300

EU Regulations

EU Reg nº 1774 – (ABPRnew 1069/2009)

Regulation on Animal-by-products

- Regulates specific requirements on the treatment of animal-by-products, if used as input materials in composting and digestion plants

Animal-by-Product-Regulation

ABPR	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/ harvesting of feeding stuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	National regulation (TierNebV)	Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h 20 Days 70°/1h	-	Closed or Open windrow	Salmonella	Absent in 50g	
Catering waste from central kitchens	National regulation (TierNebV)	Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h and Fermentation > 20 Days 70°/1h	-	Only closed reactor	Salmonella	Absent in 50g	
Former foodstuff	ABPR	70°/1h	12 mm	Closed or Open windrow	Salmonella E.coli	Absent in 25g < 1000 MPN / 4 of 5 samples 1000-5000 MPN / 1 of 5 samples	21 Days
All other Cat. 3 material	ABPR	70°/1h	12mm	Closed or Open windrow			21 Days
Manure	ABPR	-	-	-	-	-	-

Legal Specifications

End of presentation

Composting and Quality Assurance in Germany

Part 2: Quality Assurance for Compost and Digestate

Dr. Stefanie Siebert
Bundesgütegemeinschaft Kompost e.V.

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

433 plants

RAL - GZ 245

99 plants

RAL - GZ 246

8 plants

RAL - GZ 258

14 plants

Benefits of BGK

- Quality assurance system (QAS)
- Product standards
- Legal safety
- Information service
- Local consideration

Benefits of participation in BGK QAS

❖ QAS

- Conferring of quality labels
- Organisation of QAS
- Documentation and certificates
- ZAS (central evaluation station)
- HBPS (hygiene modular construction system)
- Lab recognition, methods book

❖ Produkt Standards

- Regulations for quality and examination
- Product declaration (i.e. for fertilizer regulations)
- Influence on product standards
- Coordination of market demands
- Continuing progression
- Statistical examinations

❖ Legal safety

- Monitoring of legislation regulations
- Assistance with the realisations
- Representation of the concerns of practice
- Questions of product liability
- Qualification of raw materials
- Certificates for authorities

❖ Information Service

- Journal „Humus & KomPost“
- Application recommendations and advertising material for members
- Consideration in invidual cases
- Contact for institutes, administration etc.
- Expert questions
- Internet presence

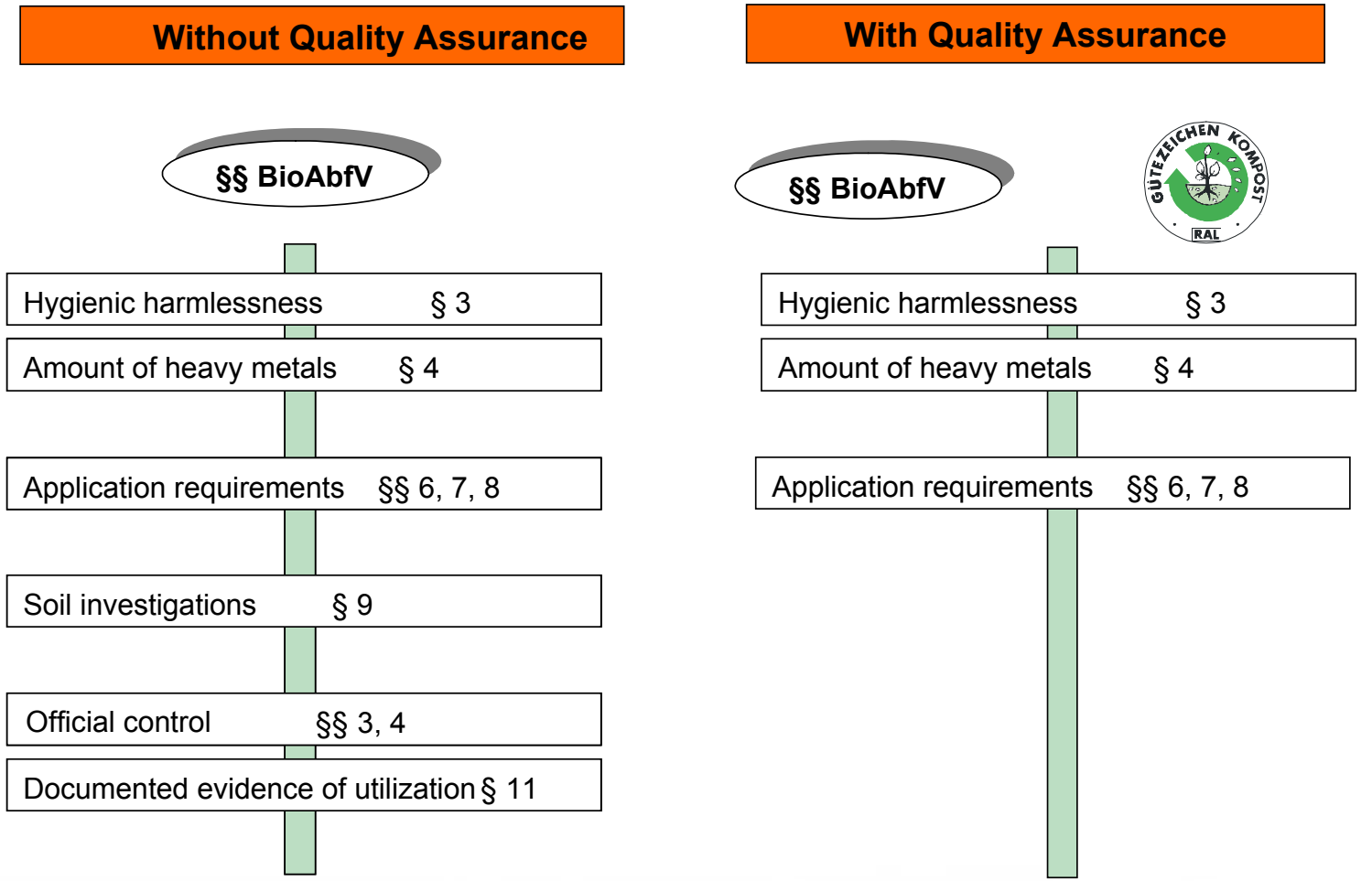
❖ Regional Consideration

- Local considerations
- Authority contacts
- Exchange of experience
- Special events
- Representation of special local concerns

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



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 pratical use

Contents of Quality Assurance System

- **Process requirements and suitable input materials**
- **Independent analysis and declaration of the product quality**
- **Documentation and application requirements**

Composting / Digestion Plant

Member of Quality Assurance Organisation (BGK)

Sample Taker

Quality Committee

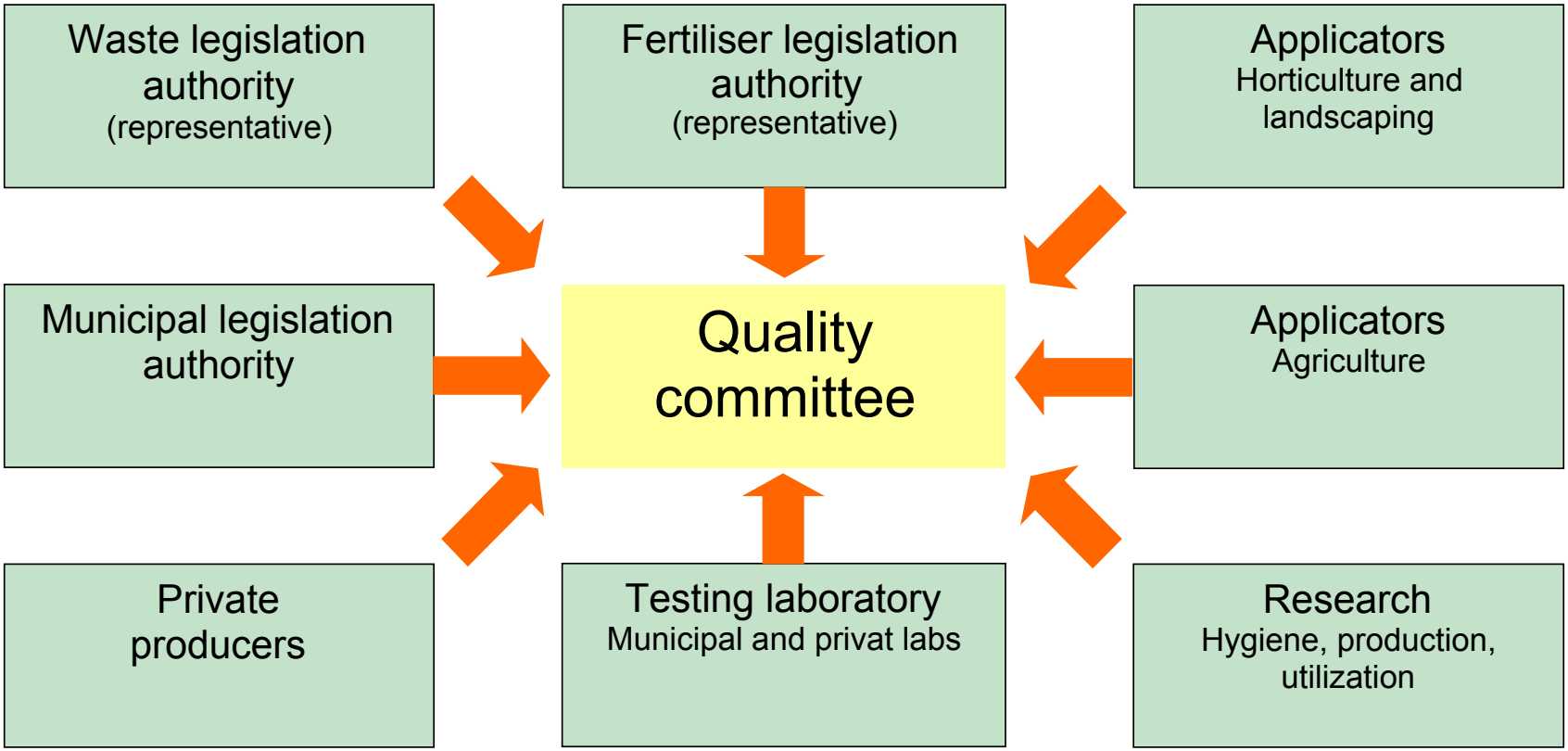
control, sanctions, measures

Acknowledged Laboratory

Quality Assurance Organisation

central data base

Quality Committee



Course of Quality Assurance System

2-Step Quality Assurance System

Recognition Procedure

single

Supervision Procedure

continuous

Contents of Quality Assurance System

Input Materials

- in accordance with the biowaste ordinance and fertiliser regulation
- operation control by plant visits of independent quality managers
- control by independent sample takers and by declaration in analysis report

Independent analysis and declaration of the product quality

- 4 -12 times a year, depends on the amount of input material
- control and sanctions by an independent quality committee
- certification with product declaration according to the fertiliser regulation

Application requirements

- application requirements based on the biowaste and fertiliser regulation
- application requirements due to good practical use

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

Urkunde

Die Bundesgütegemeinschaft Kompost e.V.
bestätigt aufgrund der erfolgreichen Teilnahme am

gemeinsamen Ringversuch Bioabfall 2006
des Landesamtes NRW und der BGK e.V.

dem Prüflabor

Messlatte GmbH
Am Shredderberg 5 in 12345 Rottenhausen

die Anerkennung als Prüflabor im Rahmen der RAL-Gütesicherungen
der Bundesgütegemeinschaft Kompost e.V.

Die Anerkennung
bezieht sich auf nachfolgende Untersuchungsbereiche:

Untersuchungsbereich 1:	**Schwermetalle**
Untersuchungsbereich 2:	**Physikalische Parameter, Fremdstoffe**
Untersuchungsbereich 3:	**Phytohygiene**
Untersuchungsbereich 4:	**Weitere Parameter nach RAL/Gütesicherung**
Untersuchungsbereich 4a:	**Verunreinigungsgrad**
Untersuchungsbereich 5:	**Seuchenhygiene**

Die Anerkennung ist zeitlich befristet bis zur nächsten Enquête.

Köln, den 27. Februar 2006
Bundesgütegemeinschaft Kompost e.V.

Der Geschäftsführer
der Bundesgütegemeinschaft

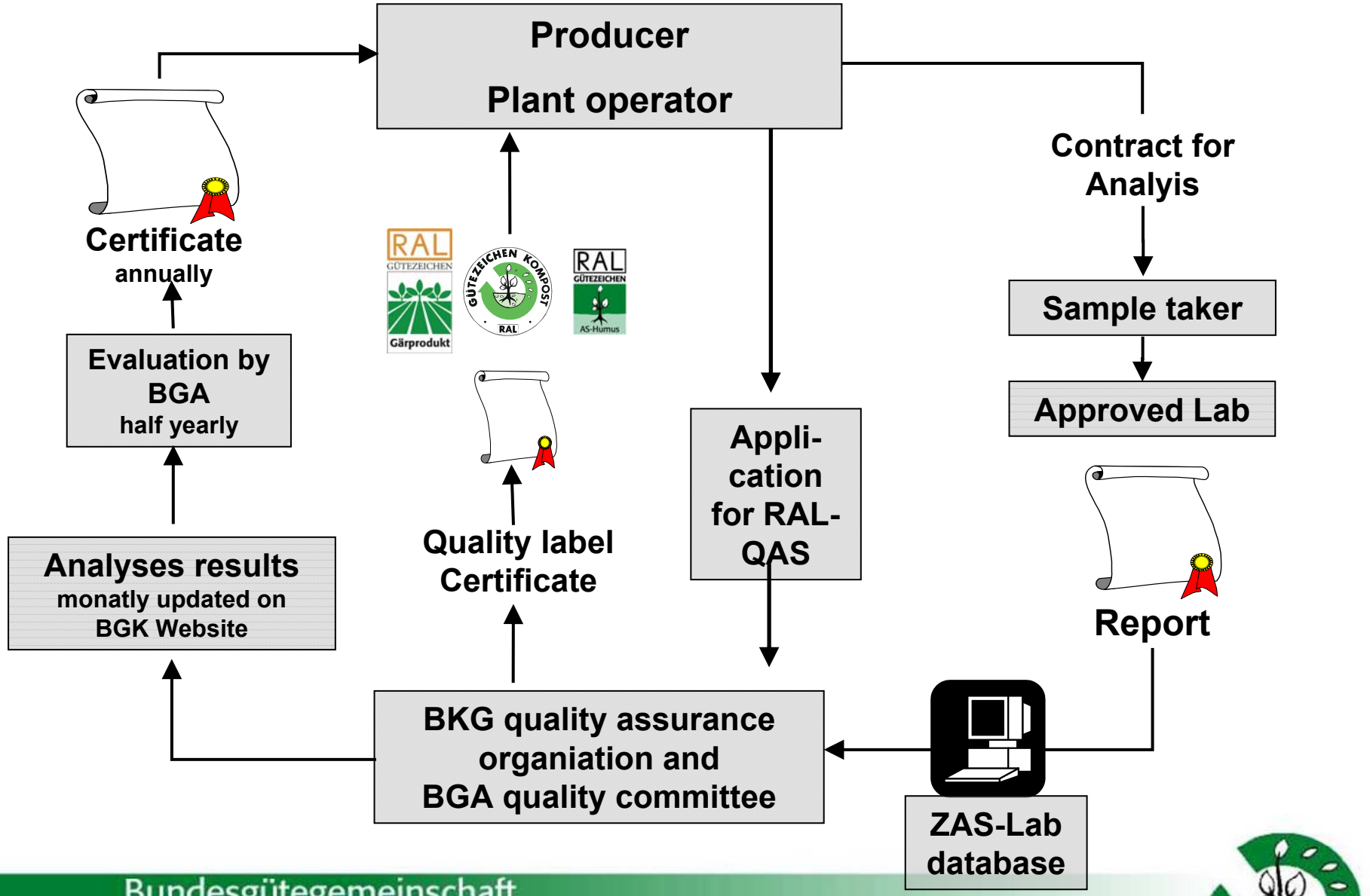
Sample Taking and Analysis

- According to the methods book of BGK
- Accomplishment only by ordered and

recognised lab

- Independancy and education of sample taker
- Samples have to supply a representative sample
- Samples must only be taken from goods ready

for sale


Producer
Plant operator
Contract for Analyis
Sample taker
Approved Lab
Report
Appli-cation for RAL-QAS
Quality label Certificate
Certificate
annually
Evaluation by BGA
half yearly
Analyses results
monatly updated on BGK Website
BKG quality assurance organiation and BGA quality committee
ZAS-Lab database
RAL GÜTEZEICHEN Gärprodukt
GÜTEZEICHEN KOMPOST RAL
RAL GÜTEZEICHEN AS-Humus

Central Data Evaluation (ZAS)

Approved Sample taker

- Sample
- Protocol

Approved lab

ZASLab Lab software

Email-Versand

BGK office

ZAS Central database

Plant manager

- Application of QAS
- Annal date (online)

- **Result reports**

- **Control certificate**
- **Annual certificat**
- **Analyses survey**
- **Sampling plan**
- **Survey of all results**

Documentation and Record System

- **Analysis records**

Analysis results of one batch

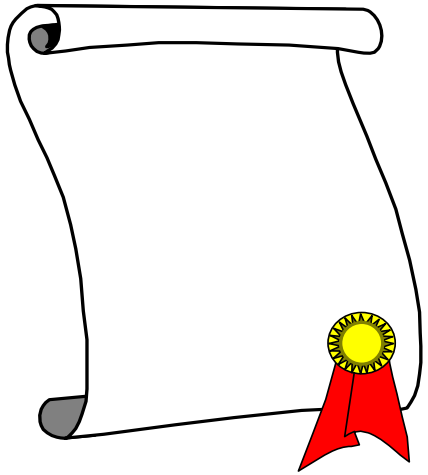
- **Quality certificate**

Results and evaluation of analysis of the last year

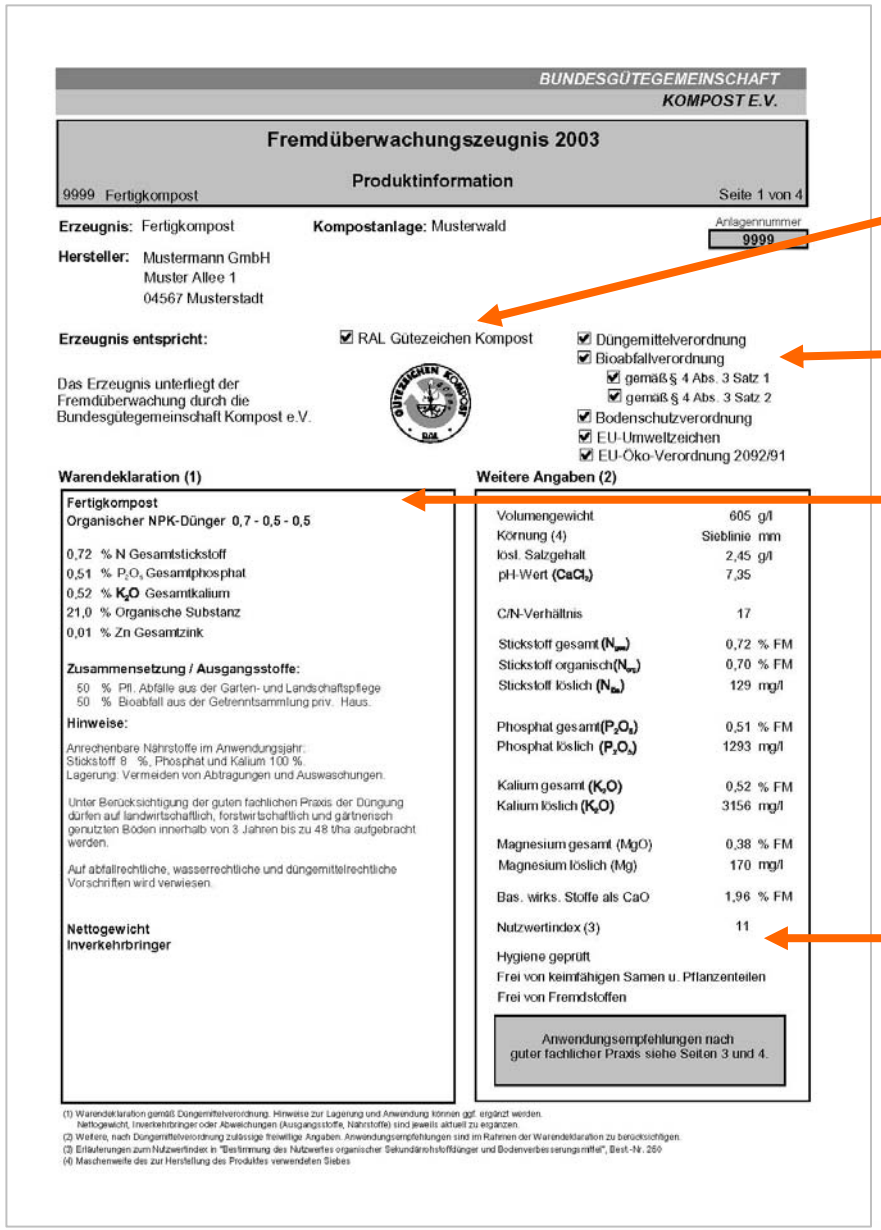
- **Documentation overview**

Summary report of all analysis results for the operator and the quality assurance committee for control and sanctions

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



BUNDESGÜTEGEMEINSCHAFT
KOMPOST E.V.

Fremdüberwachungszeugnis 2003

Produktinformation

9999 Fertigkompost — Seite 1 von 4

Erzeugnis: Fertigkompost **Kompostanlage:** Musterwald

Anlagennummer 9999

Hersteller: Mustermann GmbH
Muster Allee 1
04567 Musterstadt

Erzeugnis entspricht:

☑ RAL Gütezeichen Kompost

Das Erzeugnis unterliegt der Fremdüberwachung durch die Bundesgütegemeinschaft Kompost e.V.

☑ Düngemittelverordnung
☑ Bioabfallverordnung
☑ gemäß § 4 Abs. 3 Satz 1
☑ gemäß § 4 Abs. 3 Satz 2
☑ Bodenschutzverordnung
☑ EU-Umweltzeichen
☑ EU-Öko-Verordnung 2092/91

Warendeklaration (1)

Fertigkompost
Organischer NPK-Dünger 0,7 - 0,5 - 0,5

0,72 % N Gesamtstickstoff
0,51 % P_2O_5 Gesamtphosphat
0,52 % K_2O Gesamtkalium
21,0 % Organische Substanz
0,01 % Zn Gesamtzink

Zusammensetzung / Ausgangsstoffe:
50 % Pfl. Abfälle aus der Garten- und Landschaftspflege
50 % Bioabfall aus der Getrenntsammlung priv. Haus.

Hinweise:
Anrechenbare Nährstoffe im Anwendungsjahr:
Stickstoff 8 %, Phosphat und Kalium 100 %.
Lagerung: Vermeiden von Abtragungen und Auswaschungen.

Unter Berücksichtigung der guten fachlichen Praxis der Düngung dürfen auf landwirtschaftlich, forstwirtschaftlich und gärtnerisch genutzten Böden innerhalb von 3 Jahren bis zu 48 t/ha aufgebracht werden.

Auf abfallrechtliche, wasserrechtliche und düngemittelrechtliche Vorschriften wird verwiesen.

Nettogewicht
Inverkehrbringer

Weitere Angaben (2)

Volumengewicht	605	g/l
Körnung (4)	Sieblinie	mm
lösl. Salzgehalt	2,45	g/l
pH-Wert ($CaCl_2$)	7,35	
C/N-Verhältnis	17	
Stickstoff gesamt (N_{ges})	0,72	% FM
Stickstoff organisch (N_{org})	0,70	% FM
Stickstoff löslich ($N_{lös}$)	129	mg/l
Phosphat gesamt (P_2O_5)	0,51	% FM
Phosphat löslich (P_2O_5)	1293	mg/l
Kalium gesamt (K_2O)	0,52	% FM
Kalium löslich (K_2O)	3156	mg/l
Magnesium gesamt (MgO)	0,38	% FM
Magnesium löslich (Mg)	170	mg/l
Bas. wirks. Stoffe als CaO	1,96	% FM
Nutzwertindex (3)	11	

Hygiene geprüft
Frei von keimfähigen Samen u. Pflanzenteilen
Frei von Fremdstoffen

Anwendungsempfehlungen nach guter fachlicher Praxis siehe Seiten 3 und 4.

(1) Warendeklaration gemäß Düngemittelverordnung. Hinweise zur Lagerung und Anwendung können ggf. ergänzt werden. Nettogewicht, Inverkehrbringer oder Abweichungen (Ausgangsstoffe, Nährstoffe) sind jeweils aktuell zu ergänzen.
(2) Weitere, nach Düngemittelverordnung zulässige freiwillige Angaben. Anwendungsempfehlungen sind im Rahmen der Warendeklaration zu berücksichtigen.
(3) Erläuterungen zum Nutzwertindex in "Bestimmung des Nutzwertes organischer Sekundärrohstoffdünger und Bodenverbesserungsmittel", Best.-Nr. 260
(4) Maschenweite des zur Herstellung des Produktes verwendeten Siebes

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

Certification Document

Verleihungsurkunde

Die Bundesgütegemeinschaft Kompost e.V.
verleiht hiermit
auf Grund des ihrem Güteausschuss vorliegenden Prüfberichts

der Firma
Kompost GmbH

Kompostanlage
Mietenhausen (BGK-Nr. 9999)
Tiefer Bach in 56789 Musterhausen

das vom Deutschen Institut für Gütesicherung und Kennzeichnung e.V. (RAL)
anerkannte und durch Eintragung beim Deutschen Patentamt
warenzeichenrechtlich geschützte

RAL-Gütezeichen Kompost

für das Produkt

Fertigkompost

Die Führung des Gütezeichens setzt voraus, dass die Einhaltung
der Güte- und Prüfbestimmungen überwacht wird.

Köln, den 17. März 2006
Bundesgütegemeinschaft Kompost e.V.

Der Vorsitzende
der Bundesgütegemeinschaft

Der Obmann
des Bundesgüteausschusses

BGK BGK BGK BGK BGK BGK BGK BGK BGK BGK BGK BGK BGK BGK

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

Input Amount (t/a)	Recognition procedures	Monitoring procedures
< 2.000	4	< 8000 t input material per year 4 analysis ≥ 8.000 t input material one analysis for every 2.000 t input material per year but as maximum 12 analysis per year
≥ 2.001	6	
≥ 6.001	8	
≥ 12.001	12	

Differentiation of the RAL quality for Digestate Products

RAL-quality digestate products

	Gärprodukt	NawaRo Gärprodukt
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)	EG-VO 1774/2002 (TierNebV)

Fertiliser legislation

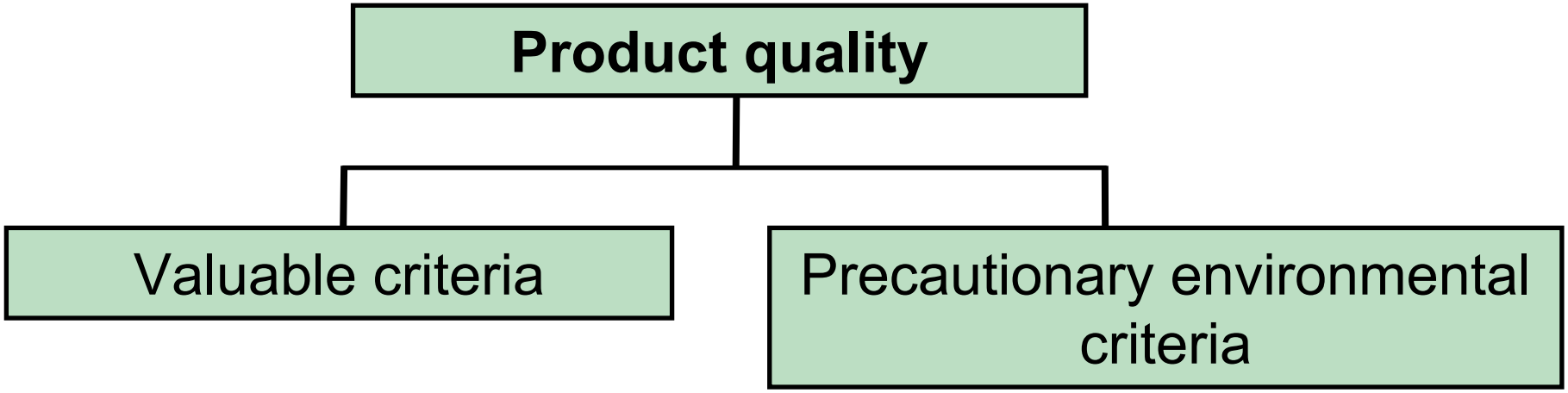
Process Requirements and Input Materials for Digestation

	Biowaste from separate collected organic municipal waste, residues from the food and animal feed industry	Renewable energy crops, Manure, slurry, dung, straw
Input materials		
Process requirements	Sanitization at 70 °C for at least 1 h or thermophilic fermentation at > 55° for 24 h and a dwell time of 20 days Salmonella not traceable	Treatment at > 37 °C for a dwell time of 20 days 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

Quality label/Quality assurance		Recognition procedures	Monitoring procedures
RAL GÜTEZEICHEN Gärprodukt	Digestate product from biowaste (RAL-GZ 245)	one analysis for every 1.500 t input material per year	one analysis for every 2.000 t input material per year
		min. 4, max. 12 per year	min. 4, max. 12 per year
RAL GÜTEZEICHEN NawaRo Gärprodukt	Digestate product from renewable energy crops (RAL-GZ 246)	one analysis for every 1.500 t input material per year	one analysis for every 8.000 t input material per year
		min. 4, max. 8 per year	min. 2, max. 4 per year



- **Decompostion degree (compost)**
- **Degree of fermentation (digestate)**
- **Bulk density**
- **pH-value, salt content**
- **Plant nutrients**
- **Carbonats**
- **Organic matter content**

- **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

Quality criteria	Parameter	Compost fresh / mature	Digestate solid / liquid
Organic matter	Loss on ignition [M. %]	≥ 15 / ≥ 30	≥ 30 / ≥ 40
Dry matter	Dry matter [M.-%]	≥ 55	-
Nutrients	N_t, P_2O_5, K_2O, MgO, S [% / dm]	Declaration	Declaration
Alkaline effective matter	CaO [% / dm]	Declaration	Declaration
Nitrogen soluble	NH_4-N+NO_3-N [mg/l FM]	Declaration	Declaration
Salt content	Salt content [g/l FM]	Declaration	Declaration
pH-value	pH-value	Declaration	Declaration
Rotting degree / Fermentation degree	°C / Organic acids [mg/l]	60 – 40,1 / ≤ 40 -	- < 1500

Precautionary Environmental Criteria

Parameter	Limit value	Remark
Impurities > 2 mm [% dm]	≤ 0.5	
Degree of pollution [cm^2 / l FM]	≤ 25	Only determinable, if impurity content exceed 0.1 M.-%
Pb [mg /kg dm]	150	
Cd [mg /kg dm]	1.5	
Cr [mg /kg dm]	100	
Ni [mg /kg dm]	50	
Cu [mg /kg dm]	100	If the content of Cu and Zn is referred to manure etc., plausible higher values in digestate are allowed.
Zn [mg /kg dm]	400	
Hg [mg /kg dm]	1.0	
Viable seeds and sprouting plant parts	2 seeds / l	

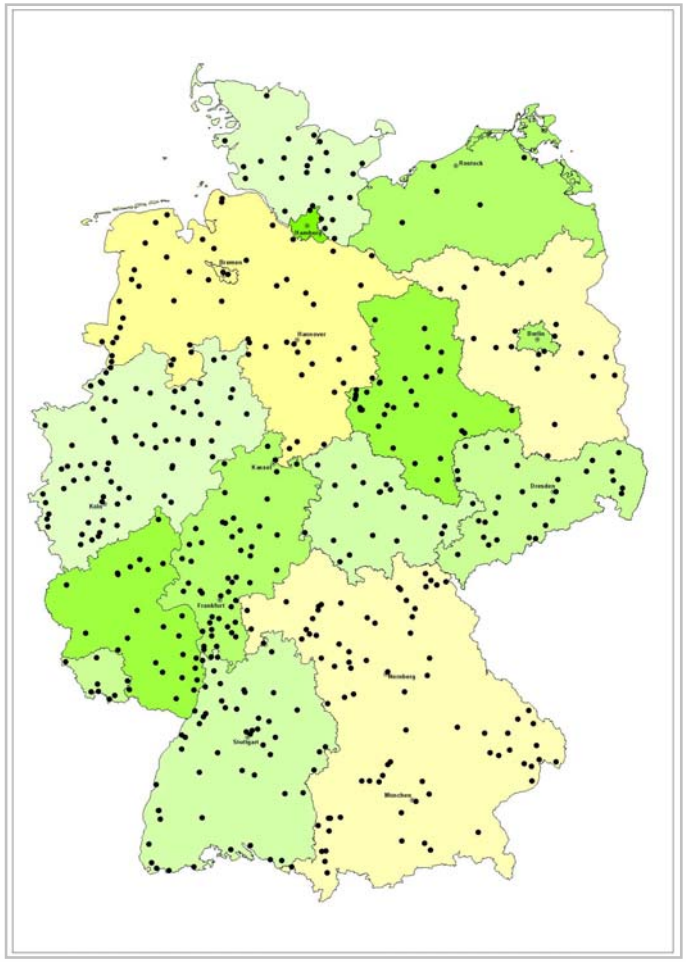
Compost from Biodegradable Waste

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	433
Digestion plants	99 / 8

Compost and Digestate Products in 2009

Input amounts in 2009

		t/a
RAL-GZ 251	Compost	5.800.000
RAL-GZ 245	Digestate product from biowaste	2.070.000
RAL-GZ 246	Digestate product from renewable energy plant	330.000

Compost Quality – valuable criteria

Parameter	Average of 2006	Average of 2007
OM_{LOI} [%]	38.9	39.1
N_t [% / dm]	1.39	1.40
P_2O_5 [% / dm]	0.66	0.67
K_2O [% / dm]	1.16	1.15
MgO_t [% / dm]	0.71	0.70
CaO [% / dm]	4.08	3.80
NH_4-N+NO_3-N [mg/l FM]	255	242
Salt content [gl FM]	4.62	4.64
pH-value	7.60	7.60

Compost - environmental criteria

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

Compost - environmental criteria

Parameter	Green-waste	Bio-waste	Green/Bio-waste	Limit values	
Samples	947	288	1.519	Type 1	Type 2
Pb [mg /kg dm]	32.6	41.4	38.0	**100**	**150**
Cd [mg /kg dm]	0.40	0.45	0.44	**1.0**	**1.5**
Cr [mg /kg dm]	19.5	23.0	21.9	**70**	**100**
Cu [mg /kg dm]	36.7	53.8	50.2	**70**	**100**
Ni [mg /kg dm]	12.3	13.3	13.6	**35**	**50**
Zn [mg /kg dm]	148.0	193.0	177.0	**300**	**400**
Hg [mg /kg dm]	0.11	0.11	0.11	**0.7**	**1.0**

Quality of Compost and Digestate

Compost quality

Due to the homogenous input material for compost (98 % of separately collected biowaste from households and park and garden waste) the quality characteristics are constant.

Digestate quality

There is a great variance in the quality of digestate residuals due to the different types of input materials (manure, food residues from industry, renewable energy plants and separately collected biowaste).

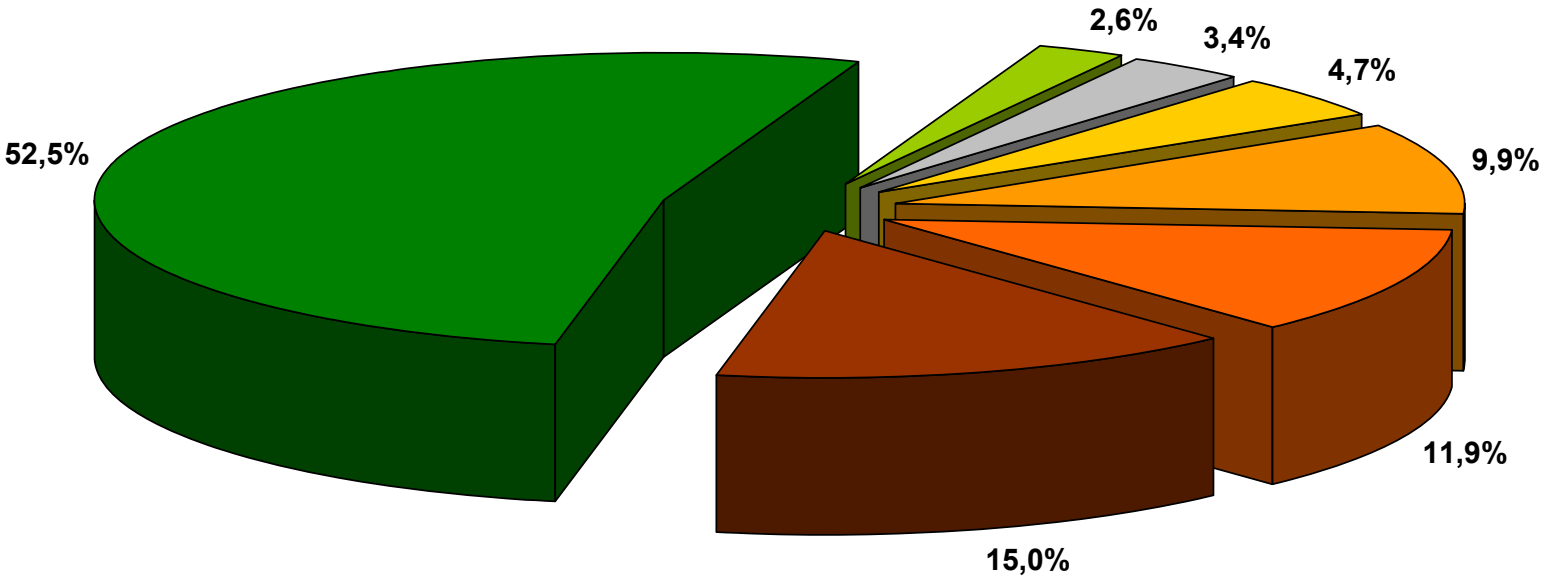
Digestate Quality – Valuable Criteria

	Liquid				Solid			
Parameter	**2003**	**2007**	**10th**	**90th**	**2003**	**2007**	**10th**	**90th**
OM_{LOI} [%]	63.4	66.5	49.5	77.7	51.2	56.6	37.4	67.3
N_t [% / dm]	7.9	10.4	2.6	17.3	2.3	3.1	1.1	4.2
P_2O_5 [% / dm]	2.9	3.6	1.1	6.0	1.4	1.7	0.9	4.4
K_2O [% / dm]	4.4	4.9	2.4	8.3	0.9	1.1	0.7	3.0
MgO_t [% / dm]	0.9	0.7	0.4	1.8	0.9	0.9	0.7	1.4
CaO [% / dm]	5.6	4.4	2.6	10.8	7.5	5.8	2.8	20.5
NH_4-N+NO_3-N [mg/l FM]	2521	3030	1256	4624	1011	744	93	2438
Salt content [gl FM]	14.7	18.4	8.2	25.8	5.7	5.8	2.5	11.7
pH-value	7.9	8.0	7.4	8.4	7.8	8.0	7.2	8.5
Sample amounts	143	433			64	69		

Digestate - Environmental Criteria

	Liquid				Solid			
Parameter	**2003**	**2007**	**10th**	**90th**	**2003**	**2007**	**10th**	**90th**
Impurities > 2mm [% dm]	0.0	0.0	0.0	0.12	0.0	0.1	0.0	0.5
Stone > 5mm [% / dm]	0.0	0.0	0.0	0.01	0.0	0.0	0.0	2.0
Pb [mg /kg dm]	7.7	6.0	3.0	48.9	39.1	25.0	8.1	51.1
Cd [mg /kg dm]	0.3	0.3	0.2	0.6	0.5	0.6	0.2	1.2
Cr [mg /kg dm]	15.1	12.6	6.0	34.6	23.8	19.0	6.0	43.2
Cu [mg /kg dm]	90.6	78.0	35.7	394	49.0	51.0	22.4	74.7
Ni [mg /kg dm]	15.0	11.2	6.1	27.9	18.9	13.1	3.0	28.0
Zn [mg /kg dm]	376	334	187	829	191	234	97.3	351
Hg [mg /kg dm]	0.1	0.1	0.0	0.4	0.1	0.1	0.0	0.5
Analyses amount	143	433			64	69		

Marketing Structure



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 feritliser, soil improver and substrates

Humuswirtschaft & Kompost - printed version 2 times a year

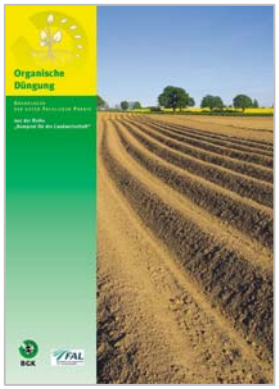
Humuswirtschaft & Kompost *Aktuell* – online version monthly

Application brochures (4 pages) -

Hobby gardening, market gardening, landscaping etc.

Comprehensive brochures (20 – 30 pages) -

Organic fertilising in cropping systems,
Compost application in landscaping

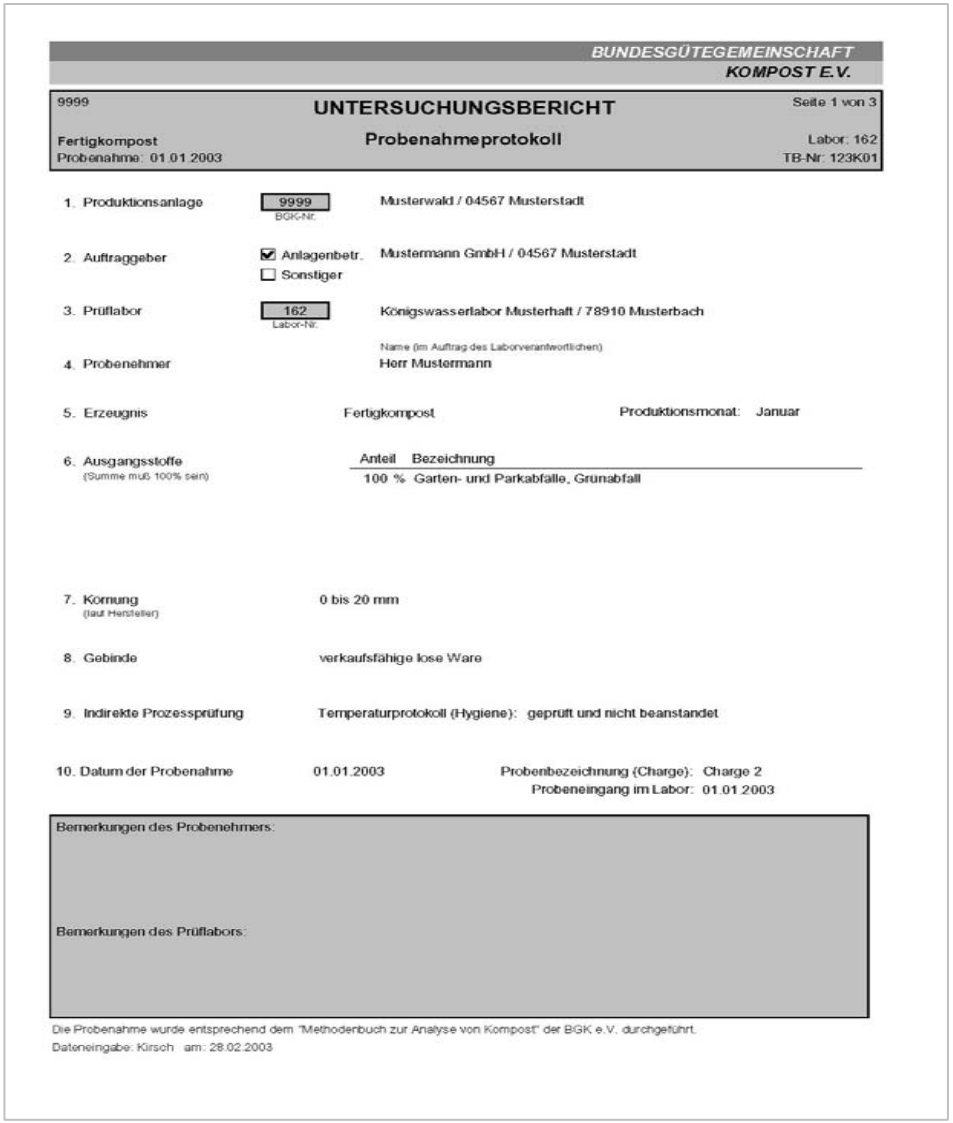


Website **www.kompost.de**

Analysis report

Page 1

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



BUNDESGÜTEGEMEINSCHAFT
KOMPOST E.V.

9999 — **UNTERSUCHUNGSBERICHT** — Seite 1 von 3

Fertigkompost — **Probenahmeprotokoll** — Labor: 162
Probenahme: 01.01.2003 — TB-Nr: 123K01

1. Produktionsanlage: 9999 (BGK-Nr.) — Musterwald / 04567 Musterstadt
2. Auftraggeber: ☑ Anlagenbetr. ☐ Sonstiger — Mustermann GmbH / 04567 Musterstadt
3. Prüflabor: 162 (Labor-Nr.) — Königswasserlabor Musterhaft / 78910 Musterbach
4. Probenehmer (Name (im Auftrag des Laborverantwortlichen)): Herr Mustermann
5. Erzeugnis: Fertigkompost — Produktionsmonat: Januar
6. Ausgangsstoffe (Summe muß 100% sein):

Anteil	Bezeichnung
100 %	Garten- und Parkabfälle, Grünabfall

7. Körnung (laut Hersteller): 0 bis 20 mm
8. Gebinde: verkaufsfähige lose Ware
9. Indirekte Prozessprüfung: Temperaturprotokoll (Hygiene): geprüft und nicht beanstandet
10. Datum der Probenahme: 01.01.2003 — Probenbezeichnung (Charge): Charge 2
Probeneingang im Labor: 01.01.2003

Bemerkungen des Probenehmers:

Bemerkungen des Prüflabors:

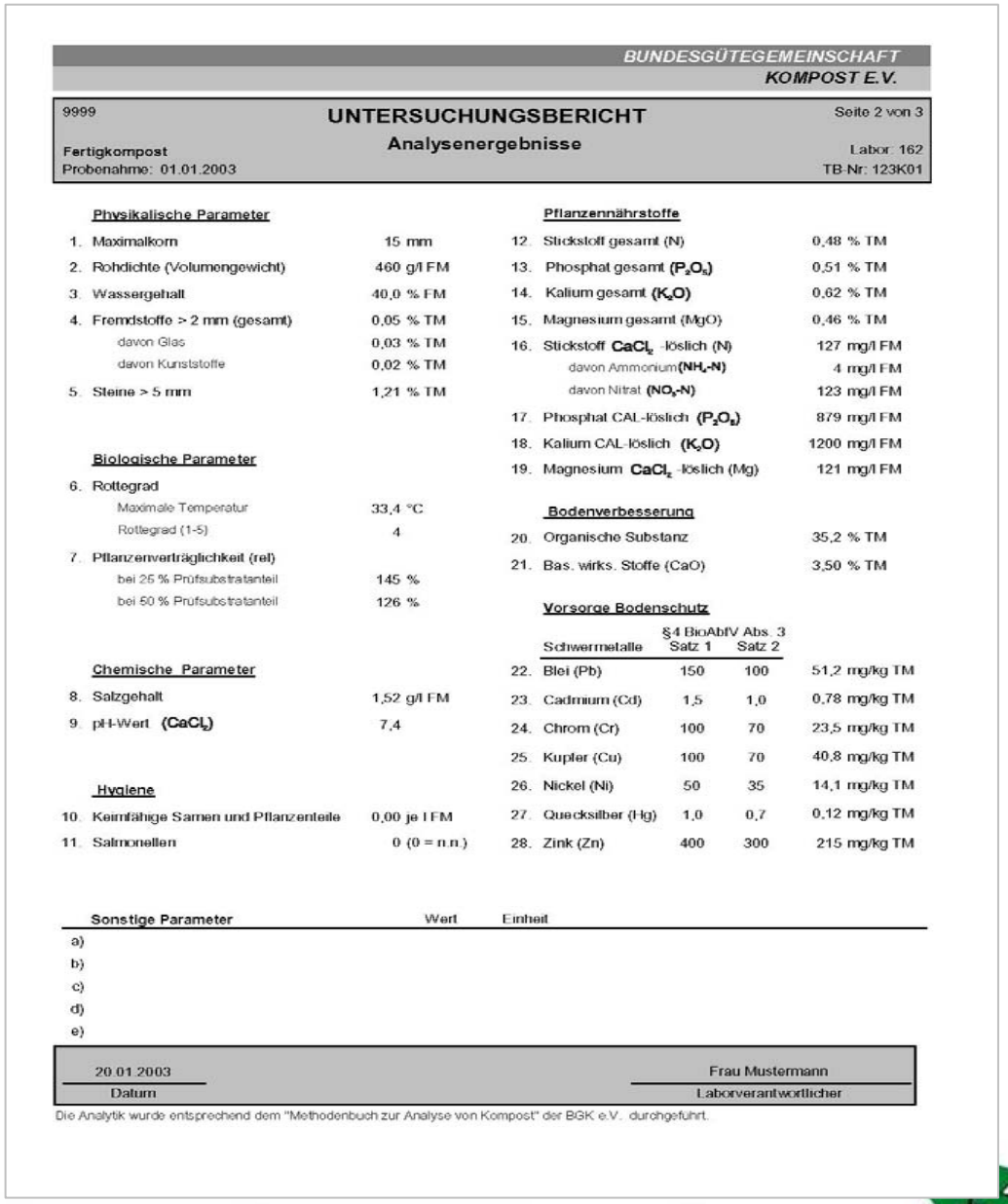
Die Probenahme wurde entsprechend dem "Methodenbuch zur Analyse von Kompost" der BGK e.V. durchgeführt.
Dateneingabe: Kirsch am: 28.02.2003

Analysis report

Page 2

Analysis results:

- Physical parameter
- Biological parameter
- Chemical parameter
- Plant nutrients
- Soil improving parameters
- Heavy metals



BUNDESGÜTEGEMEINSCHAFT KOMPOST E.V.

9999 — **UNTERSUCHUNGSBERICHT** — Seite 2 von 3

Analysenergebnisse

Fertigkompost
Probenahme: 01.01.2003

Labor: 162
TB-Nr: 123K01

Physikalische Parameter

1.	Maximalkorn	15 mm
2.	Rohdichte (Volumengewicht)	460 g/l FM
3.	Wassergehalt	40,0 % FM
4.	Fremdstoffe > 2 mm (gesamt)	0,05 % TM
	davon Glas	0,03 % TM
	davon Kunststoffe	0,02 % TM
5.	Steine > 5 mm	1,21 % TM

Biologische Parameter

6.	Rottegrad	
	Maximale Temperatur	33,4 °C
	Rottegrad (1-5)	4
7.	Pflanzenverträglichkeit (rel)	
	bei 25 % Prüfsubstratanteil	145 %
	bei 50 % Prüfsubstratanteil	126 %

Chemische Parameter

8.	Salzgehalt	1,52 g/l FM
9.	pH-Wert ($CaCl_2$)	7,4

Hygiene

10.	Keimfähige Samen und Pflanzenteile	0,00 je l FM
11.	Salmonellen	0 (0 = n.n.)

Pflanzennährstoffe

12.	Stickstoff gesamt (N)	0,48 % TM
13.	Phosphat gesamt (P_2O_5)	0,51 % TM
14.	Kalium gesamt (K_2O)	0,62 % TM
15.	Magnesium gesamt (MgO)	0,46 % TM
16.	Stickstoff $CaCl_2$ -löslich (N)	127 mg/l FM
	davon Ammonium (NH_4-N)	4 mg/l FM
	davon Nitrat (NO_3-N)	123 mg/l FM
17.	Phosphat CAL-löslich (P_2O_5)	879 mg/l FM
18.	Kalium CAL-löslich (K_2O)	1200 mg/l FM
19.	Magnesium $CaCl_2$ -löslich (Mg)	121 mg/l FM

Bodenverbesserung

20.	Organische Substanz	35,2 % TM
21.	Bas. wirks. Stoffe (CaO)	3,50 % TM

Vorsorge Bodenschutz

	Schwermetalle	§4 BioAbfV Abs. 3 Satz 1	Satz 2	
22.	Blei (Pb)	150	100	51,2 mg/kg TM
23.	Cadmium (Cd)	1,5	1,0	0,78 mg/kg TM
24.	Chrom (Cr)	100	70	23,5 mg/kg TM
25.	Kupfer (Cu)	100	70	40,8 mg/kg TM
26.	Nickel (Ni)	50	35	14,1 mg/kg TM
27.	Quecksilber (Hg)	1,0	0,7	0,12 mg/kg TM
28.	Zink (Zn)	400	300	215 mg/kg TM

Sonstige Parameter	Wert	Einheit
a)		
b)		
c)		
d)		
e)		

20.01.2003 (Datum) — Frau Mustermann (Laborverantwortlicher)

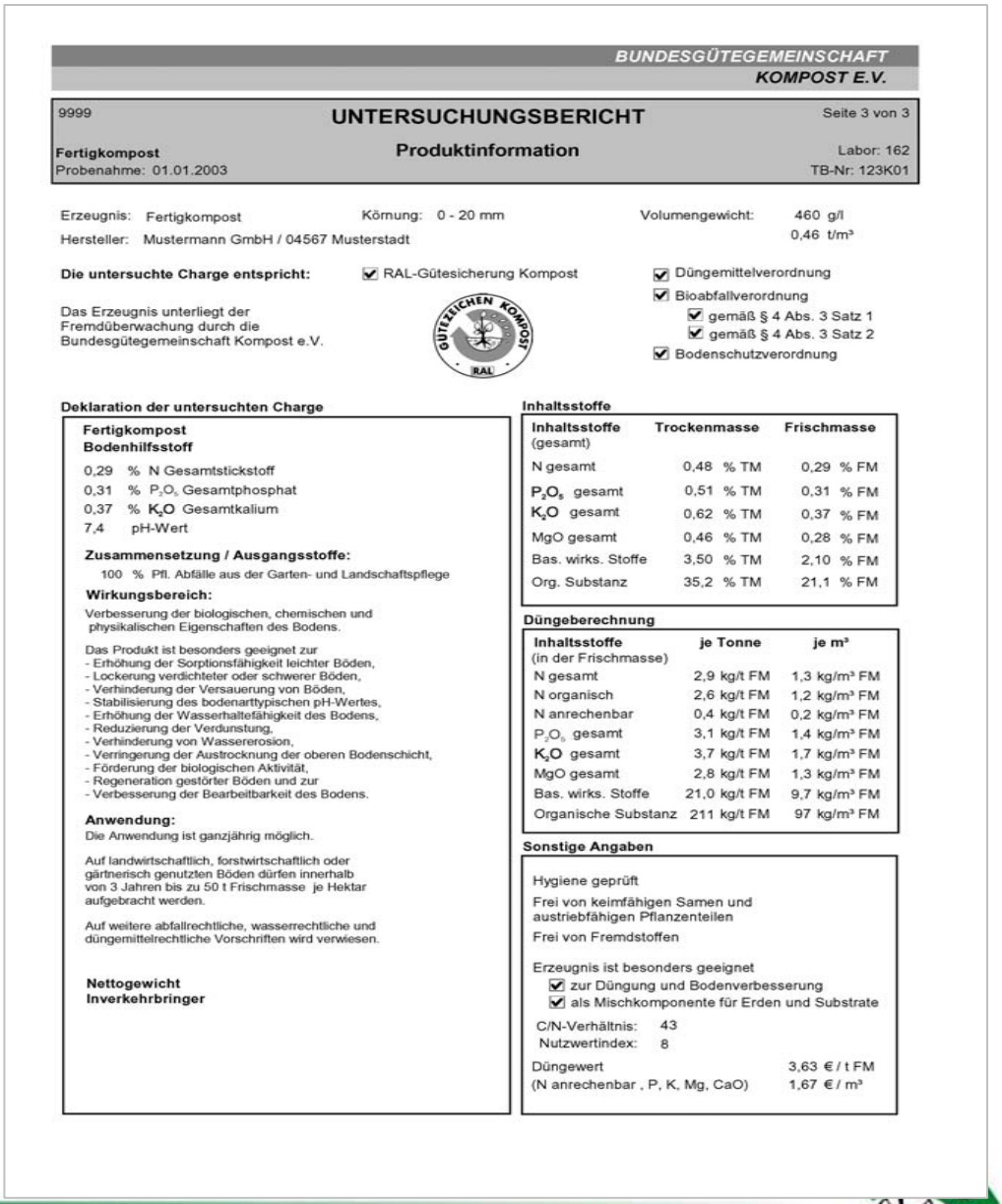
Die Analytik wurde entsprechend dem "Methodenbuch zur Analyse von Kompost" der BGK e.V. durchgeführt.

Analysis report

Page 3

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



BUNDESGÜTEGEMEINSCHAFT KOMPOST E.V.

9999 — **UNTERSUCHUNGSBERICHT** — Seite 3 von 3

Fertigkompost — **Produktinformation** — Labor: 162
Probenahme: 01.01.2003 — TB-Nr: 123K01

Erzeugnis: Fertigkompost — Körnung: 0 - 20 mm — Volumengewicht: 460 g/l
Hersteller: Mustermann GmbH / 04567 Musterstadt — 0,46 t/m³

Die untersuchte Charge entspricht: ☑ RAL-Gütesicherung Kompost

Das Erzeugnis unterliegt der Fremdüberwachung durch die Bundesgütegemeinschaft Kompost e.V.

☑ Düngemittelverordnung
☑ Bioabfallverordnung
☑ gemäß § 4 Abs. 3 Satz 1
☑ gemäß § 4 Abs. 3 Satz 2
☑ Bodenschutzverordnung

Deklaration der untersuchten Charge

Fertigkompost
Bodenhilfsstoff

0,29 % N Gesamtstickstoff
0,31 % P_2O_5 Gesamtphosphat
0,37 % K_2O Gesamtkalium
7,4 pH-Wert

Zusammensetzung / Ausgangsstoffe:
100 % Pfl. Abfälle aus der Garten- und Landschaftspflege

Wirkungsbereich:
Verbesserung der biologischen, chemischen und physikalischen Eigenschaften des Bodens.

Das Produkt ist besonders geeignet zur
- Erhöhung der Sorptionsfähigkeit leichter Böden,
- Lockerung verdichteter oder schwerer Böden,
- Verhinderung der Versauerung von Böden,
- Stabilisierung des bodenarttypischen pH-Wertes,
- Erhöhung der Wasserhaltefähigkeit des Bodens,
- Reduzierung der Verdunstung,
- Verhinderung von Wassererosion,
- Verringerung der Austrocknung der oberen Bodenschicht,
- Förderung der biologischen Aktivität,
- Regeneration gestörter Böden und zur
- Verbesserung der Bearbeitbarkeit des Bodens.

Anwendung:
Die Anwendung ist ganzjährig möglich.

Auf landwirtschaftlich, forstwirtschaftlich oder gärtnerisch genutzten Böden dürfen innerhalb von 3 Jahren bis zu 50 t Frischmasse je Hektar aufgebracht werden.

Auf weitere abfallrechtliche, wasserrechtliche und düngemittelrechtliche Vorschriften wird verwiesen.

Nettogewicht
Inverkehrbringer

Inhaltsstoffe

Inhaltsstoffe (gesamt)	Trockenmasse	Frischmasse
N gesamt	0,48 % TM	0,29 % FM
P_2O_5 gesamt	0,51 % TM	0,31 % FM
K_2O gesamt	0,62 % TM	0,37 % FM
MgO gesamt	0,46 % TM	0,28 % FM
Bas. wirks. Stoffe	3,50 % TM	2,10 % FM
Org. Substanz	35,2 % TM	21,1 % FM

Düngeberechnung

Inhaltsstoffe (in der Frischmasse)	je Tonne	je m³
N gesamt	2,9 kg/t FM	1,3 kg/m³ FM
N organisch	2,6 kg/t FM	1,2 kg/m³ FM
N anrechenbar	0,4 kg/t FM	0,2 kg/m³ FM
P_2O_5 gesamt	3,1 kg/t FM	1,4 kg/m³ FM
K_2O gesamt	3,7 kg/t FM	1,7 kg/m³ FM
MgO gesamt	2,8 kg/t FM	1,3 kg/m³ FM
Bas. wirks. Stoffe	21,0 kg/t FM	9,7 kg/m³ FM
Organische Substanz	211 kg/t FM	97 kg/m³ FM

Sonstige Angaben

Hygiene geprüft
Frei von keimfähigen Samen und austriebfähigen Pflanzenteilen
Frei von Fremdstoffen

Erzeugnis ist besonders geeignet
☑ zur Düngung und Bodenverbesserung
☑ als Mischkomponente für Erden und Substrate

C/N-Verhältnis: 43
Nutzwertindex: 8

Düngewert (N anrechenbar , P, K, Mg, CaO): 3,63 € / t FM; 1,67 € / m³

Documentation of Analysis Results

Dokumentation von Untersuchungsergebnissen im Rahmen der Gütesicherung Kompost (RAL-GZ 251)

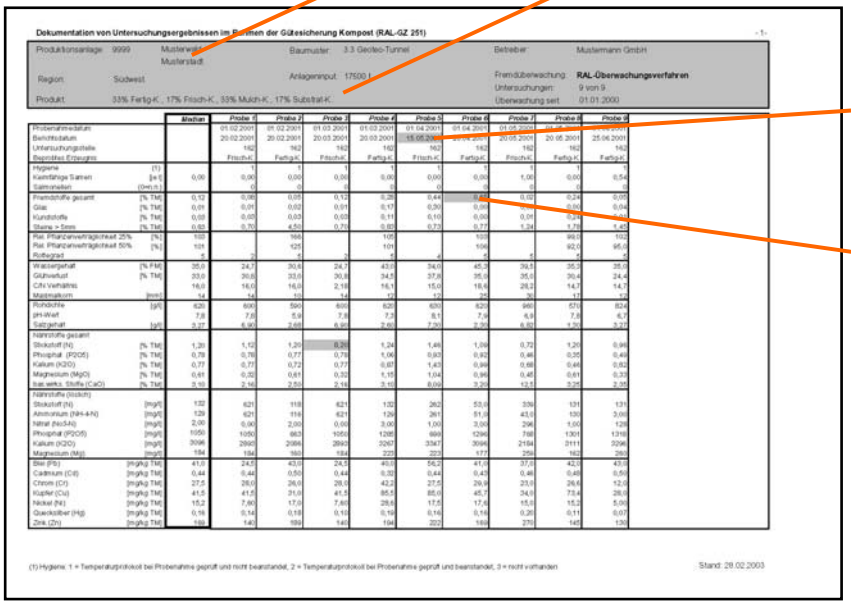
Produktionsanlage:	9999 Musterwald Musterstadt	Baumuster:	3.3 Geotec-Tunnel	Betreiber:	Mustermann GmbH
Region:	Südwest	Anlageninput:	17500 t	Fremdüberwachung: Untersuchungen:	**RAL-Überwachungsverfahren** 9 von 9
Produkt:	33% Fertig-K., 17% Frisch-K., 33% Mulch-K., 17% Substrat-K.			Überwachung seit:	01.01.2000

		Median	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Probe 6	Probe 7	Probe 8	Probe 9
Probenahmedatum			01.02.2001	01.02.2001	01.03.2001	01.03.2001	01.04.2001	01.04.2001	01.05.2001	01.05.2001	01.06.2001
Berichtsdatum			20.02.2001	20.02.2001	20.03.2001	20.03.2001	15.05.2001	20.04.2001	20.05.2001	20.05.2001	25.06.2001
Untersuchungsstelle			162	162	162	162	162	162	162	162	162
Beprobtes Erzeugnis			Frisch-K.	Fertig-K.	Frisch-K.	Fertig-K.	Frisch-K.	Fertig-K.	Frisch-K.	Fertig-K.	Fertig-K.
Hygiene	(1)		1	1	1	1	1	1	1	1	1
Keimfähige Samen	[je l]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,54
Salmonellen	(0=n.n.)		0	0	0	0	0	0	0	0	0
Fremdstoffe gesamt	[% TM]	0,12	0,08	0,05	0,12	0,28	0,44	0,65	0,02	0,24	0,05
Glas	[% TM]	0,01	0,01	0,02	0,01	0,17	0,30	0,00	0,00	0,00	0,04
Kunststoffe	[% TM]	0,03	0,03	0,03	0,03	0,11	0,10	0,00	0,01	0,24	0,01
Steine > 5mm	[% TM]	0,83	0,70	4,50	0,70	0,83	0,73	0,77	1,24	1,78	1,45
Rel. Pflanzenverträglichkeit 25%	[%]	103		166		105		103		99,0	102
Rel. Pflanzenverträglichkeit 50%	[%]	101		125		101		106		92,0	95,0
Rottegrad		5	2	5	2	5	4	5	5	5	5
Wassergehalt	[% FM]	35,0	24,7	30,6	24,7	43,0	34,0	45,3	39,5	35,3	35,0
Glühverlust	[% TM]	33,0	30,8	33,0	30,8	34,5	37,8	35,0	35,0	30,4	24,4
C/N Verhältnis		16,0	16,0	16,0	2,18	16,1	15,0	18,6	28,2	14,7	14,7
Maximalkorn	[mm]	14	14	10	14	12	12	25	30	17	12
Rohdichte	[g/l]	620	600	590	600	620	630	620	960	570	824
pH-Wert		7,8	7,8	5,9	7,8	7,3	8,1	7,9	6,9	7,8	6,7
Salzgehalt	[g/l]	3,27	6,90	2,68	6,90	2,60	7,30	2,30	6,82	1,30	3,27
Nährstoffe gesamt											
Stickstoff (N)	[% TM]	1,20	1,12	1,20	8,20	1,24	1,46	1,09	0,72	1,20	0,96
Phosphat (P2O5)	[% TM]	0,78	0,78	0,77	0,78	1,06	0,93	0,92	0,46	0,35	0,49
Kalium (K2O)	[% TM]	0,77	0,77	0,72	0,77	0,87	1,43	0,99	0,68	0,46	0,82
Magnesium (MgO)	[% TM]	0,61	0,32	0,61	0,32	1,15	1,04	0,96	0,45	0,61	0,33
bas.wirks. Stoffe (CaO)	[% TM]	3,10	2,16	2,50	2,16	3,10	8,09	3,20	12,5	3,25	2,35
Nährstoffe (löslich)											
Stickstoff (N)	[mg/l]	132	621	118	621	132	262	53,0	339	131	131
Ammonium (NH-4-N)	[mg/l]	129	621	116	621	129	261	51,0	43,0	130	3,00
Nitrat (No3-N)	[mg/l]	2,00	0,00	2,00	0,00	3,00	1,00	3,00	296	1,00	128
Phosphat (P2O5)	[mg/l]	1050	1050	663	1050	1285	699	1296	768	1301	1318
Kalium (K2O)	[mg/l]	3096	2893	2086	2893	3267	3347	3096	2184	3111	3296
Magnesium (Mg)	[mg/l]	184	184	160	184	223	223	177	259	162	260
Blei (Pb)	[mg/kg TM]	41,0	24,5	43,0	24,5	40,0	56,2	41,0	37,0	42,0	43,0
Cadmium (Cd)	[mg/kg TM]	0,44	0,44	0,50	0,44	0,32	0,44	0,43	0,46	0,48	0,50
Chrom (Cr)	[mg/kg TM]	27,5	28,0	26,0	28,0	42,2	27,5	29,9	23,0	26,6	12,0
Kupfer (Cu)	[mg/kg TM]	41,5	41,5	31,0	41,5	85,5	85,0	45,7	34,0	73,4	28,0
Nickel (Ni)	[mg/kg TM]	15,2	7,60	17,0	7,60	28,6	17,5	17,6	15,0	15,2	5,00
Quecksilber (Hg)	[mg/kg TM]	0,16	0,14	0,18	0,10	0,19	0,16	0,16	0,20	0,11	0,07
Zink (Zn)	[mg/kg TM]	169	140	189	140	194	222	169	270	145	130

(1) Hygiene: 1 = Temperaturprotokoll bei Probenahme geprüft und nicht beanstandet, 2 = Temperaturprotokoll bei Probenahme geprüft und beanstandet, 3 = nicht vorhanden

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**

Sample taking in practice

1. Basics of sample taking
2. Terms and definitions
3. Steps of sample taking
   - Sampling equipment
   - Sample taking types
   - Collective and lab sample
   - Transport/shipment
4. Cleaning of the sampling equipment

1. Basics of sample taking

- „Sample taking“ stands for the removal of a small portion from a large bulk material for the purpose of examination, where all properties of this portion (sample) must match with the properties of the main material mass.

- The drawn sample must be **r e p r e s e n t a t i v e** for the sampled material!

1. Basics of sample taking

- An exact analysis doesn't make sense, when the sample taking is incorrect.

- **A correct sample taking with the smallest possible failure is for a accurate evaluation of**
  - **major relevance!!!**

Proportion batch to sample quantity

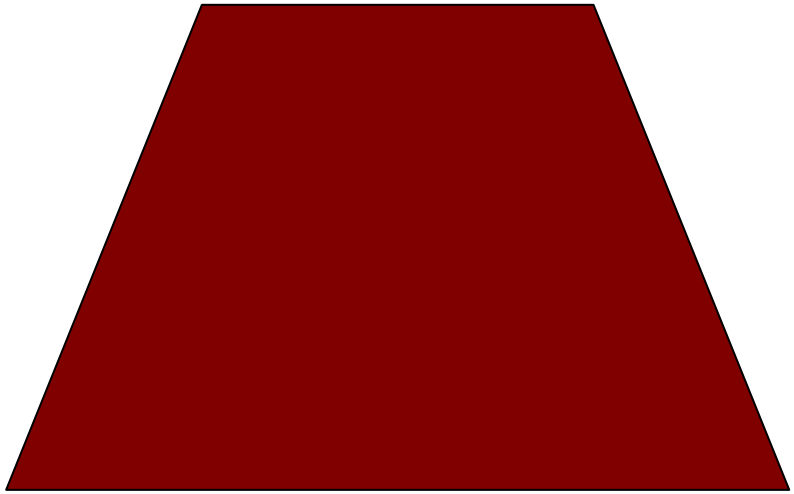
BATCH → **SAMPLE**(Lab) → **ANALYSIS**

300 Mg

=300.000 kg

=20 l

=10 g

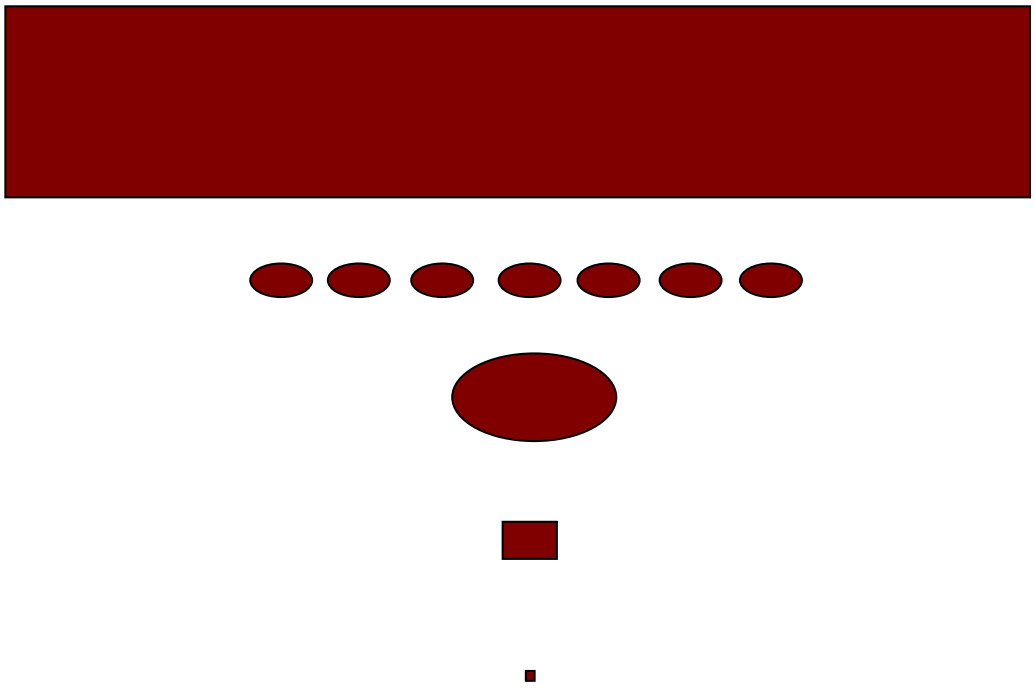


Terms and definitions

According to BGK methods book

- **BATCH**: Quantity of a fertilisier which reflects a UNIT according to composition, labeling and spatial location.
- **SPOT SAMPLE:** Small portion of a batch, which is formed a removal operation
- **COLLECTIVE SAMPLE**: Total quantitiy of all spot samples from a batch.
- **FINAL SAMPLE**: Small portion of a collective sample or a reduced collective sample determinated for the examination.

Definition of sample types



Batch

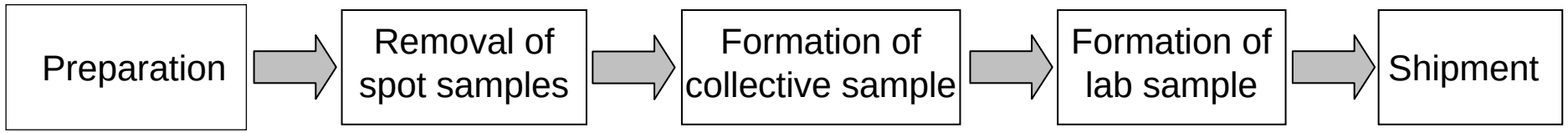
Spot samples

Collective sample

Lab sample

Test sample

2. Steps of a sample taking



- **Consideraton of the specification for sample taking**
- **Determination of the sample taking strategy**
- **with liquid materials:**
  1. Mixing up of the container
  2. Cleaning of dead storage areas
- **Documentation in the sample taking protocol**

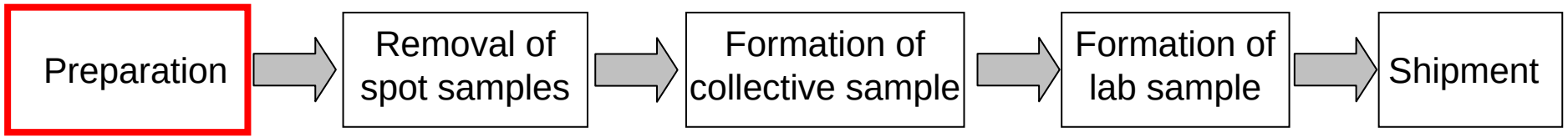
- **Use of suitable sampling equipement**
- **Representative distribution of the extraction points**

- **Merging of the spot samples**
- **Homogenisation**

- **Reduction of the collective samples**
- **Untilisation of suitable sampling containers**
- **bottling of lab samples**

- **Packaging of lab samples**
- **Shipment in 24 h to the lab**
- **If needed: cool sample**

Steps of a sample taking



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Specifications for sample taking

Reason for the examination

- External monitoring
- Self monitoring

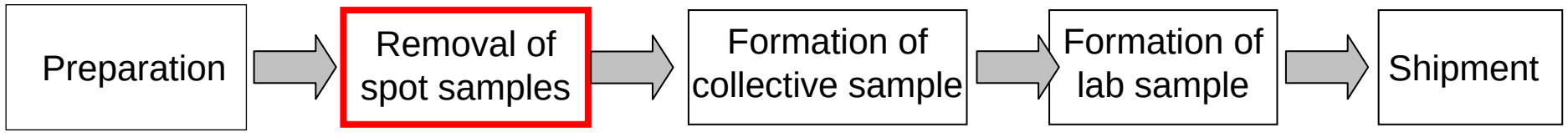
Sampling location

- Compost/biogas plant
- Ohter treatment plant

Examination parameter

- Valuable material (org. matter, nutrients)
- Heavy metals, Impurities
- Organc compounds (e.g. PFT)
- Microbiological parameter

Steps of a sample taking



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Quantity of the spot samples

The size of spot sample depends on the material:

Solid materials (e.g. composts)

- Grain sizes ≤ 20 mm: minimum **2 litre** per spot sample
- Grain sizes > 20 mm: minimum **3 litre** per spot sample

Liquid materials (e.g. digestates)

- Minimum **1 litre** per spot sample

Number of spot samples

For solid materials (e.g. compost)

- Number of diggings per 2 profiles:

Until 500 m³	1 digging with 2 profiles
Until 1000 m³	2 diggings with 4 profiles

- Number of spot samples per collective sample:

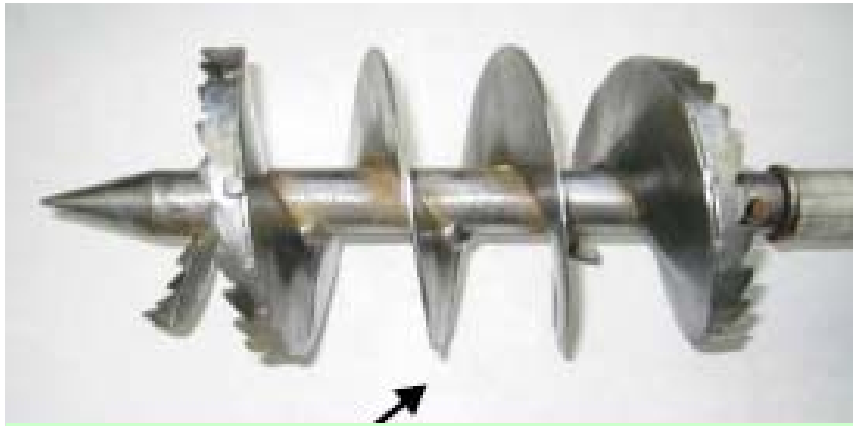
Until 500 m³	20 spot samples
Until 1000 m³	40 spot samples

The collective sample must not be smaller than 40 litre.

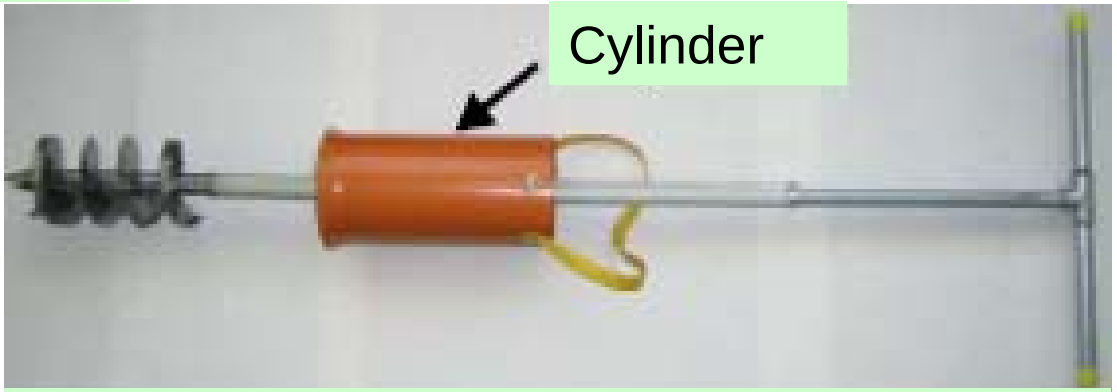
Sample taking tools for solid materials

- SCREW DRILL with minimum 100 mm diameter or portable motor-powered screw drill oder soil auger in form of a screw,
- WHEEL LOADER
- SPADE, SHOVEL
- HOE

Sample taking equipement for solid material



Feed screw with cutting edge



Sample taking equipement for compost (overall view)

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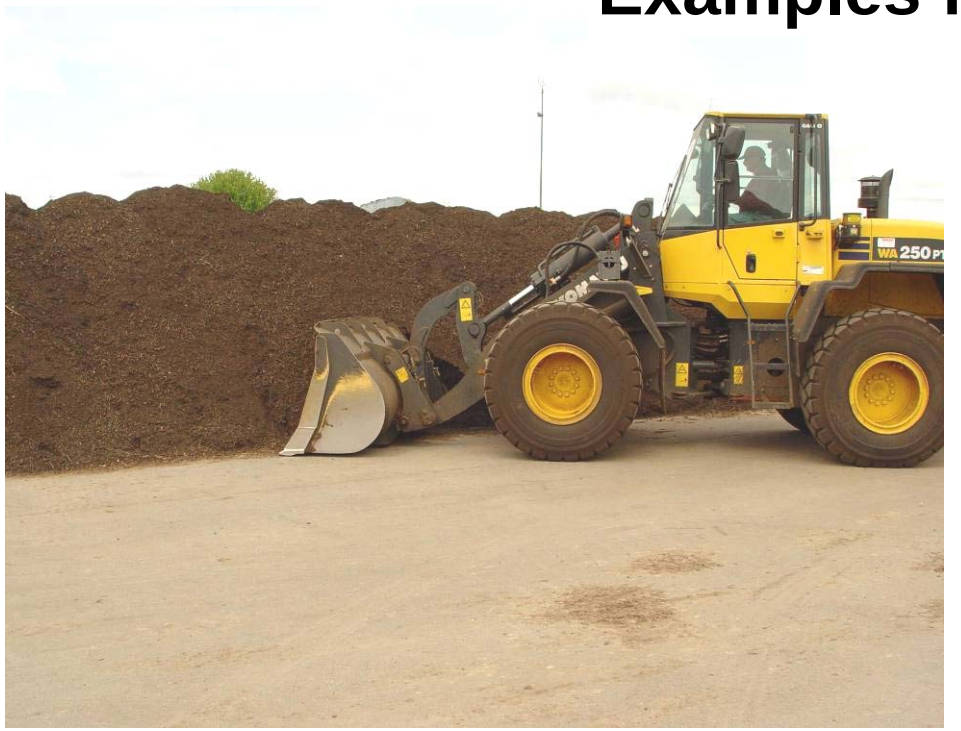
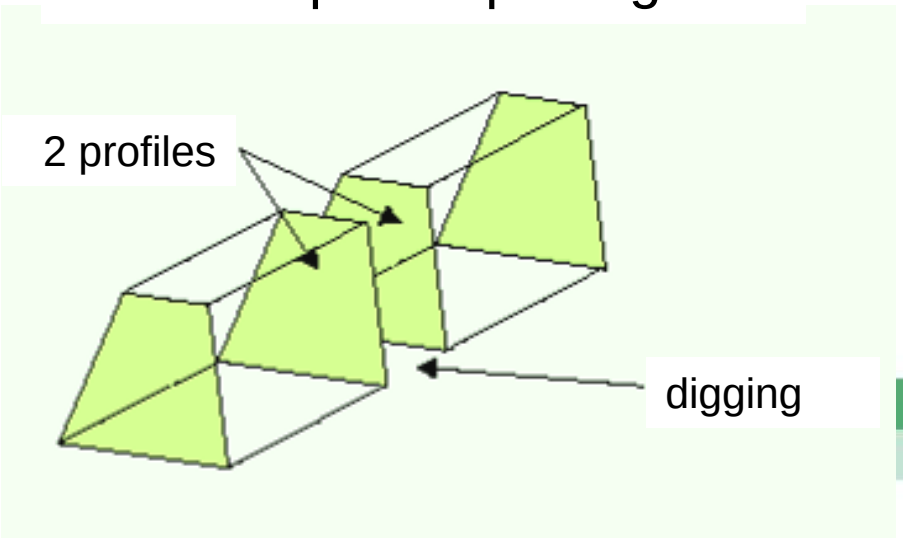
Kompost e.V.

Examples for diggings

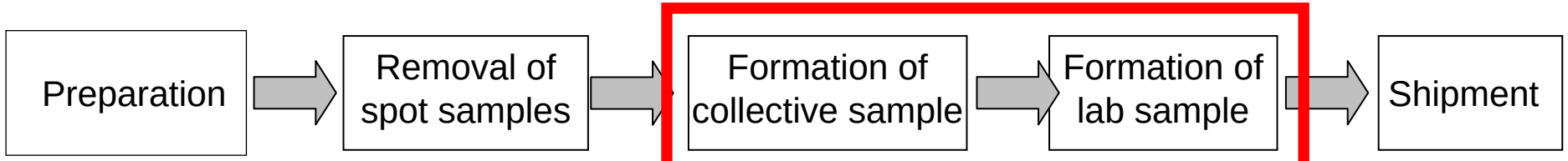


Complete opening



Triangular or incomplete digging

Steps of a sample taking



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Collective sample and lab sample

- The SPOT SAMPLES where merged into a collective sample.
- The minimum volume of the COLLECTIVE SAMPLE may not go below the requirements.
- The COLLECTIVE SAMPLE must be homogenisised.
- The COLLECTIVE SAMPLE must be reduced until the needed quantity for the lab sample (Final sample, original sample) is given.
- The quantitiy of the LAB SAMPLE depends on the material type and the purpose of the examination.
- (Example: Compost 20 l resp. liquid digestate 7-10 l).

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Homogenisation

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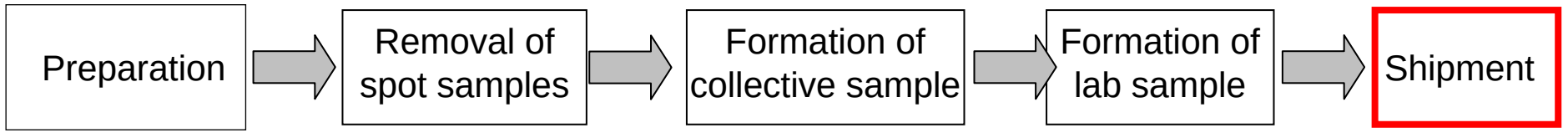
Steps of a sample taking



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Packaging of the lab sample

Sample box:

- dry, tight against humidity,

  largely air tight boxes

    e.g. clean plastic bags minimum 20 l or

    plastic bins with locking ring and rubber lip

Labeling:

- Origin and sampled batch
- Date of sample taking
- Address of the lab

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Sample transport to the lab

- As fast as possible
- Within 24 hours

Cooling (e.g. at high ambient temperature)

if needed (Cooling box)

Cleaning of the sampling equipment

- Sampling equipement has to be efficiently cleaned after each sample taking.
- Sampling material must not be carried over by the sampling equipement.
- Cleaning agents and desinfectants have to be applied according to the manufacturers' instructions.
- Residues must not remain at the equipement.

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