Scientific Accompanying relating to the implementation of the Use of Bio-Waste in Styria 1997

Contractor: Joanneum Research, Institute f. Environmental Geology and Eco-System Research

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Participants: Institute for Building Biology

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1. Summary

The "Wissenschaftliche Begleitstudie zur Umsetzung der Biomüllverwertung in der Steiermark" ("Scientific Accompanying Study relating to the Implementation of the Use of Bio-Waste in Styria") was aimed at accompanying the implementation of strategies for the use of bio-waste in Styria scientifically and thus at supporting people in meeting the requirements specified by the authorities, in assessing the efficiency of action taken and in elaborating practise oriented solutions for problems in the area of decentralised agricultural composting.

The study is subdivided into the following priorities:

1. Possibilities or necessities for checking agricultural composting facilities
2. Quality of the compost
3. Germinal load of the ambient air of composting facilities
4. Displaying bio-waste flows in Styria

Thanks to a comparison and evaluation of the results of the partial areas, the efficiency of the action taken in the field of waste management up to then as well as occurring deficiencies and possible approaches could be assessed.

The results of the present project have shown that the target of an area-wide composting may be achieved and that the aspect of "cycles covering small areas" will, on a medium-term basis, be principally guaranteed by the strategy for treatment.

Furthermore, the investigations have shown that there are no deficiencies worth mentioning in terms of the techniques and the process technology used for composting in farms. The produced composts largely meet the legal requirements and thus furnish a valuable fertiliser. At an unchanged composition, a relatively low potential of risk for the system ground-plant-animal may be assumed.

The potential of risk is largely minimised by the fact that bio-aerosols are transported by observing the safety distance of 330m.

However, practical experience has shown that optimisations are also possible when it comes to checks. For this purpose, it is recommended to elaborate the checking system proposed by the "ARGE Kompost" ("ARGE" - "Arbeitsgemeinschaft" - "Study Group"; "Kompost" - "Compost") even more.

The first step proposed is to introduce a duty to report for all the farms applying the composting process.

2. Starting Position

Due to the "Bioabfallverordnung" ("Bio-Waste Regulation") of the Federal Ministry of Environment, Youth and Family, which entered into force as a regulation relating to the "Österreichische Abfallwirtschaftsgesetz" ("Austrian Waste Management Act" (BGBl. - "Bundesgesetzblatt" - "Federal Law Gazette" 68/1992) on January 1,1995, biogenous waste is collected and recycled separately in Austria. In

Styria an area-wide separate collection of biogenous household waste was started as early as on December 31, 1992, on the basis of the Styrian Waste Management Act.

For achieving the target of the Styrian Waste Management Act, i. e. that of a area-wide composting of biogenous waste in Styria, both centralised and decentralised concepts were developed according to the motto "as decentralised as possible - as centralised as necessary". In these concepts agricultural composting plays a particularly important role.
An essential advantage of this integrated biogenous waste treatment is the fact that the intensified integration of agriculture makes it possible to close the cycle in an ecologically viable way and on a small scale.

3. Goal

The "Wissenschaftliche Begleitstudie zur Umsetzung der Biomüllverwertung in der Steiermark" ("Scientific Accompanying Study relating to the Use of Bio-Waste in Styria") was aimed at accompanying strategies for the use of bio-waste in Styria scientifically, i. e. at at supporting people in meeting the requirements specified by the authorities, in assessing the efficiency of action taken and in elaborating practise oriented solutions for problems in the area of decentralised agricultural composting.

Composting facilities were assessed, legal bases were compared and checking systems already existing were reviewed in order to create an optimal, efficient checking system.
Still another important Chapter of the study consisted in aiming at determining the quality of the produced compost, above all as far as the content of heavy metals was concerned, in order to be able to identify the effects of a possible use in agriculture.
Nevertheless, hygiene was studied as well. Therefore, still another partial chapter consisted in aiming at studying the transmission of the aerobic, mesophile and thermophile microorganisms in the surroundings of composting facilities in order to find out possible loads exerted on the environs by bacteria and fungi.
The part of the projects that dealt with bio-waste flows was not only supposed to show the development of the amount of bio-waste or the ways of its use but also to create a basis for regional bio-waste management concepts.

4. Procedure

1. **Possibilities and necessities for checking agricultural composting facilities**

   Sites that had been selected representatively were studied. For this purpose, the facilities were subjected to a legal inspection (when bio-waste is taken over, there is a not only a duty to report the quantity, type, origin and whereabouts of bio-waste to the authorities but larger facilities or facilities situated in an area where the groundwater or drinking water is protected also need an authorisation relating to water right). Furthermore, the existing checking system of the "ARGE Kompost" ("ARGE" - "Arbeitsgemeinschaft" - "Study Group"; "Kompost" - "Compost") was reviewed.

2. **Quality of the compost, in particular as far as heavy metals are concerned**

   The fact that heavy metals are not biologically decomposable may lead to their concentration in the soil and thus in the entire food chain up to human beings. In order to identify the origin of the different heavy metals and to derive prevention strategies, well-aimed investigations into the input materials were made in the second stage. The following heavy metals were studied: zinc, copper, chromium, lead, nickel, cadmium and mercury. The study was made by the "Landwirtschaftliche Versuchszentrum Steiermark" ("Agricultural Experimental Centre Styria").
   Still another item of this Chapter is the composition of the raw materials in compost and the change in this composition in the course of the year. The following input materials were studied: bin for bio-waste, stable droppings, straw, rough structural material, orgaver (compostable mixture) and rock meal. The analyses were made by the "Institut für Thermische Verfahrenstechnik und Umwelttechnik der TU Graz" ("Institute for Thermal Process Technology and Environmental Technology of the Technical University of Graz").

3. **Air germ measurement in the surroundings of the agricultural composting facilities**

   The bio-aerosols were measured at noon between 10 am and 1 pm. This was done no later than 2 days after the piles had been transplanted. However, one measurement was also made while the piles were being transplanted or after they had been transplanted.

4. **Analysing the bio-waste flow**

   For analysing the bio-waste flow, the following data were used:

   - Data on the quantities of collected bio-waste according to a survey made by the Province of Styria
   - Operational data of commercial composting facilities in Styria (acquired by Questionnaires prepared by "Joanneum Research")
   - Data on the quantities collected by those collecting bio-waste (acquired by Questionnaires prepared by "Joanneum Research")
   - Data on the quantities treated by farmers (own survey made by "Joanneum Research", information given by the "ARGE Kompost" ("ARGE" - "Arbeitsgemeinschaft" - "Study Group"; "Kompost" - "Compost" and those collecting bio-waste)

   The collected data served to calculate the amount of bio-waste separately for individual composting, joint composting and bin for bio-waste for each Styrian commune.

5. Result / Benefits

1. **Possibilities and necessities for checking agricultural composting facilities**

   The overall result of the site visits was as follows:

   + The relevant guidelines for agricultural composting were kept, which means that a correct treatment of biogenous waste in terms of process technology is guaranteed.

   + The quality of the produced composts was in accordance with ÖNORM S 2200 (ÖNORM - Austrian Standard) (quality criteria for composts produced from biogenous waste)

   + Agricultural composting allows an effective recycling of bio-waste

   + Regional ways of waste disposal increase the acceptability of the operation of composting facilities among the population

   - The quantities delivered and treated and the agricultural areas available are recorded insufficiently, which is why it is more difficult to check the observance of admissible quantities.

   - Lack of continuity in the operations, i. e.:

      1. Temporary taking-over of excessive quantities that cannot be treated at once and may lead to annoyance caused by bad smell because of anaerobic metabolic processes
      2. Individual steps of composting that may lead to short-term annoyance caused by bad smell, (e. g. transplanting processes), are not performed at fixed times, which would, however, increase the acceptability among the population. There are problems with fixing the periods for processes depending on the weather.

   - Insufficient transparency in the operations may lead to emotional problems between the operator and the neighbours, which will make it impossible to solve the problems objectively.

   - Lack of legal basic conditions for checking agricultural composting

Problems with checking:

- It is quite difficult to have a clear view of the actual number of the facilities with their capacities, etc., because there is no general duty to report
- This means that the structures of waste disposal are not clearly visible and that a comprehensive checking system is impossible
- The checking system is not regulated by provincial law and is currently exclusively based upon a voluntary basis
- There is no institution for coordinating all the issues relating to composting.

Proposals for an uniform composting system for agricultural composting facilities:

The checking system used by the "ARGE Kompost" ("ARGE" - "Arbeitsgemeinschaft" - "Study Group"; "Kompost" - "Compost") should be used as a basis even though its weak point is that it is not compulsory for each composting facility.

An index file, a data base or the like is to be created. The following data should be contained: name, address, company size, capacity, collection, catchment area, process description, delivery data, protocols of checks and results of investigations.

Another proposal is to restrict the examination of compost in terms of the quality to the parameters of the BGBl (Bundesgesetzblatt - Federal Law Gazette) 1990/252, § 32 lit. 2 and ÖNORM 2200 (ÖNORM - Austrian Standard) while increasing the intensity of the investigations depending on the quantity treated. In analogy to checks of functionality in sewage clarification plants, results of quality inspections are to be submitted without being asked

For guaranteeing clarity and for executing effective checks, it is necessary to register all the composting facilities and the following items would have to be regulated legally:

- **Quality of compost in terms of heavy metals**

  At the moment there are two classes of compost with different maximum limits in Austria, a third class being elaborated.

	Limits referring to 30% organic dry substance [mg/kg DS]			
Element	Compost Class I	Compost Class II	Compost Class III	Soil
Chromium	70	70	150	100
Nickel	42	60	100	60
Copper	70	100	400	100
Zinc	210	400	1000	300
Cadmium	0.7	1	4	1
Mercury	0.7	1	4	1
Lead	70	150	500	100

Table 1: Limits for heavy metals (acc. to ÖNORM S 2200 and ÖNORM S 2202 draft)

  The limits are partly massively exceeded in bio-waste and graveyard composts. At 27 composts, the limits relating to chromium were exceeded, at 14 those relating to nickel, at 12 those relating to copper and mercury and at 27 those relating to zinc, (103 samples having been analysed).

  As for graveyard composts, the limits were exclusively exceeded in terms of lead and chromium. The raw materials for compost partly fail to meet the quality requirements placed on compostable waste (acc. to ÖNORM S 2201 - ÖNORM - Austrian Standard).

  The results show that the raw materials need to be inspected continuously so that the correct mixture of raw materials for composting can be obtained and compost corresponding to Quality Class I can be guaranteed. For bio-waste itself often is not highly contaminated and certain quantities of pollutants may be compensated by admixtures.

- **Air germ measurement in the surroundings of the agricultural composting facilities**

  The number of bio-aerosols will rapidly decrease with distance and will already cause nothing but the natural background load 300 m from the facility. If, however, the facility is managed incorrectly, higher values are possible as well. For working in a composting facility, corresponding protective measures should be taken, (e. g. suitable protective masks).

- **Analysing the bio-waste flow**

  For the quantities of bio-waste that is not only produced in a commune but also treated in the commune itself, a proportional number Q has been created:

Class	Proportional No.	Meaning:

Class 1	Q = 1	All the quantities of produced bio-waste are treated within the commune.
Class 2 2a-2c	Q = <1	Within the commune, more bio-waste is treated than produced.
Class 3 3a-3c	Q = >1	Within the commune, not all the bio-waste produced is treated by the commune itself.

Table 2: Classification of the communes or districts according to the proportional number Q

In the investigation period 1994, an overall amount of appr. 100.000 t was identified. This amount is subdivided into individual composting with appr. 50,000 t (exactly 49%), into joint composting with appr. 2,500 t (exactly 2.5%) and into the quantities collected in the bins for bio-waste with appr. 48,000 t (exactly 48.5%).

If the regions are considered more closely, the aspect of small cycles will be principally guaranteed on a medium-term basis and the target of composting covering quite large an area is ensured.

Now a first basis for assessment allowing the development of strategies for holistic treatment and recycling of biological waste in Styria is available. This basis will, in combination with

- the regional agricultural potential for recycling (surfaces) and
- the share of biogenous waste produced by trade and industry,

make it possible to close regional cycles.
Furthermore, the efficiency of action relating to waste management and possible further need for action can be made visible by continuously updating the data.