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1 Introduction on biowaste management in Switzerland

Switzerland has 367¹ (2017) composting and fermentation plants that treat 1.6 million tons of biowaste, 1 million ton of farm manure and 0.1 million ton aggregates (2021)². Last year, in 2022, a new set of guidelines regarding the quality of products from fermentation and composting was introduced. These guidelines define the products themselves and their needed quality aspects depending on purpose of use. They should help to optimize the use of these products for fertilizing and soil-enhancing, without negative impacts on crops and environment.

For the purpose of this report, we translated the guidelines to English as it's originally written in German. For official use please refer to the German version since there might be errors in the translated version.

There is still a lot of potential in the utilisation of biowaste. Much biowaste is still not separated and gets incinerated (around 0.9 million tons)³. This waste could be used energetically and further used as solid and liquid digestate or transformed to compost. The largest city in Switzerland, Zurich, has declared city-wide collection of separated biowaste last year. This shows that there is a trend for using more of the potential from biowaste.

2 National concept/strategy on biowaste management

2.1 Legal framework

Environmental Protection Act, EPA (1983)

The EPA states that the environment has to be protected and measures should be taken to limit negative impacts on the environment. It contains the cost-by-cause principle which states that anyone who causes measures under this Act shall bear the costs thereof. Further it gives a definition of waste and states the waste management principles.

Ordinance on the Environmental Impact Assessment, UVPV (1988) (only in german)

This ordinance states that all biowaste-management facilities that handle more than 5000 tons fresh matter of organic waste have to do an environmental impact assessment to be operational.

Ordinance on the Avoidance and the Disposal of Waste, ADWO (2015)

ADWO defines municipal and biowaste. It contains the state of the art: the current state of development of processes, equipment and operating methods of the biowaste-management facilities. Through this ordinance, cantons are required to report the amounts of biowaste disposed in their canton to the Federal Office of Environment (FOEN). Further it states that any biowaste management facility that processes more than 100 tons of fresh matter biowaste needs to have an operating regulation which specifies the requirements for the operation of the facilities. They must have a training. Waste shall only be processed if nutrient and pollutant content allow it and has been collected source-separated. Waste can only be processed on impermeable surfaces

unless it's on-farm (field edge composting) where one windrow can only be at the same place every third year. It contains a list of suitable biowaste material for processing. And last, but not least, it regulates the trafficking of biowaste.

Waters Protection Act, WPA ([1991](#))

This act regulates the correct treatment of wastewater that comes from the biowaste management facility.

Ordinance on Air Pollution Control, OAPC ([1985](#))

OAPC states that biowaste management facilities shall produce no excessive (odour-) emissions, minimal distance to livestock facilities and residential zones must be kept. Further, threshold values of operating machines must comply, leakages avoided, and liquid fermentation products must be contained airtight.

Fertilizer Ordinance, DüV ([2001](#)) (only in german)

DüV contains definitions of fermented manure liquid and solid, recycling fertilizers, compost, solid and liquid digestate. It contains threshold values for heavy metals and foreign substances (such as plastics, metals and glass). In 2024 this ordinance will be replaced by a more adapted version to comply with EU-regulations.

Chemical Risk Reduction Ordinance, ORRChem ([2005](#))

ORRChem regulates the threshold values for heavy metals and foreign substances (such as plastics, metals, and glass) in DüV.

2.2 Waste management programs and strategies

Strategy for the production, processing and utilisation utilisation of biomass in Switzerland ([2009](#))

Goal: The biomass - both in terms of materials and energy - is optimised in terms of the three dimensions of sustainability - ecology, economy, and social aspects - and is optimally produced, processed, and utilised. utilised. The areas for the cultivation of biomass remain at least at the current level in terms of both quantity and quality.

For biowaste: By-products and waste products generated in the process of biomass production should be utilised in the best possible way, both in terms of energy and as materials like compost or digestate. (Target IV: Biomass generates high added value through cascade utilisation. Target V: The biomass is utilised according to the circular economy principle.)

Strategy for the energetic utilisation of biomass in Switzerland ([2010](#))

Goal: The biomass intended for energy utilisation, regarding the three dimensions of sustainability - environment, economy, and society -, is optimally produced, processed and utilised. The available potential is utilised as fully as possible.

For biowaste: the existing biomass energy potential should be utilised as fully, efficiently, and environmentally friendly as possible. (Target I: Complete sustainable utilisation of the domestic biomass energy potential, Target II: Positive environmental balance and no additional safety risks, Target III: Reduction of greenhouse effective pollutant emissions, Target V: Provision of high-quality energy (high exergy level), Target VI: Utilisation of synergies)

2.3 National standards and technical guidelines (collection, treatment and use)

Quality Management Biogas⁵

QM Biogas contributes to continuous improvement during all phases of a biogas plant's life cycle, from planning to construction, operation, and decommissioning.

Quality guideline for the production and use of composts and fermentation products (2022)

Overview of the applicable technical and legal basis for the production and use of composts and fermentation products.

2.4 Quality Assurance Scheme (QAS) and National Quality Assurance Organization (NQAO)

In general there is no certification for compost except for fulfilling the legal requirements. Organic farming has half the amount of allowed foreign plastics thresholds in the products certified for organic farming use.

Legal requirements are as following:

Table 1: The pollutant content of organic fertilisers, recycled fertilisers and farmyard manure must not exceed the following limit values:

Element	Limit value in grams per tonne of dry matter
Lead (Pb)	120
Cadmium (Cd)	1
Copper (Cu)*	100
Nickel (Ni)	30
Mercury (Hg)	1
Zinc (Zn)**	400

* from a proportion of more than 50 % excrement from pigs in relation to dry matter 150 g/t DM

**from a proportion of more than 50 % excrement from pigs in relation to dry matter 600 g/t DM

For compost and digestate, the following additional requirements apply for inert foreign matter:

- Foreign matter (metal, glass, waste paper, cardboard, etc.) may not exceed 0.4 per cent of the weight of the dry matter;
- the content of aluminium foil and plastics may not exceed 0.1 percent of the weight of the dry substance;
- the content of stones with a diameter of more than 5 mm should be as low as possible so that the quality of the fertiliser is not impaired.

These values will be adapted according to the revision in DüV from 2024.

Further there are quality guidelines which are aimed to improve the quality of product going to the recipients. The quality guideline 2022 provides an overview of the applicable technical and legal basis for the production and use of composts and fermentation products. The quality guideline is intended to help to consider biogenic residues as resources and to market them as products. The legal foundations, guidelines, implementation aids and specifications of label have evolved, and new scientific findings have been gained. This quality guideline updates and replaces the document "Quality Guideline 2010".

This quality guideline provides desired values for products depending on their application visible in Table 1.

Table 2: Summarised table of separation values for the qualities of compost for gardening criteria

Criteria	Use in horticulture		
	Compost for outdoor gardening	Compost for soil mixtures and outdoor hobby areas	Compost in covered horticulture and for substrate mixtures
Heavy metals	Limit values fulfilled according to ORRChem		
Polycyclic aromatic hydrocarbons (PAH)	Guideline values fulfilled according to ORRChem		
Foreign substances	Additional requirements fulfilled according to ORRChem		
Hygiene	fulfilled according to minimum quality (temperature measurement), free of germinable seeds and plant parts		
Nutrients: P ₂ O ₅ , K ₂ O, Mg, Ca	X	X	X
Rotting	Source material no longer recognisable, except wood		
DM (dry matter)	> 50 %	> 55 %	> 55 %
OM (organic matter)	< 50%	< 40 %	< 40 %
pH value	< 8.2	< 8.0	< 7.8
Sieve size	< 25 mm	< 15 mm	< 15 mm
Specific weight	X	< 620 g/l	< 620 g/l
Extract colouring (absorbance 1 cm cuvette _{550nm})	< 0.6	< 0.4	< 0.2
Electrical conductivity	2 mS/cm	1.3 mS/cm	1.0 mS/cm
Salt content	< 20 gKCl _{eq} /kg TS	< 13 gKCl _{eq} /kg TS	< 10 gKCl _{eq} /kg TS
Total nitrogen (total N)	> 10 g/kg TS	> 12 g/kg TS	> 12 g/kg TS
C/N ratio	< 25	< 25	< 20
Ammonium-N	< 200 mg/kg TS	< 100 mg/kg TS	< 40 mg/kg TS
Nitrate-N	> 80 mg/kg TS	> 100 mg/kg TS	> 160 mg/kg TS
Nitrite-N	< 20 mg/kg TS	< 20 mg/kg TS	< 10 mg/kg TS
N _{min.} (Ammonium + Nitrat)	> 100 mg/kg TS	> 100 mg/kg TS	> 160 mg/kg TS
Nitrate-N / N _{min.} - Ratio (only if N _{min} > 100 mg/kg TS)	> 0.4	> 0.5	> 0.8
Plant compatibility (according to Fuchs, 2000 and Fuchs, 2002)			
Cress open	> 50 % of ref.	> 75 % of ref.	> 75 % of ref.
Cress closed	> 25 % of ref.	> 50 % of ref.	> 50 % of ref.
Salad test	> 50 % of ref.	> 70 % of ref.	> 70 % of ref.
Bean test			> 70 % of ref.
Ray grass test			> 70 % of ref.
Disease suppression test			(X)
Fields with dark background: minimum/maximum values to be fulfilled	Fields with a light background: Recommended minimum/maximum values (for interpretation)		
X: must be declared			
(X): Recommended to declare			

Inspectorate⁴

ADWO specifies that cantons are responsible for biowaste treatment facilities. In detail they are obligated to make a waste management plan (Art.4), to report quantities to FOEN (Art. 6) and to ensure proper training (Art.

8). Most importantly they are in charge of controlling the facilities if they handle more than 100 t of FM biowaste. Not all cantons of Switzerland do this the same way, but most of them rely on a branch inspectorate to do the controlling for them. Totally 275 biowaste treatment facilities get controlled yearly by the inspectorate. Next to the required legal standards these facilities need to meet, as mentioned above there are several added points that are controlled by the inspectorate: The inspectorate controls additionally proper hygienisation to avoid propagation of pathogens and reinfection of treated material, further they control input-output plausibility of the facilities, and last but not least they control the operating procedure of the facilities especially for risks in operations.

3 Source separated collection of biowaste

Separate collection has been gradually introduced in Switzerland since the Technical Ordinance on Waste (TVA) came into force in 1990, the ordinance TVA has been replaced by ADWO meanwhile. In ADWO it states that only source separated waste shall be used for processing. In addition, since 2000 - when the landfill ban for organic waste came into force - the amount of separately collected biogenic waste has increased significantly. Currently Switzerland collects 1.6 million tons of biowaste. In Switzerland, the municipalities collected around 92.4 kg of biogenic waste per capita in 2016. This corresponds to a total quantity of 0.77 million tonnes per year. A similar amount (0.9 million tonnes per year) is still disposed of via rubbish bags and incinerated (Federal Office for the Environment 2012). The efficiency of separate collection is therefore currently around 45%³.

4 Biowaste treatment (recycling, material/energy recovery)

Quantity of plants²:

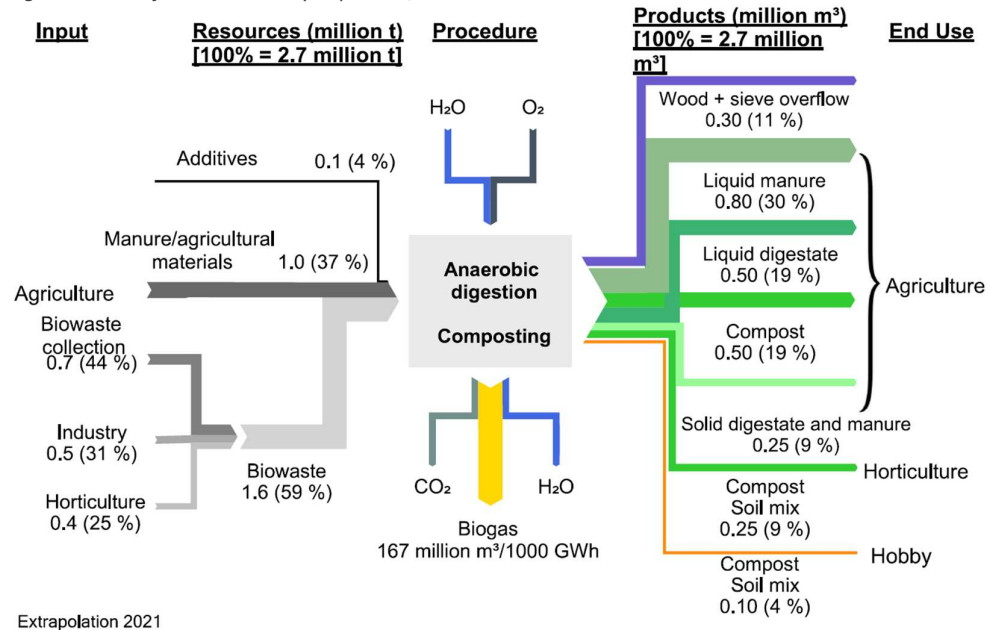
Table 3: Ratio of different plant types in Switzerland, ratio of total biowaste handled, and ratio of input material by source for each type of plant

Type, Procedure	Number of installations in %	Processing quantity in %	Share in % from municipalities	Share in % from gardening	Share in % from industry	Share in % from agriculture
Field edge composting	28.7	4.0	71.1	24.3	2.1	2.5
Composting	35.5	25.3	49.6	38.6	4.3	7.5
Co-Fermentation	21.3	40.3	3.9	1.7	16.6	77.8
Fermentation	8.7	29.2	48.0	11.3	35.0	5.6
Collection point	5.8	1.2	59.6	40.4	0.0	0.0

Total cost of biowaste collection and treatment comes to 10 – 20 CHF per capita and year with around 100 kg biowaste per capita per year.

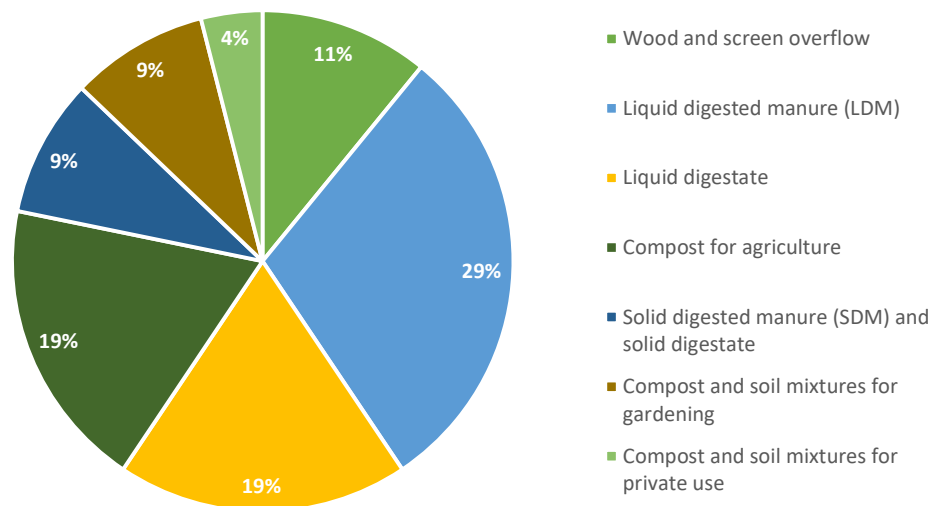
Mass flow of biowaste²

Figure 1: Flow of biowaste totally in percent, million tons and million cubic meters 2021.



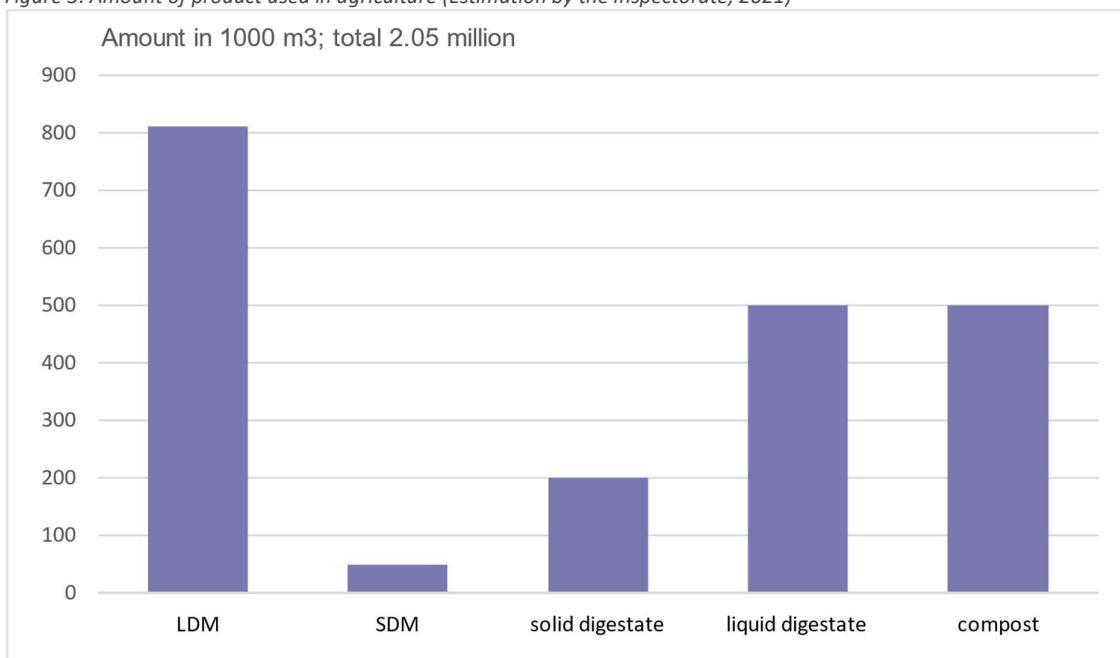
5 Application and market

Figure 2: Products from biowaste treatment on the market



Products supplied to agriculture are the biggest piece of the pie with 78% totally, which equals more than 2 million m³, containing LDM and SDM, liquid and solid digestate, and compost for agriculture. Agriculture products are more detailed described in the graph below. Compost for agricultural use is usually sieved to 30 – 40 mm and generally given young in terms of maturity. Products for agriculture are supplied free of charge, while in some cases cost of distribution to the farming fields is carried by the treatment plant itself or by the farmer. Compost and soil mixtures for private and professional gardening use make up 13% of the pie, which equals 0.35 million m³. Compost for horticulture is usually sold between 60 – 90 CHF per m³ and soil mixtures are sold depending on cost of production and price of the input materials that must be bought to make the mixture. That product is usually sieved to 10 – 20 mm.

Figure 3: Amount of product used in agriculture (Estimation by the Inspectorate, 2021)²



A study in the canton of Zurich 2015 showed the main earnings of a biowaste treatment plant. Most of the income is generated through the fees for waste disposal paid by municipal waste collection, professional gardening, and industry, with 80% of the income. Income generated through energy production (methane gas, electricity, and heat) is the second biggest income with 18%, while income generated through sales of products generated from the biowaste process only accounts for 2%.

6 Expected trends and developments

More income should be generated through products in the future. With increasing prices for fertilizers, recycling fertilizers become more valuable. Further carbon enhanced farming is a hot topic. Products from biowaste, such as compost can have a positive impact on the soil carbon budget. If certification for carbon enhancing soil practices get introduced, the value is further raised. Last but not least, peat is an often criticised material and

shall be reduced as much as possible. High quality compost showed that it can serve as a substitute for peat in some extent. Reduced peat consumption further increases the value of compost. Owners of biowaste treatment plants hope that in the future more income will be generated through the products produced by them, especially for products for agriculture. In the table below we show the fertilizing values of the products and their current average selling price. Only compost for horticulture use is currently above its fertilizing value, but up to the point of selling a lot of work has been put into it.

Table 4: Received value for the products versus their value of fertilizing substitute according to the amount of different fertilizer and their specific Swiss market value (N – only the amount that has to be put in the nutrient balance, P, K, Ca, Mg)

Product	Liquid digestate	Solid digestate	Compost for agriculture	Compost for horticulture
Fertilizer value [CHF/m ³]	22.7	25.7	23.2	23.2
Actual value [CHF/m ³]	0 – 5	0 – 5	0 – 5	60 – 90

Foreign material in the end products still is a major concern. Plastic must be further reduced to reduce the negative impacts on the environment. Mostly the foreign material originates from the municipal biowaste, where general municipal waste is mixed with municipal biowaste. Independent companies in Switzerland are working on the approach to use AI enhanced camera technology to monitor the impurities in collected municipal biowaste. This should help to further reduce front-of-the-pipe pollution of the input material. The stricter regulations for products for organic farming should further help to increase pressure for improvement on the topic.

New regulations in DÜV starting 2024 pose new challenges to the biowaste treatment facilities. It will take some time to see how the adapted regulations affect the facilities in practice.

7 Contacts and sources of information

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Key actors of the branch are all represented in the inspectorate:
<https://www.mpsecure.ch/cvis/index.aspx?site=informationen>

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About Umweko GmbH

We care about biomass and its utilisation

Basic task – biowaste

- from collection to transport
- to treatment and processing
- to products

Our competences

- Monitoring incl. inspection and quantity analyses with reports
- Training and further education for various segments from lectures to employees at the plants
- Expert assessment for the various official levels



8 Annex

¹Composting and fermentation plants survey in Switzerland and Lichtenstein. BAFU (2019).

file:///C:/Users/manue/Downloads/link3.1_BerichtUmwekoBAFUKompostier%20und%20Verga%CC%88rungsanlagen%20Erhebung-2.pdf

²In English: Quality guidelines for products and their application from composting and fermentation (2022)

<https://www.umweko.ch/sharedFiles/154?signature=23b318c22737d3ae3d8f1d04e0c9ec4e99a7d4a0245d38f91337532a45ef79e8>

²In German: Qualitätsrichtlinie für Produkte aus Vergärung und Kompostierung (2022)

https://www.mpsecure.ch/cvis/public/pdf/Qualitaetsrichtlinie_22_d.pdf

³Nationwide survey on biogenic waste from municipal sources: Survey of the municipalities. BAFU (2017).

https://www.bafu.admin.ch/dam/bafu/de/dokumente/abfall/externe-studien-berichte/gesamtschweizerische-erhebung-ueber-biogene-Abfaelle-aus-kommunalen-quellen-umfrage-bei-den-gemeinden.pdf.download.pdf/Bericht_biogene_Abfa%CC%88lle_-def_D-F-I.pdf

⁴CVIS - Inspektoratssystem für die Kompostier- und Vergärbranche Schweiz

<https://www.mpsecure.ch/cvis/index.aspx?site=informationen>

⁵Handbuch QM Biogas. Biomasse Suisse. https://biomassesuisse.ch/handbuch_qm_biogas