Quality begins at home: the Swiss strategy to improve the image of compost

Jacques G. Fuchs, Ulrich P. Galli, Catherine M. Fischer and Konrad E. Schleiss

I. Introduction: the Swiss context of biowaste production and treatment

I.1 Legal framework

Ensuring an environmentally sound disposal of waste is one of the requisites for the long-term sustainability of the standard of living in industrialised nations. A non-EU country with a high population density and limited space, Switzerland has tried since the middle of the 1980s to bring innovative solutions to the management of its waste. The implementation of this policy by the cantons, the municipalities and the economic sector, resulted in an increase in the percentage of recycled municipal waste, from 25% in 1988 to over 45% in 2000.

The relevant principles and goals of the federal government pertaining to waste management were laid down, in the Guidelines on Swiss Waste Management (1986) and in the Waste Concept for Switzerland (1992):

- Waste should as far as possible be avoided at source. This can be achieved by means of low-waste production methods, the production of long-life goods and the optimization of packaging.
- Both in manufacturing processes and in products, pollutants are to be avoided or reduced as far as possible, in order to facilitate subsequent waste treatment or recycling steps.
- Waste is to be recycled wherever this appears to be environmentally beneficial and economically feasible.
- Residual wastes are to be treated in an environmentally sound manner. In the long term, only materials of final storage quality should be disposed of in landfills.

The main ordinance pertaining to waste management is the "Technical Ordinance on Waste" of December 10, 1990 (*Technische Verordnung über Abfälle, TVA*). Article 6 prescribes the separate collection of the recyclable fractions of MSW. Article 7 states that home composting must be encouraged by the cantonal authorities. Biowaste which cannot be privately disposed of must be collected separately and recycled in centralised facilities.

The TVA also prescribes measures for the construction and operation of composting facilities that treat more than 100 t of compostable materials per year (art. 43 to 45). These measures concern the protection of groundwater, the proper control of the materials accepted and the analysis of the quality of the compost produced (nutrients and content in heavy metals).

These guidelines and prescriptions have resulted in the development of incineration as the main treatment mode for MSW. Already in the '90s, Switzerland incinerated over 80% of its unsorted municipal waste. However, in parallel, high levels of separate collections for a large number of materials had also been reached, due to a long history of such collections, in particular for glass, paper and metals. Over 45% of municipal waste is now collected separately and recycled.

To achieve the objective of non-polluting final storage, landfilling of all combustible waste (i.e MSW, construction waste and sewage sludge) has been banned since January 1st 2000. At the end of 2002, this objective was fulfilled to 97%.

I.1 Waste statistics

I.1.1 Municipal solid waste

In the year 2000, a total of 4.7 Mio t of urban waste were collected in Switzerland (652 kg per capita). This figure does not include construction waste, industrial waste or sewage sludge (see below).

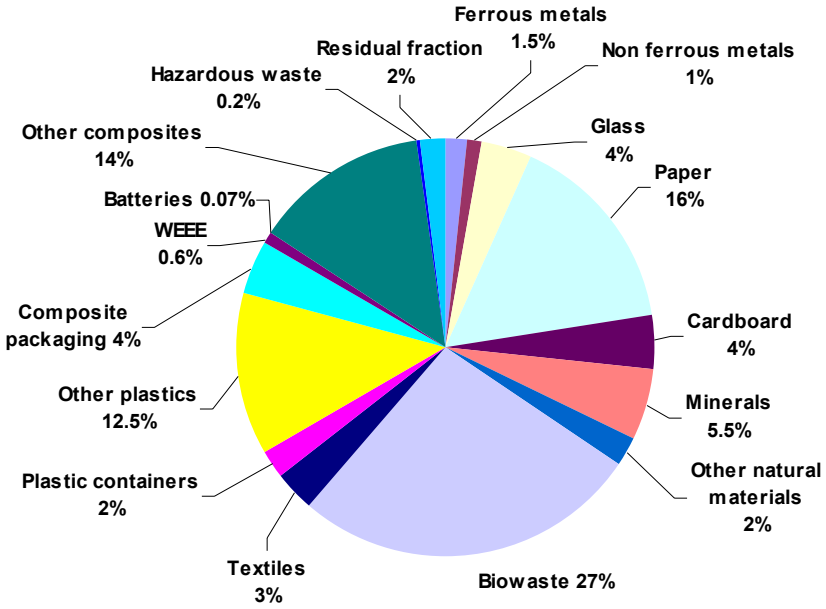
Some 2.3 Mio t. of MSW were incinerated and only 0.292 Mio t were still directly landfilled. Separately collected green waste amounted to 641'000 t or 14% of the total. 88% of this waste was composted, the rest was treated by anaerobic digestion.

Table 1. Municipal solid waste production in Switzerland (2000)

	Mio t	kg/inh	%
Unsorted municipal solid waste	**2.588**	**359**	**54.8%**
To incineration	*2.296*	*319*	*48.6%*
To landfill	*0.292*	*41*	*6.2%*
Separate collections	**2.138**	**297**	**45.2%**
Biological treatment (composting & anaerobic digestion)	*0.641*	*89*	*13.6%*
Paper	*1.137*	*158*	*24.1%*
Other recyclables (glass, metals, PET, textiles)	*0.360*	*50*	*7.6%*
Total	**4.726**	**656**	**100.0%**

In 2001-2002, a study of the composition of unsorted municipal waste was conducted in 33 localities of different size and characteristics, representing some 750'000 inhabitants (10% of the Swiss population). The result of this analysis, which does not include bulky waste, is shown in figure 1. It appears that 27% of the unsorted municipal waste is biologically treatable, not including paper and cardboard. Extrapolating this result, one can assume that approximately 450'000 t/a of biowaste are still available in MSW for diversion.

Figure 1. Average composition of the unsorted MSW from 33 Swiss communities (2002)



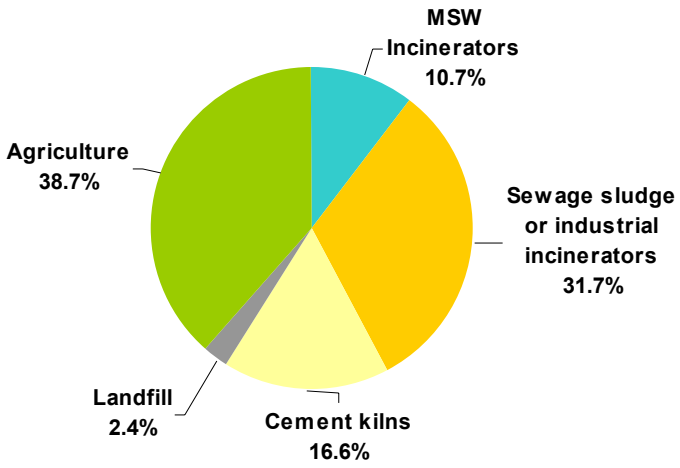
1.1. 2 Sewage sludge

An estimated 0.275 Mio t (dry matter) of sewage sludge are produced each year in Switzerland. This sludge is digested or stabilised at the sewage treatment plants themselves, losing some 20 to 30% of its weight. Thus some 0.2 Mio t of dry sewage sludge remain to be disposed of each year.

There are two main disposal channels: either for use as fertiliser in agriculture or by incineration. On the 1st of May 2003, new legal prescriptions came into force, prohibiting the recovery of sewage sludge in agriculture as of the 1st of October 2006, because of the inorganic and organic pollutants,

including traces of drugs and hormones. The demand for sewage sludge as fertiliser is thus steadily decreased, all the more since a potential risk of contamination with BSE has been shown to exist, due to the wastewater from slaughterhouses. Even though strict security measures that have been enforced, i.e. separation of solids from the wastewater flow, thus rendering this risk negligible, the principal food distributors have banned the use of sewage sludge for the production of their labelled meat and dairy products. Organic farming has long banned the use of sewage sludge.
In 2000, 0.1196 Mio t of sewage sludge (dry matter) were incinerated in Switzerland. 0.0048 Mio t had to be landfilled owing to lack of incinerator capacity. Only 0.0784 Mio t (amounting to less than 39% of the total 0.2028 Mio t produced) were disposed of in agriculture in 2000 (figure 2).

Figure 2. Sewage sludge disposal in Switzerland (2000)



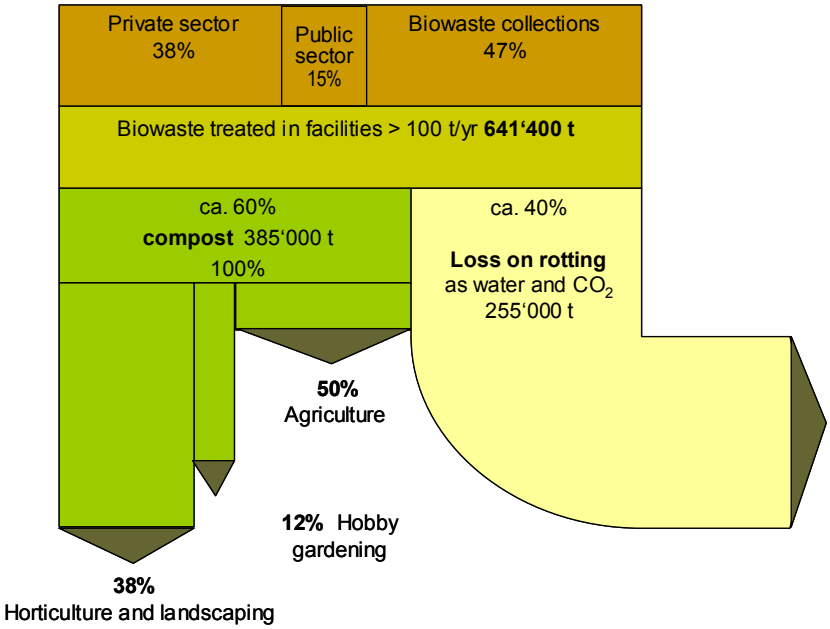
I.1.3 Other biowaste

An estimated 7'000 t/a of industrial and commercial wastes are co-digested in agricultural biogas plants, while some 3'000 t/a of industrial and catering wastes are co-digested with sewage sludge in wastewater treatment plants.

I.2 Compost application and markets

The processing of the 641'000 t of biowaste yielded some 385'000 t of compost in 2000. The outlet for about half of this amount is agriculture. Professional gardeners and substrate producers used 38%, and hobby gardening 12%.

Figure 3. Origin of the biowaste and use of compost in Switzerland (2000)

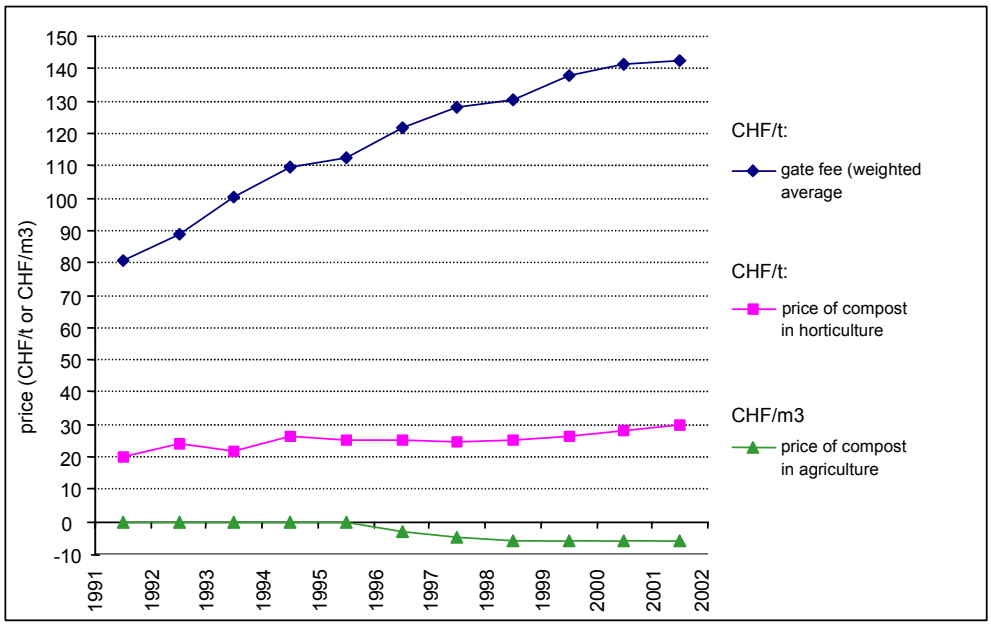


II. Changing the image of compost

With the ban on landfilling of combustible waste, the load on the existing incinerators has increased. Most have been functioning to near full capacity. Some 6% of urban waste still has to be directly landfilled in 2000, due to insufficient incineration capacity (Table 1).

As shown in figure 4, gate fees for biowaste have risen regularly in the last 11 years, mostly due to the investments for technical equipment including those for anaerobic digestion. During the same period, the price of compost in horticulture has remained practically unchanged, while the price in agriculture has become negative, i.e. the composting plants not only give the compost free to the farmers, but also pay for its transport and spreading.

Figure 4. Evolution of gate fees (CHF/t, including 7.6% VAT) and price of compost (CHF/m³) in the canton Zurich in the last 11 years



Swiss waste management guidelines require that the recycling of a waste fraction be not only environmentally beneficial, but also economically sustainable. Advanced disposal fees have thus been

introduced on many products (PET beverage containers, batteries, glass bottles, electrical and electronic appliances) to finance collection and recycling schemes. This is not possible for biowaste. Nevertheless, the economic sustainability of biowaste treatment is a necessary long-term goal and can only be achieved if a real market can develop for its products.
All this confirms how necessary it has become to change the image of compost in the eye of the public and users, from a waste by-product to a valuable resource.

II.1 The ASCP

It is in this context of decreasing economic sustainability and increasing demands from the food producers and consumers regarding traceability that the Association of Swiss Compost and Methanisation Plants (ASCP) was founded in 1999, with three main aims:

- close material and energy cycles in biowaste management
- encourage high professional standards in compost production
- create the conditions for a real market for compost and its by-products

The Association, which groups the plants processing more than 1'000 t/yr of biowaste, now counts over 30 members, who together process more than 400'000 t of biowaste, two-thirds of the amount collected yearly in Switzerland.
Training, quality and monitoring are the three keywords of the ASCP strategy. Encouraged by the federal authorities, the ASCP has developed a training program, quality guidelines and a branch inspectorate and label, aimed at guaranteeing high standards of quality, both for the process management and for its products.

II.1 Training program

To produce quality compost every worker on the plant must possess some basic knowledge that enables him to understand the consequences of his actions. In practice, the driver of the front-end loader must not only know how to drive his vehicle, but must for example also be conscious that by piling up compost without the necessary precautions, the resulting compaction will cause a decrease in the quality of the product.
A modular *training program* has been developed and carried out by the ASCP at a national level since 2000, both in German and French. The training courses are tailored for workers on composting and anaerobic digestion plants and aim to promote best practice during compost production, but also to raise self-awareness and esteem among compost workers, by a better knowledge of their products and of their properties and qualities.

II.1.1 Basic module

Participants are given a general overview of biowaste management and a grounding in the legal basics. After this introduction, the biological basics of composting are taught. In this way every participant learns what is happening in a compost pile. All the other aspects of the management of a composting plant which are then treated relate more or less directly to this biological basis: choice of treatment techniques, type of waste accepted, worksheets, quality assurance systems, etc... Site visits complete the course, so the participants get an insight into the variety of existing composting techniques and processes. During the entire three days of the course, theory and practice are closely intermingled and a large part of the course is given on various composting plants.

II.1.2. Quality module

In this module, the accent is placed on process and quality control. Simple chemical analyses and plant tests are taught, that can be used by the workers themselves after a minimal training, to monitor the quality of their compost on-site. Such analyses, in particular the plant-germination and growth tests, allow compost workers and producers to discover directly the influence of their own products on plant health and growth. This serves to promote awareness that producing high-quality compost is no mean feat and demands specific skills and careful process management.
This course is almost entirely practical. After having learned the procedure for each tests, and tested a sample of their own compost, the results obtained are discussed and interpreted.

II.2 Quality criteria for composts and digestates from biowaste

The *compost and digestate quality guidelines* were published in 2001 by the ASCP in collaboration with the Swiss Biogas Forum. The aims of theses guidelines are to assist producers in producing compost of consistent and reliable quality and to encourage greater consumer confidence in composts. They define the characteristics a compost must possess for its use in agriculture, in horticulture and market gardening, landscaping or in covered cultures. Covered cultures and private gardening require the highest quality and degree of maturity. Slightly lower standards suffice for commercial horticulture. The minimal requirements set out in the Federal guidelines apply for agricultural and other use.

The present guidelines are intended as complementary to the federal instructions and recommendations, and in no case do they replace them. The minimal quality requirements have been amended and the meaning of the terms "rotted" and "digestate" has been further specified.

The distinction between digestate (with no post-maturation) and compost, based on product specificity and the NH_4-N content is new. Several hundreds of analyses have clearly shown that digestates without post-maturation contain higher levels of NH_4-N than compost, well over 300 mg per kilo fresh weight. As a further practical criterion for the definition of the term "rotted" in the definition of a compost, the guidelines propose that, except for wood, no other feedstock be recognisable visually or by smell. For example, it must not be possible to recognise the species of leaves. Compost complying with all the requirements of the present guidelines can be obtained from digestates which have undergone state-of-the-art aerobic post-composting.

A further novelty of these guidelines, going considerably farther than any of the standards formulated by the federal research stations, are the quality requirements for compost used in horticulture and landscaping, both for outdoor and covered cultures. Beside chemical and physical parameters, normalised biological tests are also proposed. With increasing maturity, the salt content and pH decrease. The nitrate to ammonium ratio should increase due to nitrification. The decreasing solubility of the humic substances that form during maturation will result in an increasingly lighter colour of the aqueous extracts. The advanced maturation also drastically improves the stability and plant compatibility of the product.

To obtain a high quality finished product requires not only state-of-the-art processing, but also a correct choice of feedstocks. Only materials with low levels of pollutants should be used. This excludes wastes susceptible of being highly contaminated, such as sewage sludge, or waste from street cleansing. The ASCP and Biogas Forum recommend that the feedstock and additives be declared.

II.3 Plant inspectorate and label

At present the ASCP is working to set up an independent and nationally recognised inspectorate of biowaste processing plants, in close co-operation with the other professional associations in the field and with the regional and federal authorities. An inspectorate commission has recently been officially constituted, with representatives of all the parties involved: compost producers and their branch associations, federal and cantonal authorities, research institutes and end-users (agriculture, horticulture and market gardening). The inspectorate aims to be recognised by the federal and cantonal authorities as the official branch inspectorate, thus substituting itself to the controls carried out by the authorities. This is already the case in the cantons of Aargau, Solothurn and Zürich, where the authorities have given mandate to the branch inspectorate to inspect all the plants treating more than 100 t of biowaste annually. In cantons where no such mandate exist as yet, it is up to the plants themselves to ask to be inspected. In some cases the cantonal authorities then recognise the inspection as equivalent to the controls they carry out. Discussions are continuing with the cantonal authorities throughout Switzerland to extend the recognition of the branch inspectorate.

At its most basic level, this inspectorate controls the minimal quality requirements prescribed by the law. These concern mainly environmental protection (water, air and soil protection), and compliance with the minimal quality requirements set out in the federal recommendations. Compost producers who so wish can also be inspected as to their compliance with the ASCP quality guidelines for their higher-quality products. If they comply with these guidelines, these compost qualities will then be

awarded a label, which will be a guarantee for the consumers that a specific compost is adapted to specific uses.
The inspections are carried out by accredited inspectors, who are specialists of composting processes and compost quality, but are not compost producers themselves. This independence is essential to guarantee the strict conformity and quality of the inspections.

III. Conclusions

An essential aspect of this process is the intense cooperation that developed between the various actors in the field of biowaste treatment: compost producers, federal and cantonal authorities (who have both provided financial support and actively participated in this project), the research institutes (the federal research stations, the Swiss Research Institute of Organic Agriculture, etc.) and the end-users (agriculture, horticulture and market gardening). It is this intense collaboration that made it possible to attain the results we are presenting here in only four years. The system set up by the ASCP is a framework that allows mutual recognition and understanding to emerge between compost producers and its end-users. Only in this way will it be possible to guarantee a long-term future for the recycling of biowaste. The ASCP knows it is engaged in a long-term process, but the aim is always the same: to change the image of compost from a waste product to what it really is, a valuable resource.

REFERENCES

SAEFL, Guidelines of Waste Management in Switzerland, Bern, 1986.
SAEFL, Waste Concept for Switzerland, Bern, 1992.
SR 814.600, Technical Ordinance on Waste, Bern, 1990.

The authors

Jacques G. Fuchs is a graduate in Agronomy of the Swiss Federal Institute of Technology, with a PhD in soil microbiology. Founder of Biophyt AG, Mellikon, a company specialised in the biological quality of compost and compost utilization. He counsels and assists composting plants in maintaining consistent and reliable products. He is a researcher in plant pathology at the Swiss Research Institute of Organic Agriculture (FiBL). He co-authored the Swiss guidelines for compost quality (2001). *e-mail: jacques.fuchs@biophyt.ch*

Ulrich P. Gall, graduated in plant physiology from the University of Bern. His PhD research was carried out at the Research Station for Fruit-Growing, Viticulture and Horticulture of Wädenswil and concerned the effect of heavy metals on mycorrhiza. He is at present director of Terra Nova Umweltberatung GmbH, and specialises in compost analysis and counselling of composting, anaerobic digestion and other waste treatment plants. He co-authored the Swiss guidelines for compost quality (2001). *e-mail: galli.u@regpop.ch*

Catherine M. Fischer is a graduate in biology from the University of Neuchâtel. After researching the biological oxidation of methane in landfills, she has worked as a consultant and public relations officer for waste management in the private and public sectors. She is now associate company manager of the waste management consultancy firm Ecodéchets (Yverdon) Sàrl, where she is primarily concerned with questions relating to communication and information on solid waste. She is regional secretary for the ASCP in the French-speaking part of the Switzerland and a board member of ISWA-CH. *e-mail: catherine@ecodechets.ch*

Konrad E. Schleiss has a PhD in Agronomy from the Swiss Federal Institute of Technology. For his thesis dissertation, he studied the biowaste management of the Canton of Zürich. He is now director of the environmental and compost consultancy firm K. Schleiss Umwelt- und Kompostberatung in Baar. He co-authored the Swiss guidelines for compost quality (2001) and developed the training program for workers on composting and anaerobic digestion plants. He also works as a plant inspector and market observer for biowaste and compost. *e-mail: k.schleiss@bluewin.ch*