

Composting and Compost use in Organic Farming

Tartu & Tallinn - 4 & 5 October 2017

How to do COMPOSTING in a SIMPLE & SMART way?

Florian Amlinger

Compost – Consulting & Development

100NGO



The characteristics of organic waste materials show a wide variability:

.... Structure/porosity Bulk density C/N ratio
Humidity Fermentability



Key elements of the **ART OF COMPOSTING**



- **Organic feedstock & additives +**
non-compostables / impurities
- **Humidity**
- **Oxygen**
- **[Temperature]**

09/09/2009

What compost do we want to achieve?



Compost from an in-vessel industrial bio-waste treatment facility



Compost from an open windrow composting plant



**Green waste composting in
big table piles
turned only with loader**



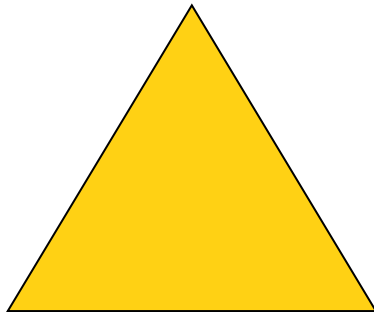
...

**This does not allow for
homogenous and
efficient aerobic
process conditions !!!**



The two contrary digestion processes in nature

AEROBIC



CO₂ Carbon dioxide

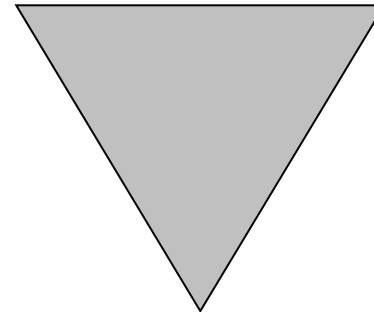
NO₃ Nitrate

PO₃₋₄ Phosphate

SO₂₋₄ Sulfate

BO₃ Borate

ANAEROBIC



CH₄ Methane

NH₃ Ammoniak

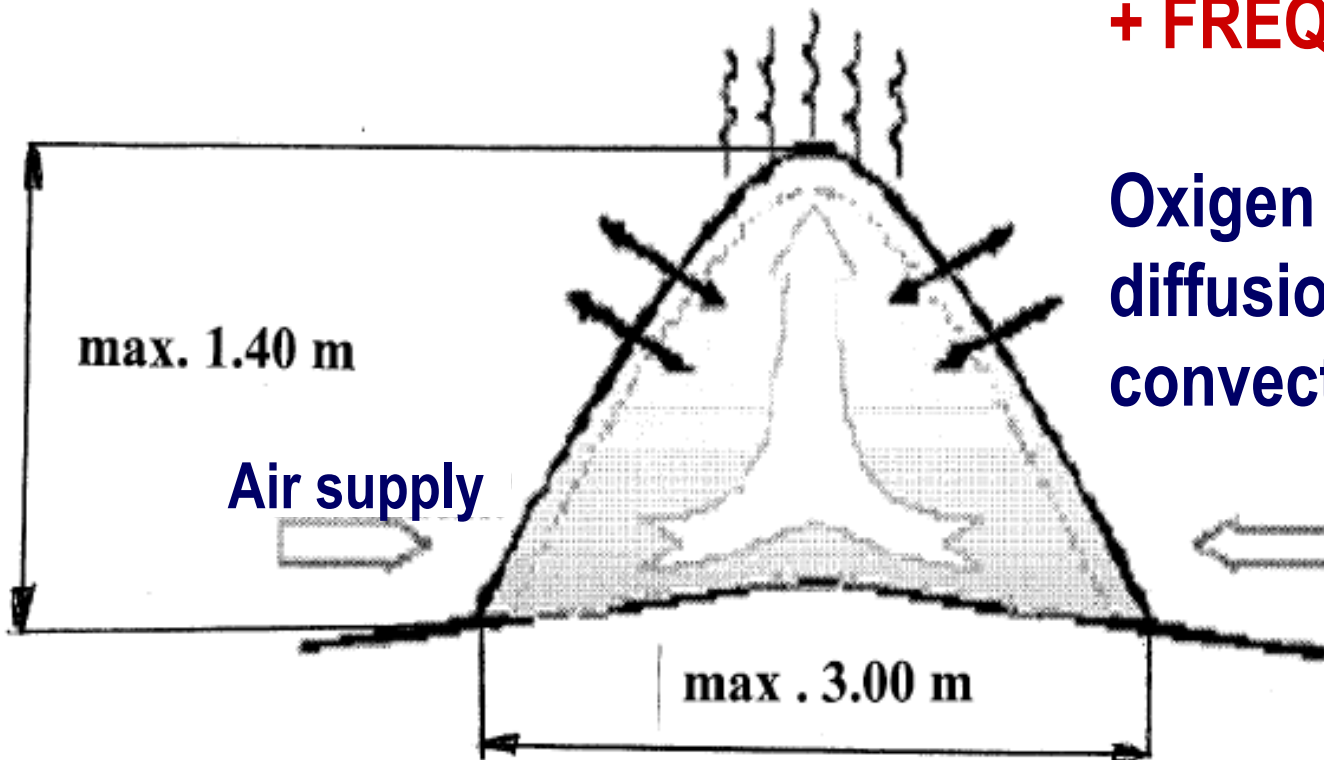
PH₃ Phosphine

H₂S Hydrogen sulfide

BH₃ Borane

Windrow Composting Natural Aeration

Sufficient material structure & pore volume
+ **FREQUENT** turning



Oxygen supply by
diffusion &
convection

The main task: create and maintain the the optimum environment for the transformation & humus build-up process

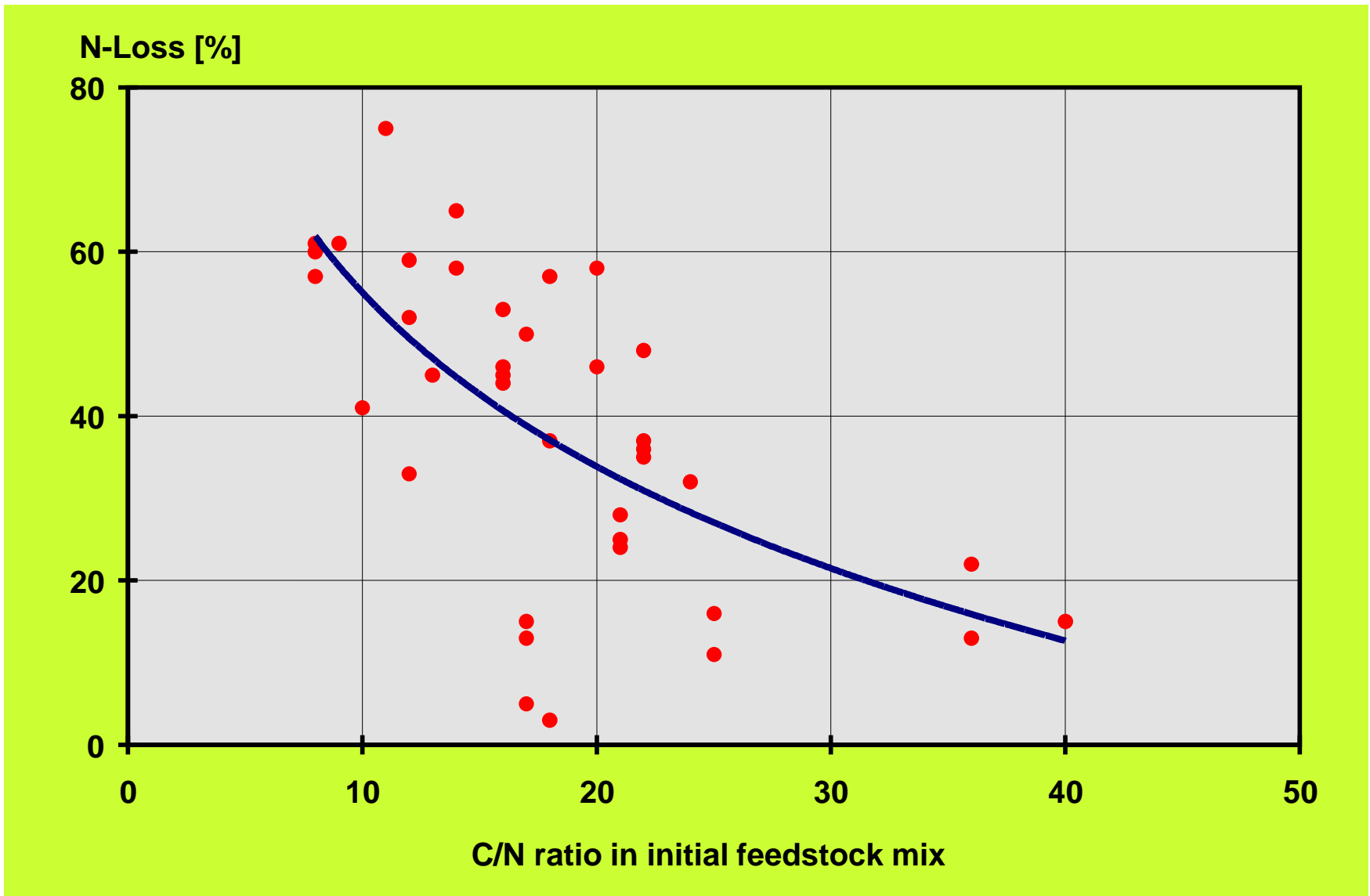


- C : N ratio 25 - 35 : 1
- Addition of **clay SOIL** 10 - 15 %
- Addition of **COMPOST** 10 - 15 %
- Fresh ,green‘ residues min. 15 %
- Bulking agents 30 – 40 %
 - ligneous /hemi-celluloses /C source
 - Structure .. Air filled pore space
- Temperature max. 60-65 °C
- Sufficient OXIGEN min. 5 %
- Maximum CO₂ max. 10 – 12 %
- Humidity 55 – 60 %





N-losses depend also on C/N





Fotos: Hildebrandt, Amlinger

Mixing the „Ingredients“



Fotos: Angelika Lübke-Hildebrandt, Urs Hildebrandt / Urs Landmanagement





Fotos: Amlinger

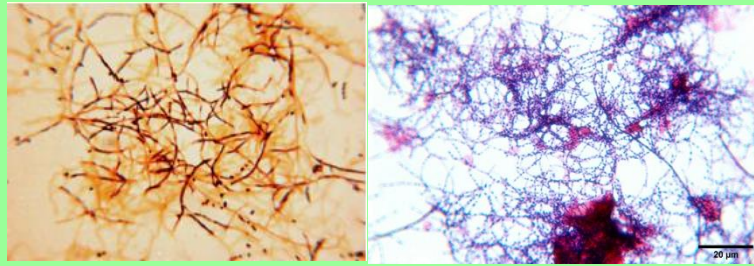


Coprinus - species

Typical fungal stabilisation zones in standard



Thermoactinomyces vulgaris



***Streptomyces*
*Actinomyces***



Aspergillus niger

Managing - Adding Water



- Add water during turning
- Add water slowly
- Ideal 50 – 60%
- Squeeze test
- Too wet = anaerobic/leachate odour/GHG
- Too dry = no decomposition





Foto: Urs Landmanagement

**Watering with a hose pipe or water tank mounted to the turning machine:
the water is sprayed directly into the turned material**

OR

by spraying on top of the compost piles with a vacuum water tank before turning



Foto: Urs Landmanagement



Foto: B. Gamerith; Compost Systems, Austria





Foto: Courtesy of Seiringer
Umwelttechnik GmbH

Optimum Temperature Ranges



for Different Requirements of the Composting Process

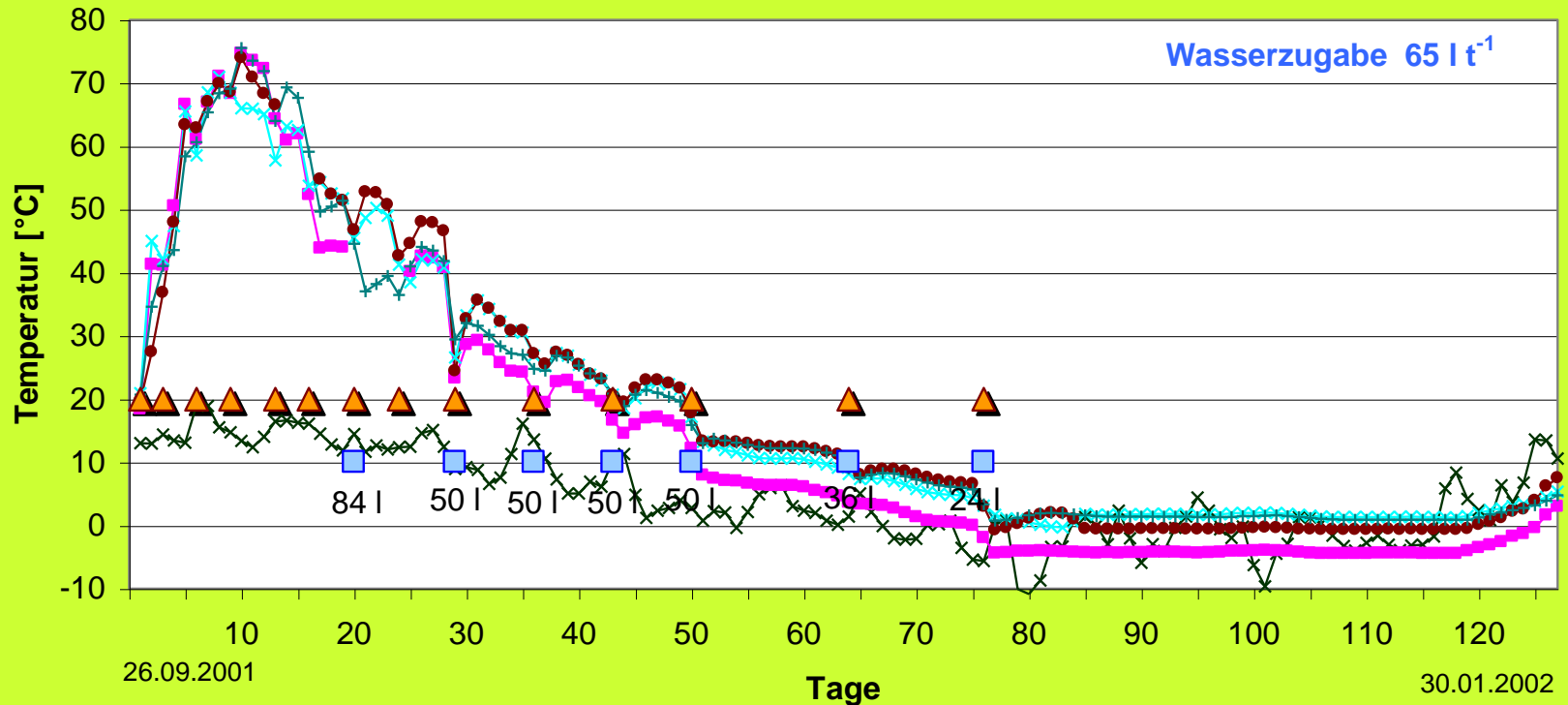
| Process Optimum for | Temperatur Range |
|---|------------------------------------|
| Hygienisation ... [Ordinance: 10 days] | $> 55 \text{ }^{\circ}\text{C}$ |
| Maximum Decomposition Start of formation of fomic substances | $45 - 55 \text{ }^{\circ}\text{C}$ |
| Max. Biodiversity + decomposition of microbial biomass; max. Formation of humic substances | $35 - 40 \text{ }^{\circ}\text{C}$ |



N-Überschuss, feucht, hohe Reaktivität



Temperaturverlauf, Umsetztermine und Wassergaben

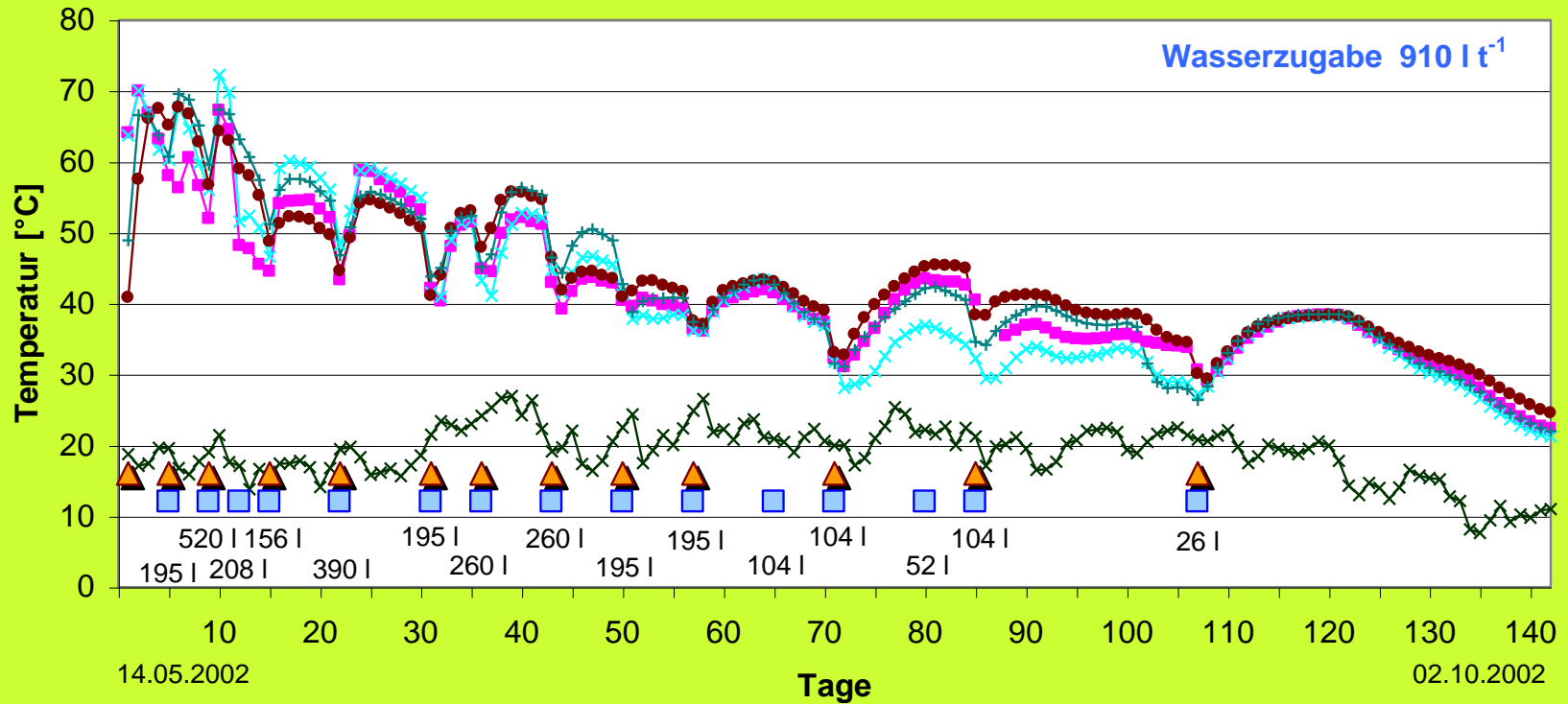


- × Tagesmittel Außentemperatur
- × Tagesmittel Sensor 2 (Scheitel Abluft)
- + Tagesmittel Sensor 4 (Kern Abluft)
- Gießen
- Tagesmittel Sensor 1 (Scheitel Zuluft)
- Tagesmittel Sensor 3 (Kern Zuluft)
- ▲ Aufsetzen/ Umsetzen

Gartenabfall mit C-Überschuss, trocken, geringe Reaktivität



Temperaturverlauf, Umsetztermine und Wassergaben



- x— Tagesmittel Außentemperatur
- x— Tagesmittel Sensor 1 (Scheitel Abluft)
- x— Tagesmittel Sensor 2 (Scheitel Zuluft)
- x— Tagesmittel Sensor 3 (Kern Abluft)
- x— Tagesmittel Sensor 4 (Kern Zuluft)
- x— Aufsetzen/ Umsetzen
- Gießen



- **ABP-Regulation (EC) 1069/2009**
 - Does not apply for *green waste*
 - National rules for *catering waste* (households, restaurants)
 - Exception from 70 °C / 1hr / at 12mm particle size
 - **OPEN WINDROW Composting → OK**
 - ... if all the material in the system is exposed over the required time to a defined temperature level
→ **TURNING // MONITORING**

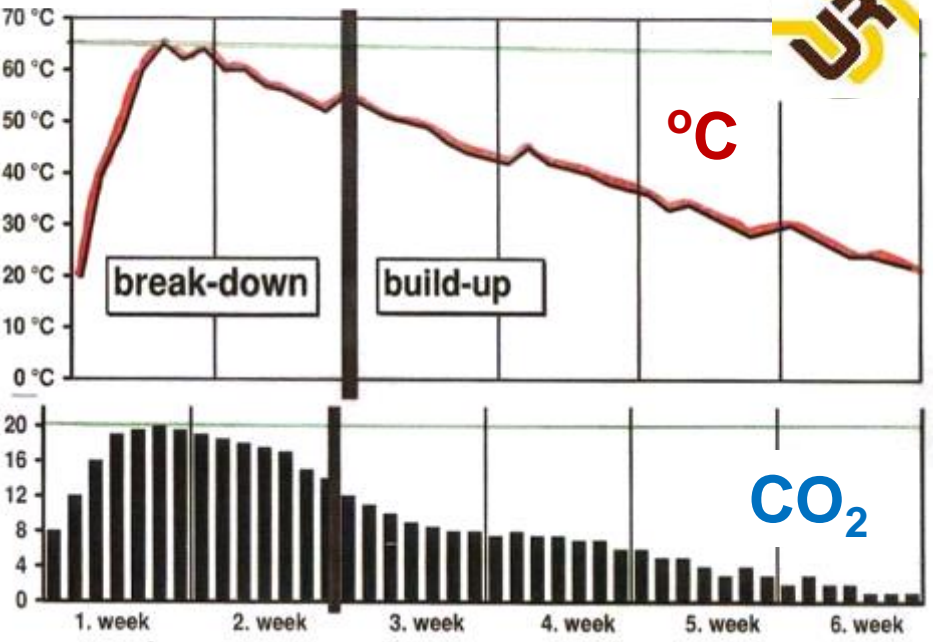
FLEXIBLE Time –Temperature profile for **COMPOSTING** – as required e.g. in Austria



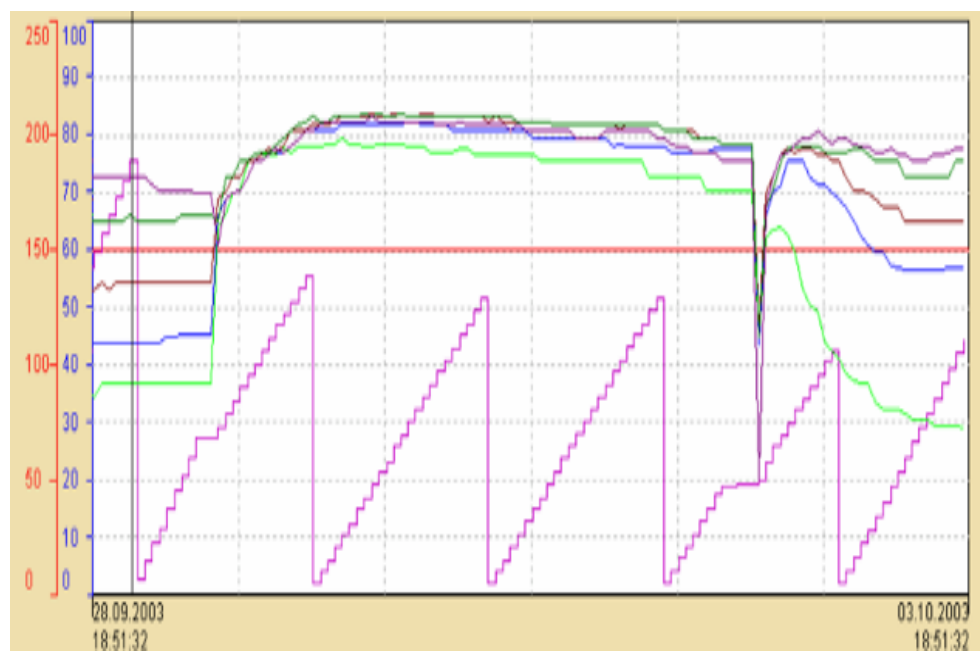
| Minimum Temperature | Duration - Records |
|--|---|
| Open and enclosed Windrows (including halls) +/- forced aeration | |
| 55 °C | <u>Automatic, continuous recording with probe</u> ; minimum temperature to be met over a time span of 4 hours, each after 5 mechanical turnings; total recording period: 10 days |
| 55 °C | <u>Discontinuous recording at least once per working day*</u> ; minimum temperature to be met on all recording days, within a total recording period of 10 days; at least 3 mechanical turnings |
| 60 °C | <u>Discontinuous recording at least once per working day*</u> ; minimum temperature to be met on 3 x 3 recording days, within a total recording period of 14 days; at least 2 mechanical turnings |
| 65 °C | <u>Discontinuous recording at least once per working day*</u> ; minimum temperature to be met on 2 x 3 recording days, within a total recording period of 14 days; at least 1 mechanical turning |
| Enclosed and in-vessel systems with forced aeration (e.g. boxes, tunnels) | |
| 55 °C | <u>Automatic continuous recording with probe</u> ; minimum temperature to be met over a time span of 4 days within a total period of 10 days |
| 65 °C | <u>Automatic continuous recording with probe</u> ; minimum temperature to be met over a time span of 3 days within a total period of 10 days |

* The automatic, continuous recording with probes is permitted

°C & CO₂ in a controlled process



The controlled process: °C & CO₂

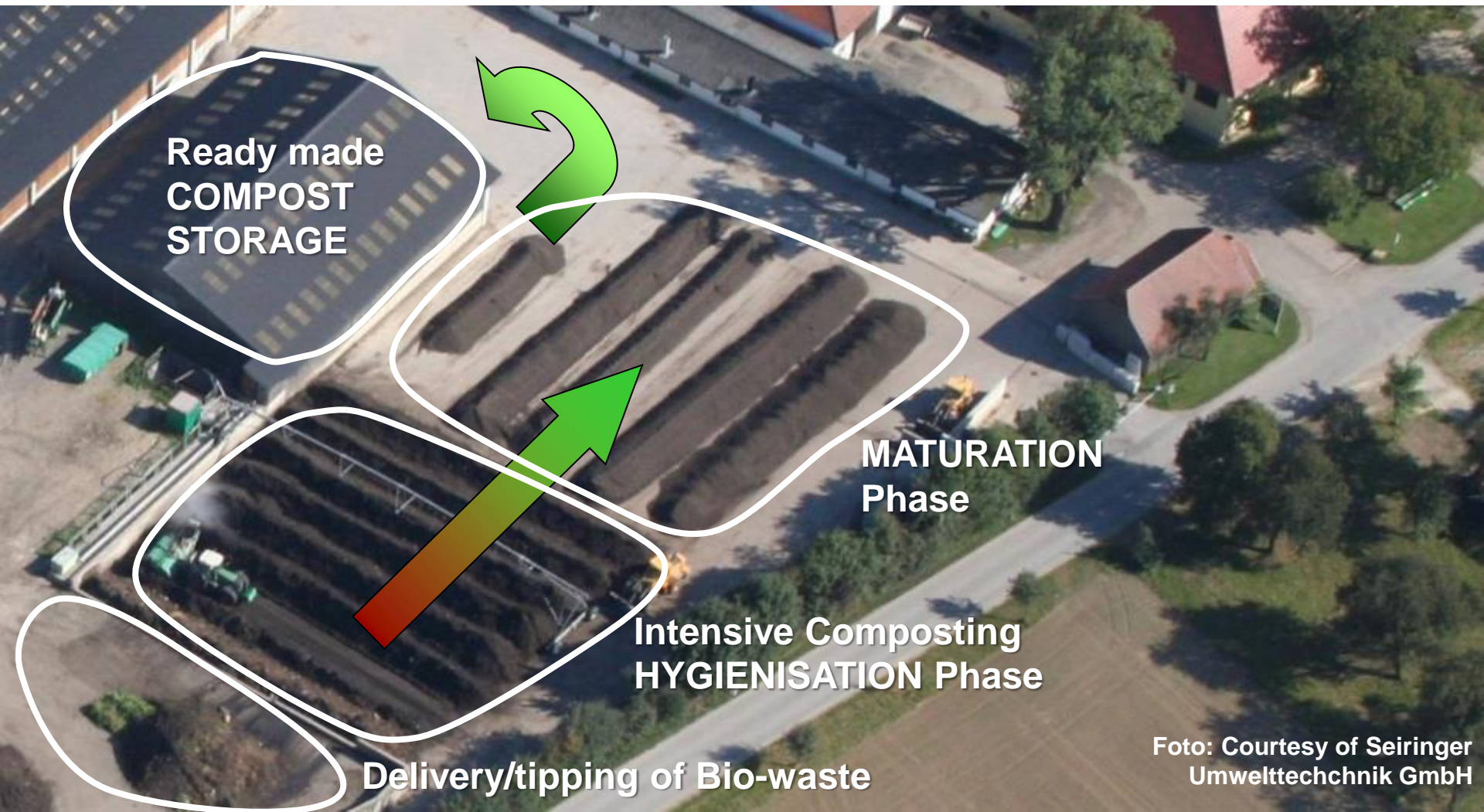


Hygiene Aspects in Process Management



➤ Further Measures & Records (as part of the QM)

- ✓ watering, turning, aeration, material additions, screening...
& separating / working from **DIRTY** to **CLEAN** zone



**Sealed /paved surface for the main rotting area
draining of rain and waste water**



2 to 5 % slope





Composition

- 40 % shredded bush and tree cuttings
- 30% fine garden waste
- 10% rotted cattle manure
- 10% loamy soil

ON-FARM FIELD COMPOSTING



Composting

- 8 to 12 weeks (summer)
- 12 to 20 weeks (winter)
- Turning : 5 to 3x/week
- Screening: 10 to 20 mm





Bäuerliche Kompostierung



2006 6 6



Foto: Urs Landmanagement



Foto: Urs Landmanagement

OPEN WINDROW composting



Foto: Amlinger





Managing Impurities



Managing IMPURITIES



Foto: Compost Systems, Austria



Foto: NOVER spol. s r.o.; CZ



Foto: Amlinger



Foto: Amlinger

Composting Training:

... Temperature and CO₂ measurements



Composting Training: ... *what is compost quality?*



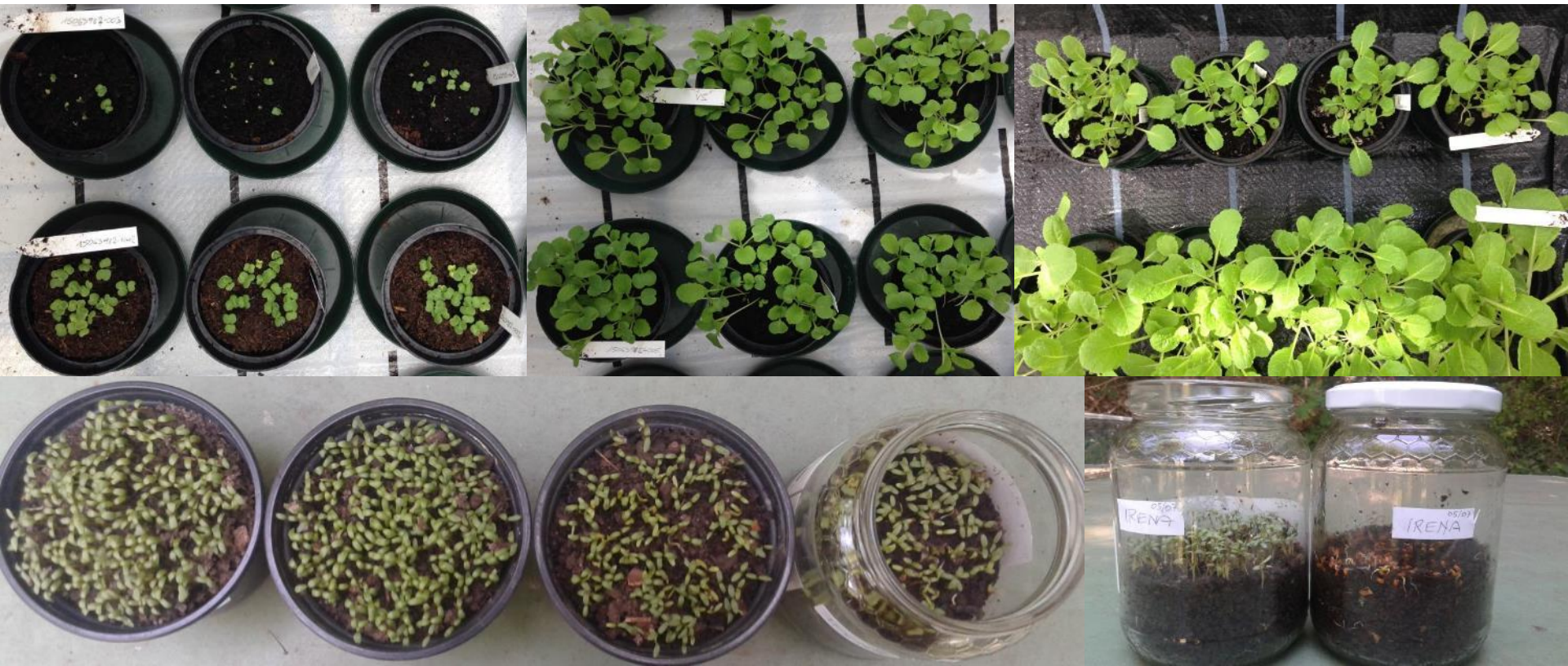
Quality Criteria for **COMPOST**



- Plant response / germination test!

- → **growing media, bagged** ... 25% compost → 90% - 100% performance
- → **private gardening** ... 50% compost → 80% - 90% performance

Cress (*Lepidium sativum*) & Chinese cabbage





- National **TECHNICAL REQUIREMENTS FOR COMPOSTING PLANTS**

- A guidance to good practice
- Detailed handbook
- Manual for engineering
- Basis for waste license
- Best practice / range of technologies
- Criteria for construction, operation and documentation
- Environment & health protection

https://www.bmlfuw.gv.at/greentec/abfall-ressourcen/behandlung-verwertung/behandlung-biotechnisch/richtlinie_sdt.html



lebensministerium.at

The State of the Art of Composting

A guideline in good practice

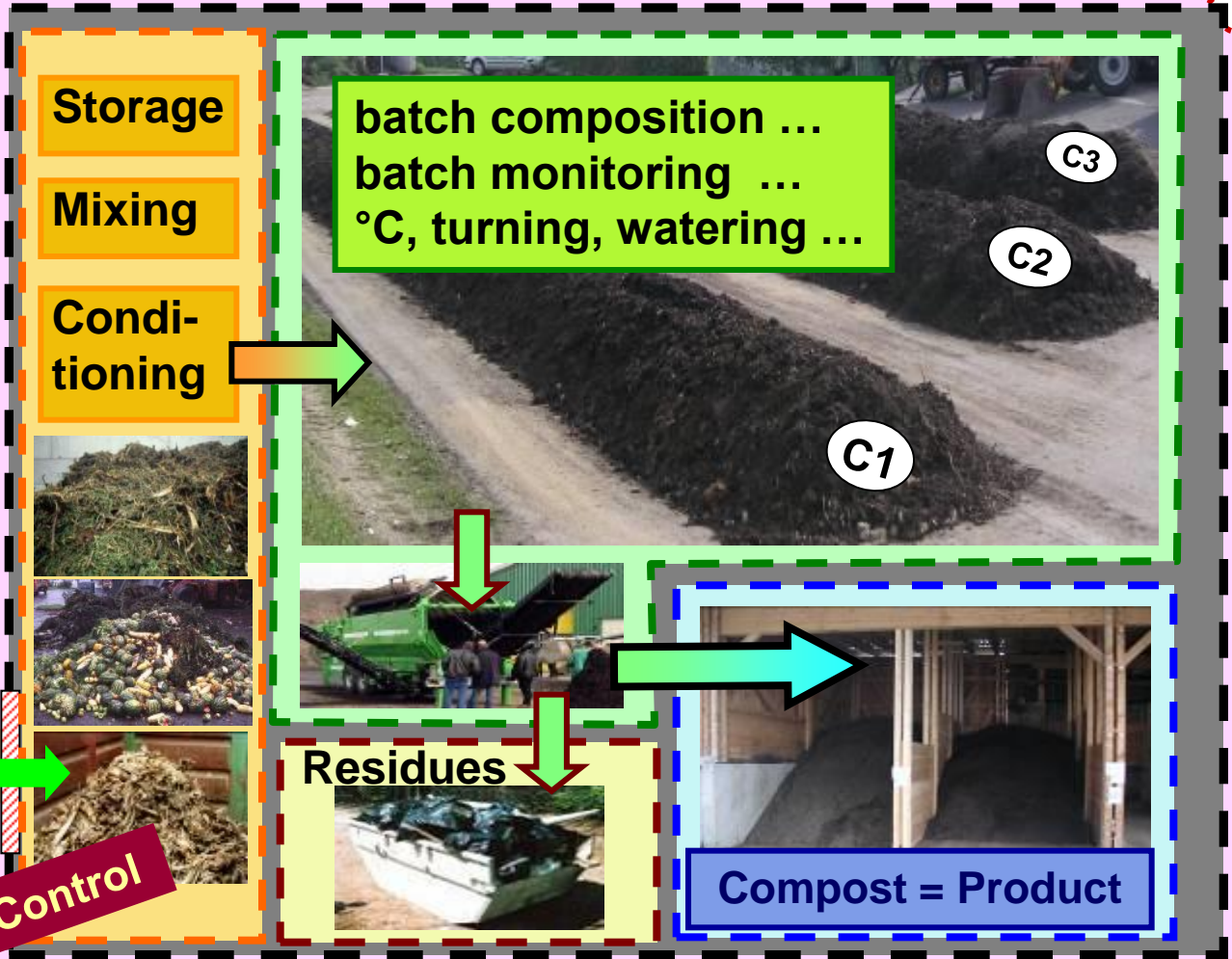




Registered Composting Plant



Receipt Control



QM: the principle of a traceably documented process



International QAS for compost <http://eu100ngo.net/qas/>

provided by: "100 NGO" / "Compost & Biogas Association Austria Austria"



ZERTIFIKAT

Quality Management and Control System
for Compost Austria

MUNICIPAL ENTERPRISE FOR WASTE TREATMENT - SOFIA

Compost Plant Han Bogrov
Gorni Bogrov village, Malo livade

on behalf of arge kompost & biogas has been inspected and controlled by its partner organisation

"100 – First Zero Waste & Organic Cycle Organisation"
for compliance with:

Ordinance on the Treatment of Biowaste from 15 October 2013, Technical Regulation DNR 192206 Implementation of quality assurance on composting plants; ÖNORM S 2206-1: Requirements for a quality assurance system for the production of composts - Part 1: Principles for quality assurance of a company and of the internal technical processes; ÖNORM S 2206-2: Requirements for a quality assurance system for composts - Part 2: Determination of tasks and conditions for a quality assurance organisation

The enterprise is eligible to refer to this certificate in the declaration and labeling of compost products that have been tested in compliance with the Ordinance on the Treatment of Biowaste from 15 October 2013 and to use the label „Kompost Qualitätsbetrieb“ as sign at the facilities premises and official documents issued by the composting plant in electronic and printed format.

Last inspection: 03.06.2015

Validity: until the next inspection, at maximum until 31.12.2016

Conditions of the validity of the certificate:

- Compliance with all relevant legal obligations, including the plant's permits
- Fulfillment of the requirements of arge kompost & biogas

Vienna, Sofia, 04.11.2015

Beimig

Für das Qualitätssicherungs-Kollegialen
Vorsitzender Seiringer Hubert

QAS AKZO certified
by ECN-QAS



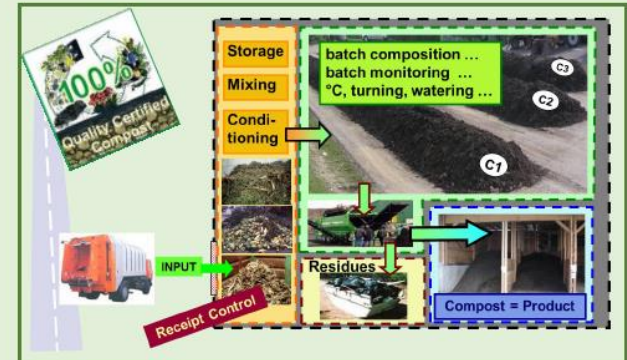
kompost
& biogas
verband



First Zero Waste & Organic Cycle Organisation / 100NGO
ZVR Zahl: 636713918 Österreich
Hochbergstraße 3, 2380 Fercholdsdorf
T.F.: 0043 (0)1 8656084
M.: 0043 (0) 69914144699; 0043 (0) 69917282690
E.: eu100ngo@gmail.com
I.: www.eu100ngo.net



100NGO – INTERNATIONAL QUALITY ASSURANCE SCHEME FOR COMPOST



Quality Manual



BULGARIA

- SOFIA Composting plant 2015
 - Capacity: 24000 t/y GREEN WASTE
 - Actually treated: ca. 10000 t/y
 - Reference standard: BG Biowaste Ordinance
 - Compost analyses: Laboratory in Austria

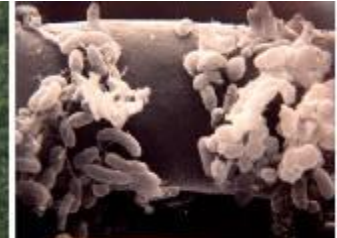
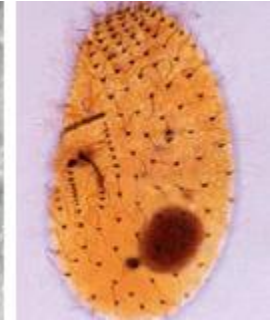
- BOURGAS Composting plant 2016
 - Capacity: 10000 t/y GREEN WASTE
 - Actually treated: ca. 2000 t/y
 - Reference standard: BG Biowaste Ordinance
 - Compost analyses: Laboratory in Austria



POLAND

- Pila: GWDA Composting plant 2017
 - Capacity: 85000 t/y SEWAGE SLUDGE; STRAW; GREEN WASTE
 - Actually treated: ca. 85000 t/y
 - Reference standard: 100NGO QAS Manual
 - Compost analyses: Laboratory in Poland & Austria

The Key = BIODIVERSITY !



Fotos: Bioforschung Austria, Hildebrandt, Hedl, Amlinger



Many Thanks!



Florian Amlinger
eu100ngo@gmail.com
www.eu100ngo.net

