



Overview: Compost and Digestate Safety for Agriculture



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1 What is this document for?

This document provides a brief overview of the findings from four separate risk assessments procured by WRAP and Zero Waste Scotland that examine the safety of composts and digestates when used on agricultural land. Background information on the regulatory controls governing compost and digestate production and use in Scotland is also provided. More detailed summaries of the risk assessments can be downloaded from the WRAP website¹.

¹<http://www.wrap.org.uk/content/digestate-quality-and-safety-agriculture>; <http://www.wrap.org.uk/content/summary-report-compost-quality-and-safety-agriculture>



2 What are compost and digestate?



Compost is made from the controlled biological decomposition of either solely green waste (such as lawn clippings, prunings and woody material) or from a mix of green waste with food waste, in the presence of oxygen. The resulting 'green compost' and 'green/food compost' are excellent soil conditioners and sources of major plant nutrients, including readily available potash. Compost is not the same as 'potting soil' or other media used for container-grown plants, but compost can be used as an ingredient in potting soil mixes.

Digestate is one of the products of anaerobic digestion (AD), which is the controlled decomposition of biodegradable materials (such as food waste, animal manures and energy crops), in the absence of oxygen. Digestate is also known as 'anaerobic digestate' or 'biofertiliser'. It is normally produced as 'whole' (a slurry with a dry matter content of around 5%), but this can be separated into fibre and liquor fractions. Digestates supply readily available nitrogen and other plant nutrients. Fibre digestates are a source of organic matter and can act as soil conditioners.

3 Are there any regulations around compost and digestate manufacture?

Yes – the processes of compost and digestate manufacture are considered ‘waste’ activities, and need appropriate approvals from SEPA. Wastes accepted for processing must be source-segregated biodegradable wastes only, and be restricted to those listed in the SEPA approval. Where food wastes are composted or digested, then an additional approval is required from the Animal and Plant Health Agency (APHA). Composting and AD processes that accept wastes normally incorporate a sanitisation or pasteurisation step; this is typically $\rightarrow 65^{\circ}\text{C}$ for several days (compost sanitisation) and 70°C for one hour (digestate pasteurisation). Sanitisation and pasteurisation are a legal requirement where food wastes are composted or digested, under the ABPR (Animal By-Products Regulations).



4 Delivering quality compost and digestate

Where wastes are composted or digested, the resulting composts and digestates are normally considered 'wastes'. This 'waste' status can give the impression of poor quality, causing compost and digestate to be under-valued as resources. To help overcome this perception, the UK environmental regulators all recognise 'end of waste' approaches for compost and digestate, delivered under the Compost Certification Scheme (CCS)² and Biofertiliser Certification Scheme (BCS)³.

The CCS requires all composts to meet the requirements of PAS100⁴, whilst the BCS requires all digestates to meet the requirements of PAS110⁵, both are 'Publicly Available Specifications' owned by the British Standards Institution. The PAS specifications provide baselines for product quality on which customers can build, and compliance is checked through annual audits by third parties. Compliant sites must operate a Quality Management System based on HACCP (Hazard Analysis and Critical Control Points) principles to ensure that the required quality is consistently delivered. Certified composts and digestates are no longer considered wastes, however Animal By-Product Regulation (ABPR) controls on grazing and forage harvest intervals still apply to composts made from food wastes.



5 Confidence in compost and digestate

Although the regulatory and CCS/BCS requirements are freely available, the lack of visibility around their supporting evidence has previously prompted questions on the safety of composts and digestates from food-chain stakeholders. In response to this, a wide-ranging programme of evidence-gathering was funded by WRAP and then Zero Waste Scotland. This included four separate risk assessments for compost and digestate quality, examining risks to humans, livestock and crops:

- Green composts used where livestock graze or forage crops are grown;
- Green/food composts used where livestock graze or forage crops are grown;
- Green and green/food composts used where crops are grown for human consumption;
- Digestates used where crops are grown for human consumption, and where livestock graze or forage crops are grown.

These risk assessments were undertaken by a number of expert institutions, including: the James Hutton Institute, Animal & Plant Health Agency, Cranfield University, ADAS and Earthcare Technical. At all stages, input was sought from food-chain stakeholders that included the UK Food Standards Agency (FSA), Food Standards Agency in Scotland (now Food Standards Scotland; FSS), farming unions, retailers and many others.



The independent advisory committees⁶, coordinated by the FSA, also provided scientific scrutiny.

²<http://www.qualitycompost.org.uk/>

³<http://www.biofertiliser.org.uk/>

⁴<http://www.qualitycompost.org.uk/standards/pas100>

⁵<http://www.biofertiliser.org.uk/pas110>

⁶The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (CoT) and Advisory Committee on the Microbiological Safety of Food (ACMSF)

6 Risk assessment overview

Where possible, quantitative risk assessments (QRA) were undertaken using a classic source-pathway-receptor model. Where published data were insufficient to populate full quantitative risk assessments, then qualitative assessments were made – for example, by comparing the ‘concentration’ of hazard in digestate or compost with environmental backgrounds or the ‘concentration’ of the same hazard in other materials that are commonly applied to land, such as livestock manures. Based on stakeholder feedback, and following preliminary evidence reviews, several categories of hazardous agents were compiled for consideration, as listed in Table 5-1.

The overall conclusions were that current statutory composting and AD process requirements and (where appropriate) statutory grazing and forage harvest bans were sufficiently robust to ensure that risks to humans and livestock were acceptably low. Where AD systems did not include a pasteurisation stage, it was recommended that the further testing for specific crop pests and diseases be undertaken on the resulting digestates before use.

Taking account of the current evidence base and scientific opinion, Food Standards Scotland (FSS) concurs with existing advice that the risks from PAS-100 compliant composts and PAS-110 compliant anaerobic digestates used in

agriculture are low and comparable with other materials used for this purpose. Businesses intending to use composts and anaerobic digestates in food production should ensure that they are used appropriately i.e. that measures are taken in the food production process to control potential contamination arising from the

soil, water and any fertilisers used⁷. Businesses should use such products in accordance with manufacturers’ instructions.

Table 5-1 Categories of hazards considered, with examples. Full lists of hazards considered can be found in the detailed risk assessment summaries⁸

Toxic compounds present in plants

Ragwort (*Senecio jacobaea*)

Organic compound contaminants

PAHs (Polycyclic Aromatic Hydrocarbons); PCBs (Polychlorinated biphenyls); and PCDD/Fs (Polychlorobenzodioxins and Polychlorodibenzofurans)

Potentially Toxic Elements

Zn (Zinc); Cu (Copper); Ni (Nickel); Cd (Cadmium); Pb (Lead); Hg (Mercury); Cr (Chromium)

Pathogens and other organisms of relevance to animal health

Classical Swine Fever Virus (CSFV); Foot and Mouth Disease Virus (FMDV); Scrapie

Pathogens and other organisms of relevance to human health

Enterobacteriaceae (*E. coli* O157); *Salmonella* spp.; *Campylobacter* spp.; *Listeria* spp.; *Cryptosporidium parvum*

Pathogens and other organisms of relevance to crop health*

Potato cyst nematodes (PCN); Free-living nematodes (such as stubby root nematodes); Clubroot of brassicas; *Fusarium*; Potato pathogens such as Powdery and common scab, *Rhizoctonia*, Ring rot, Brown rot and *Phytophthora*.

Physical contaminants of relevance to human and animal health+

Glass; metal; plastic; non-stone fragments; stones; sharps.

*Digestate risk assessment only

+Compost risk assessment only

The detail of the hazards considered differed slightly between compost and digestate risk assessments; for example, risks to crop health from plant pests and diseases in composts were not covered in detail by the risk assessments, as they had been examined previously – and underpin the sanitisation recommendations in PAS100.

⁷as defined in Regulation (EC) 852/2004; Annex 1; Part A(II); 3(a)
⁸<http://www.wrap.org.uk/content/digestate-quality-and-safety-agriculture>; <http://www.wrap.org.uk/content/summary-report-compost-quality-and-safety-agriculture>



7 Quality controls for materials applied to land



Although the risk assessments showed that the underlying regulatory requirements were robust, the regulations do not provide guidance on best practice that could reduce risks even further. Such best practice guidance is already in place for other materials, such as:

- Managing Farm Manures for Food Safety (published by the Food Standards Agency)
- The Safe Sludge Matrix (published by ADAS and Water UK)

Consequently, the findings of the risk assessments and wider research programme were used as the basis for a 'Renewable Fertiliser Matrix', which covers digestate and compost. The requirements are presented in Table 6-1. Versions of this matrix have now been embedded into the requirements of farm assurance schemes such as Quality Meat Scotland and Red Tractor Assurance. The statutory ABPR controls are a key risk management barrier, allowing for the attenuation of residual pathogens in compost or digestate before livestock could come into contact with the materials. This same principle is applied to fresh produce, where crops are harvested several weeks after compost or digestate is applied, minimising potential exposure of humans to residual pathogens.

Table 6-1 The renewable fertiliser matrix

		PAS110 digestates				PAS100 composts			
		Pasteurised ¹		Non-pasteurised		Green		Green/Food	
Cropping category									
Fresh produce	Group 1	✓	Before drilling or planting ²	✗	NOT within 12 months of harvest and also at least six months before drilling or planting ²	✓	Before drilling or planting ²	✓	Before drilling or planting ²
	Group 2	✓	Before drilling or planting ²	✗	NOT within 12 months of harvest and also at least six months before drilling or planting ²	✓	Before drilling or planting ^{2,3}	✓	Before drilling or planting ^{2,3}
	Group 3	✓	Before drilling or planting ²	✓	Before drilling or planting ²	✓	Before drilling or planting ^{2,3}	✓	Before drilling or planting ²
	Combinable and animal feed crops	✓	May be applied before and after drilling or planting ⁴	✓	May be applied before and after drilling or planting ⁴	✓	May be applied before and after drilling or planting ⁵	✓	May be applied before and after drilling or planting ⁵
	Grassland and forage – grazed	✓	Statutory no-graze intervals apply ⁵	✓	Three week no grazing period applies	✓	Three week no grazing period applies	✓	Statutory no-graze intervals apply ⁵
	Grassland and forage – harvested	✓	Statutory no-harvest intervals apply ⁵	✓	Three week no harvest period applies	✓	Three week no grazing period applies	✓	Statutory no-graze intervals apply ⁵

Notes

1. Derived from feedstocks that include Animal By-Products (ABPs), according to the requirements of the European Animal By-Products Regulations (Regulation (EC) No. 1069/2009 and Commission Regulation (EU) No. 142/2011, as implemented by the nations of the UK and Northern Ireland). Pasteurised digestates also include those

derived from inputs that have undergone prior processes equivalent to pasteurisation.
 2. Target of zero and absolute limit of $\leq 0.1\%$ (m/m dry weight) glass must be achieved.
 3. May be applied as a mulch
 4. No specific additional risk-management approaches are

required for this cropping category, as regulatory and good practice requirements apply to this (and all other) categories
 5. In accordance with the Animal By-Products Regulations (see above). These currently stipulate intervals of two months for pigs and three weeks for other livestock.

The cropping categories used in Table 6-1 combine those previously adopted by Red Tractor Assurance for fresh produce, with those used in the Safe Sludge Matrix (Table 6-2).

Table 6-2 Categories used in the Renewable Fertiliser Matrix (updated to be in line with Red Tractor amendments)

Fresh produce	Group 1	Crops that the customer can eat raw and which do not have a protective skin that is removed before eating; they may also have a significant risk or history of pathogen contamination:	Whole head Lettuce, Leafy Salads (including any vegetable leaf you can eat raw), Celery, Salad Onions, Radish, Fresh and Frozen Herbs, Strawberries, Chicory etc.
	Group 2	Crops that the customer can eat raw and which either have a protective skin or grow clear of the ground, or that have no history of pathogen contamination:	Apple, Beetroot, Blackcurrant, Blueberry, Broad Bean, Broccoli, Cabbage, Carrot, Capsicum, Cauliflower, Celeriac, Cherry, Courgette, Cucumber, Garlic, Green Beans (including runner beans), Melon, Mushroom, Onion (red and white), Pea, Pear, Peach, Plum, Raspberry, , Sugar Snap Peas, Sweet Corn, Tomato and Tree Nuts, etc.
	Group 3	Crops that the customer always cooks:	Artichoke, Aubergine, Brussels Sprouts, Hops, Horseradish, Kohl Rabi, Leek, Marrow, Parsley root, Parsnip, Potato, Pumpkin, Squash, Swede, Turnip, etc.
	Combinable and animal feed crops	Wheat, Barley, Oats, Rye, Triticale, Field peas, Field beans, Linseed/flax, Oilseed rape, Sugar beet, Sunflower, Borage.	
	Grassland and forage – grazed	Grass, Forage swedes and turnips, Fodder mangolds, Fodder beet, Fodder kale, Forage rye and triticale, Turf.	
	Grassland and forage – harvested	Grass silage, Forage maize, Haylage, Hay, Herbage seeds.	

8 Additional Resources

Farmer's guide to sourcing and using digestate and compost

https://www.zerowastescotland.org.uk/sites/default/files/Farmers_guidance_document.PDF

Digestate and compost good practice guidance

<http://www.wrap.org.uk/content/digestate-and-compost-good-practice-guidance>

Compost quality and safety for agriculture risk assessment summary

<http://www.wrap.org.uk/content/digestate-and-compost-good-practice-guidance>

PAS 100

<http://www.qualitycompost.org.uk/standards/pas100>

PAS 110

<http://www.biofertiliser.org.uk/pas110>

SEPA position statement on regulation of outputs from composting processes

<https://www.sepa.org.uk/media/219843/wst-g-050-regulation-of-outputs-from-composting-processes.pdf>

SEPA position statement on regulation of outputs from Anaerobic Digestion processes

<https://www.sepa.org.uk/media/219842/wst-ps-016-regulation-of-outputs-from-anaerobic-digestion-processes.pdf>



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