

Quality digestate

# Using quality anaerobic digestate to benefit crops







Images courtesy of Green Energy UK

## Nutrients in digestate are valuable

“At Gask Farm we used to spend £52,000 a year on fertilisers, but we’ve been using digestate for 6 years and now we only spend £10,100. You have to balance these savings against the costs of application, but on wheat and barley crops we only apply a fifth of the fertiliser that we used to. The winter oilseed rape that we grow receives no fertiliser - the nutrients and trace elements in the digestate do the job for us.”

Andrew Rennie, farmer and AD operator



## Anerobic digestate is a biofertiliser, providing crops with readily available nitrogen

It is an excellent alternative to bagged fertilisers. Using it improves the sustainability of farming by reducing emissions of greenhouse gases associated with fertiliser manufacture, and by reconnecting nutrient cycles.

This guide provides farmers and their advisers with an introduction to anaerobic digestate, what it is and how to use it. For those interested in finding out more, there is a section on 'Further information' at the end of this guide, including a list of all websites referred to.

Cover image courtesy of Andigestion

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## What is anaerobic digestate?

“Digestate is an excellent biofertiliser which can help farmers to reduce their costs. With the recent rapid growth in AD infrastructure, it is becoming increasingly available to farmers across the UK. It is therefore important that anaerobic digestate is managed appropriately to achieve the best results.”

Nicola Dunn, NFU

Anaerobic digestion (AD) is a natural process, using microbes to break down biodegradable materials in the absence of oxygen, in a controlled environment. Suitable biodegradable materials for use in AD include left-over food, livestock slurries or crops such as maize and grass silage. As well as digestate, AD produces biogas which can be used to generate renewable heat and electricity.

### Digestate typically comes in three forms:

**Whole:** similar in its appearance to a livestock slurry, with typically less than 5% dry matter.

**Liquor:** this is whole digestate which has had most, or all, of the solid material separated.

**Fibre:** similar to compost, this is the solid material separated out of the whole digestate.

### Do digestates include animal by-products?

Some digestates are made from food wastes such as dairy produce, meat and fish. The production and use of these digestates is governed by the Animal By-Products Regulations, which require all materials to be pasteurised. Once pasteurised, digestate is safe to use, although livestock should not be grazed, or forage crops cut, within three weeks of application (or within two months for pigs), in accordance with legislative and good practice requirements for the use of all organic materials.



Image courtesy of Agrivert

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## What nutrients does digestate contain?

The typical nutrient content of a food-based digestate is illustrated in the table below and is worth over £100/ha on current fertiliser prices.

### Nitrogen

Analysis shows that an impressive 80% of the total nitrogen in food-based digestate is present as readily available nitrogen. This high level of availability means that digestate can be used as a direct replacement for 'bagged' nitrogen fertiliser. Digestion of livestock slurry will typically increase availability of the nitrogen in the slurry by around 10%.

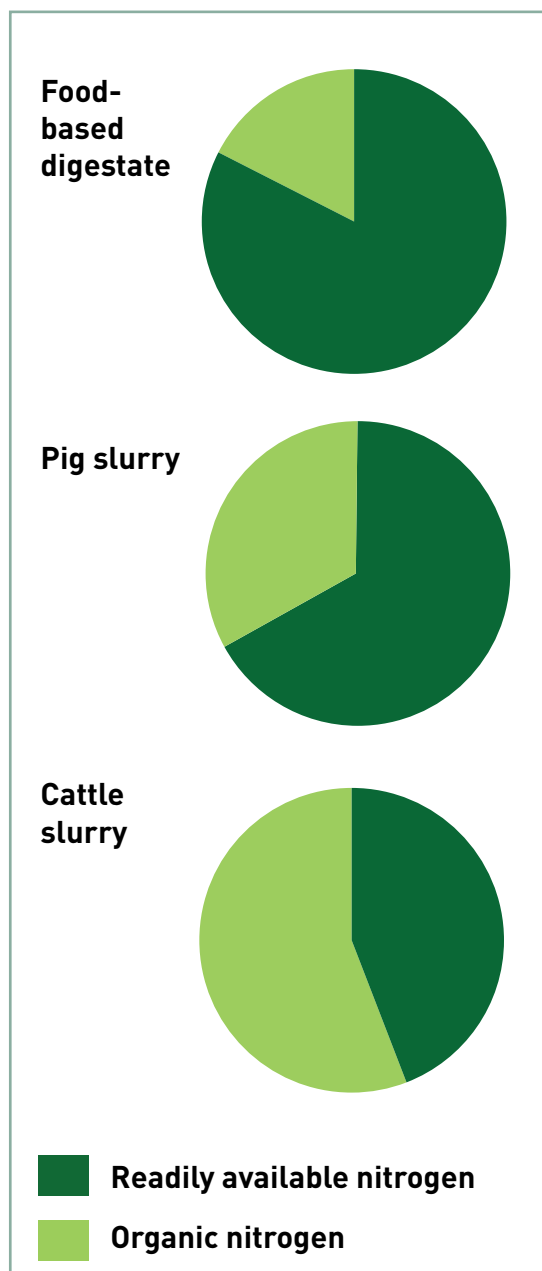
As with livestock slurries, the amount of nitrogen that will be available to the crop will be less than the total, due to potential losses of nitrogen as ammonia gas or through nitrate leached into groundwater, although following good agricultural practice will help crops take up more (see below). Where digestates are banded to growing crops in the spring, on-going field experiments have shown that up to 60% of the readily available nitrogen can be available to the crop in the year of application.

### Phosphate & potash

Digestate contains useful amounts of phosphate and potash, together with small quantities of other nutrients and trace elements to help maintain soil fertility.

As a general rule, 50% of the phosphate and 80% of the potash will be available to the crop in the year of application. These values should be used to calculate crop nutrient requirements where a response to either phosphate (P) or potash (K) is expected, e.g. soil P and K Indices of 0/1 or very low/low, or where responsive crops are grown. Where soil P and K Indices are at target levels or above, i.e. Index 2/ moderate status and above, the total nutrient content of the digestate should be taken into account in nutrient balance sheet calculations.

### Nitrogen analysis

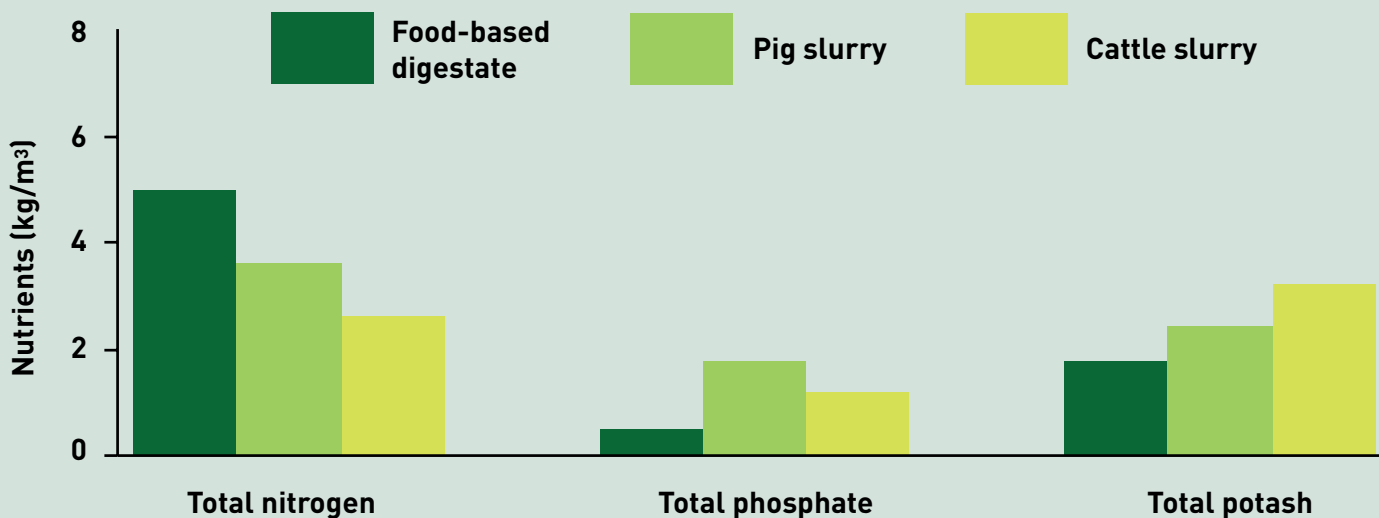


### Fertiliser replacement value for a typical whole digestate

	Crop available N (nitrogen) (kg)	Total P <sub>2</sub> O <sub>5</sub> (phosphate) (kg)	Total K <sub>2</sub> O (potash) (kg)	Potential digestate fertiliser value*
Digestate, per m <sup>3</sup>	3.0	0.5	2.0	£4.11
Digestate, applied at 30m <sup>3</sup> /ha	90.0	15.0	60.0	£123.30

\*Based on a banded application (which assumes a 60% nitrogen efficiency) and using 2011 average nutrient prices of nitrogen = £0.89/kg, phosphate = £0.83/kg and potash = £0.51/kg (based on fertiliser prices published by FARM BRIEF)

## Digestate fertiliser values: average nutrient content of food-based digestate, compared with livestock slurries



### Nutrient planning

Digestate is a biofertiliser and, as with all organic materials, full allowance for the nutrients supplied should be factored into farm nutrient management plans. If you are unsure, contact a FACTS qualified adviser to provide advice on making the best use of digestate.

The nutrient content of digestate will vary between producers and users are advised to ask suppliers for a recent nutrient analysis of their product, or to analyse the digestate themselves. Integrating this analysis into farm nutrient management plans will help maximise the fertiliser potential of digestate, without compromising crop yields or quality.

As digestate is a relatively new material, it does not feature in the latest editions of the [Fertiliser Manual \(RB209\)](#), [SAC \(Scottish Agricultural College\) Technical Notes \(TN622\)](#) or the nutrient management software tools, [MANNER](#) and [PLANET](#). Research is underway to provide data to update these and other useful farmer tools, like [Tried and Tested Nutrient Management](#), with information on digestate (see below), but it is still possible to use RB209 and the nutrient management software to plan digestate applications by using pig slurry as a proxy.

www.defra.gov.uk

# Fertiliser Manual (RB209)

8th Edition June 2010

Welsh Assembly Government | FACTS | defra Department for Environment, Food and Rural Affairs



# How to apply digestate

## When to apply?

To make optimum use of the nitrogen content of digestate, it should be applied at times of maximum crop growth. This would normally be from late winter (i.e. February) through spring and summer. It is unlikely that nitrogen will be taken up efficiently by crops from autumn applications of digestate, other than for the few crops that have a nitrogen requirement at this time of year, such as oilseed rape. In accordance with good practice, digestate should not be spread in any of the following conditions:

- heavy rain is forecast within 48 hours;
- the soil is waterlogged;
- the soil is frozen;
- there is a covering of snow;
- the soil is cracked down to field drains or backfill; or
- the field has been pipe or mole drained, or sub-soiled over drains, in the last 12 months.

Similarly, digestate should not be applied:

- within 10 metres of any ditch, pond or other surface water;
- within 50 metres of any spring, well, borehole or reservoir that supplies water for human consumption or for farm dairies; or
- on very steep slopes.

For further information on the management of organic materials, refer to Defra's ['Code of Good Agricultural Practice'](#), the ['Code of Good Agricultural Practice for Wales'](#) or, in Scotland, the code for the ['Prevention of Environmental Pollution from Agricultural Activity'](#).

## NVZs (Nitrate Vulnerable Zones)

An NVZ is an area where land drains into waters which are already, or are at risk of becoming polluted by nitrates. Farmers within NVZs must comply with mandatory rules controlling the application of nitrogen fertilisers, including organic materials. Maps showing NVZ areas are available from [Defra](#) in England, [SEPA](#) in Scotland, or the [Welsh Government](#) in Wales. In Northern Ireland, all farmers must comply with the NVZ rules.

Within an NVZ, currently the maximum total nitrogen that can be applied to an individual field in organic manures cannot exceed 250kg per hectare within any twelve month period. For bagged fertilisers and some organic materials with a high readily available nitrogen content, including digestate, there are 'closed spreading' periods during which they cannot be applied. Closed spreading periods cover autumn and winter, although the precise dates vary depending on the soil type and the crop. Defra's ['Guidance for Farmers in Nitrate Vulnerable Zones'](#) sets out these dates clearly.

Where digestate is wholly or partially derived from livestock manures and/or slurries, a corresponding proportion of the digestate must be taken into account in the farm average livestock nitrogen loading, currently 170kg/ha per year. Always check with a FACTS qualified adviser for the latest NVZ requirements.

## What spreading equipment to use?

Best practice is to apply digestate using a band spreader with a trailing hose or shoe, or a shallow injector. Applying digestate close to the plant roots in this way will increase the amount of nitrogen available to the crop, and reduce the amount lost to the atmosphere as polluting ammonia gas. In contrast, broadcasting digestate with a splash-plate or similar would waste a lot of the nitrogen, with only a very small proportion becoming available to the crop.

Further information on spreading equipment is available in the guidance document published by ['WRAP Cymru Digestate: Realising the fertiliser benefits for crops and grassland'](#).

Applying digestate with...



... a trailing hose ... Image courtesy of Gask Farm



... or a trailing shoe. Image courtesy of ADAS



# What is the evidence?



Image courtesy of ADAS

**“We’re actively involved in digestate research and on-farm recycling – its rocket fuel!”**

**Professor Brian Chambers,  
Head of Soils & Nutrients, ADAS**

**“We ran trials at SAC and the spring barley grown with fibre digestate got excellent yields, with no impact on crop quality.”**

**Audrey Litterick,  
Earthcare Technical Ltd**

## **The evidence: using digestate in practice**

The Digestate & Compost in Agriculture project involves a series of replicated scientific field experiments, led by WRAP and funded by Defra and the governments of Scotland and Wales. The project is providing the information necessary for farmers to maximise the potential of digestate and compost to grow quality crops, whilst helping to meet our climate change and waste reduction commitments.

The experiments are providing robust data on several key research questions, including the crop available nitrogen supply from digestate, the emissions of greenhouse gases (particularly nitrous oxide) and the impacts on soil and crop quality. The project includes an extensive knowledge exchange programme targeted at students, farmers and agricultural consultants.

The experiments run for the period 2010-14 and are already producing interesting results, including the nutrient content and nutrient availability data provided in this guide. For further information and the latest project bulletin, please visit [www.wrap.org.uk/dc-agri](http://www.wrap.org.uk/dc-agri)



# How to source digestate

## Quality assurance

The Biofertiliser Certification Scheme is an independent quality assurance scheme, giving confidence to farmers that digestates are safe, consistent and fit for purpose. To register on the scheme, digestate manufacturers must comply with process and product standards which:

- clarify what inputs can be used in digestate production;
- impose strict controls to ensure that organic materials are processed safely; and
- specify minimum quality standards for digestates sold to farmers (and other markets).

## Products, not wastes

Across the UK, digestates certified under the [Biofertiliser Certification Scheme](#) are classified as products by the respective regulatory bodies, and there is no need to apply for a waste exemption or permit to spread the digestate. The regulatory requirements in Scotland are different to those in England, Wales and Northern Ireland, although the Biofertiliser Certification Scheme takes these differences into account and users can be confident that digestates certified under the scheme comply with the relevant regulations, wherever they are in the UK.

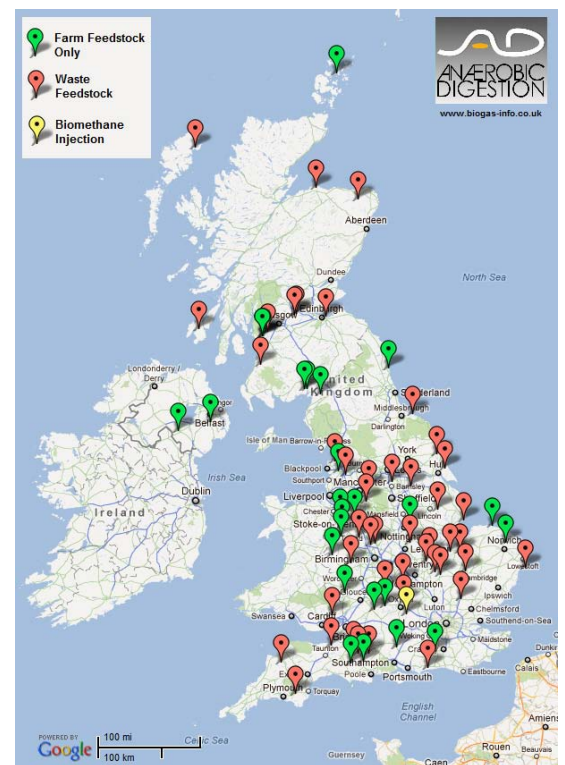
In England, Wales and Northern Ireland, digestates must be certified under the [Quality Protocol](#) (which includes the [BSI PAS 110](#) specification). In Scotland, the Quality Protocol requirements do not apply, although compliance with BSI PAS 110 is necessary and digestate users must apply the digestate in accordance with SEPA's position statement on the '[Classification of outputs from anaerobic digestion processes](#)'. Digestates certified under the scheme must be used in accordance with good practice and regulatory controls, particularly where the Animal By-Products Regulations apply.

Digestates not certified under the Biofertiliser Certification Scheme are likely to be classified as wastes and their use must comply with waste regulations. To obtain advice on what is required to comply with regulatory controls, speak to your local Environment Agency or SEPA officer, or a FACTS qualified adviser, if you know they are familiar with the waste regulations.

## How can I find digestate producers?

A list of certified digestate producers is available on the [Biofertiliser Certification Scheme website](#).

In addition, a map and contact details of digestate producers are available online from the Official AD Information Portal.



Map illustrating the widespread distribution of AD operators across GB

## Further information & weblinks

Set out below is a list of useful information and full website addresses for materials referred to in this guide.

### Locate your nearest supplier

List of certified digestate producers

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

Map and contact details of all known AD producers

<http://www.biogas-info.co.uk/index.php/ad-map.html>

Searchable database of certified compost producers

<http://compostsuppliers.wrap.org.uk/>

### Other useful WRAP websites

WRAP webpages on the field experiments for the use of digestate & compost in agriculture

[www.wrap.org.uk/dc-agri](http://www.wrap.org.uk/dc-agri)

WRAP's Compost Calculator for up-to-date fertiliser replacement values of digestate and compost

[www.wrap.org.uk/compostcalculator](http://www.wrap.org.uk/compostcalculator)

WRAP Cymru publications, including *Digestate: Realising the fertiliser benefit for crops & grassland*

[www.wrapcymru.org.uk/content/organics-1](http://www.wrapcymru.org.uk/content/organics-1)

### Information on AD industry, biofertiliser certification and regulation

The Official AD Information Portal: <http://www.biogas-info.co.uk/>

Biofertiliser Certification Scheme: <http://www.biofertiliser.org.uk/>

BSI PAS 110 *Specification for quality anaerobic digestate*

<http://www.wrap.org.uk/content/bsi-pas-110-specification-digestate>

Environment Agency's *Quality Protocol for Anaerobic Digestate*

<http://cdn.environment-agency.gov.uk/geho0610bsvd-e-e.pdf>

SEPA's *Position Statement – Classification of outputs from anaerobic digestion processes*

[http://www.sepa.org.uk/waste/waste\\_regulation/guidance\\_position\\_statements.aspx](http://www.sepa.org.uk/waste/waste_regulation/guidance_position_statements.aspx)

AHVLA guidance on the use of ABP (animal by-product) derived materials as organic fertilisers

<http://animalhealth.defra.gov.uk/managing-disease/animalbyproducts/compost-biogas-manure/use-of-organic-fertilisers-soil-improvers.htm>

Task 37 working group of the IEA (International Energy Agency) on the biological treatment of organic materials

<http://www.iea-biogas.net/>



## Fertiliser planning

Defra's *Fertiliser Manual (RB209)*

<http://www.defra.gov.uk/publications/2011/03/25/fertiliser-manual-rb209/>

Tried & Tested Nutrient Management Plan, produced by and for the agriculture industry (AIC, FWAG, LEAF, NFU and CLA)

<http://www.nutrientmanagement.org/>

SAC technical note *Optimising the application of bulky organic fertilisers*

[http://www.sruc.ac.uk/downloads/download/209/tn622\\_optimising\\_the\\_application\\_of\\_bulky\\_organic\\_fertilisers](http://www.sruc.ac.uk/downloads/download/209/tn622_optimising_the_application_of_bulky_organic_fertilisers)

MANNER (Defra/ADAS software for predicting the fertiliser values of organic manures)

<http://www.adas.co.uk/MANNER/FurtherInfo/tabid/274/Default.aspx>

PLANET (Planning Land Applications of Nutrients for Efficiency and the environment)

<http://www.planet4farmers.co.uk/>

## Good agricultural practice

Defra's *Code of Good Agricultural Practice*

<http://archive.defra.gov.uk/foodfarm/landmanage/cogap/documents/cogap090202.pdf>

Welsh Government *Code of Good Agricultural Practice*

<http://wales.gov.uk/docs/legislation/inforcenonsi/environmental/110304code20eng.pdf>

Scottish Executive's *Code of Good Practice for the Prevention of Environmental Pollution from Agricultural Activity (PEPFAA)*

<http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/Environment/PEPFAA/Overview>

## NVZs (Nitrate Vulnerable Zones)

Defra webpages on NVZs

<http://www.defra.gov.uk/food-farm/land-manage/nitrates-watercourses/nitrates/>

Defra's *Guidance for Farmers in Nitrate Vulnerable Zones*

<http://archive.defra.gov.uk/environment/quality/water/waterquality/diffuse/nitrate/documents/leaflet1.pdf>

Scottish Government webpages on NVZs

<http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/Environment/NVZintro>

Welsh Government webpages on NVZs

<http://new.wales.gov.uk/topics/environmentcountryside/epq/waterflooding/nitratezones/?lang=en>

**For further information visit:**  
[www.wrap.org.uk/agriculture](http://www.wrap.org.uk/agriculture)

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