This report aims to inform The Food Waste Treatment Procurement Programme for Wales of the market potential, regulation and specific issues regarding the beneficial end use of Anaerobic Digestate as a bio-fertiliser.
WRAP’s vision is a world without waste, where resources are used sustainably.

We work with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

Find out more at www.wrap.org.uk
Contents

Contents ................................................................. 3

Key facts ........................................................................ 4

Introduction ....................................................................... 5

BSI PAS 110 & Biofertiliser Quality ..................................... 6

What is BSI PAS 110? ....................................................... 7

What does PAS 110 require ............................................... 7

What does the ADQP require ........................................... 8

Market Economics for Quality Biofertiliser ....................... 8

Agriculture ....................................................................... 10

Applying Biofertiliser to land .......................................... 11

Other Potential Markets for biofertiliser ......................... 13

Further Information ......................................................... 14
Key facts

- Under the WAG Food Waste Treatment Procurement Programme, Wales is set to deliver at least 150,000 tonnes of biofertiliser from municipal AD plants by 2013/4.

- Quality biofertiliser can be used as an excellent fertiliser.

- If biofertiliser is produced and used in accordance with PAS110 and ADQP then it becomes a quality biofertiliser product and not a waste.

- Quality biofertiliser, derived from source segregated biodegradable municipal waste, will contribute towards Local Authority recycling targets when destined for appropriate use in one of the designated market sectors.

- Where biofertiliser complies with PAS 110 & ADQP it can be safely applied to agricultural land without Environment Agency permitting requirements.

- Inorganic fertiliser values and transport economics will play a significant role in the marketing of biofertiliser.

- Application of biofertiliser to arable land is currently the most prevalent market in the UK.

- Application of bio-fertiliser to pasture land is more likely in most areas of Wales and will require adherence to codes of good agricultural practice.

- Some farm assurance standards do not currently allow food waste derived materials as fertiliser for their member farms.

- Ongoing research may provide evidence of a significant market potential for biofertiliser application in brownfield land reclamation and landscape restoration.
A Brief Guide To The Use of Anaerobic Digestate in Wales

Working together with the Welsh Assembly Government, WRAP (Waste & Resources Action Programme) has undertaken a detailed review of the research into the opportunities for the use of the biofertiliser outputs from Anaerobic Digestion facilities.

Introduction

This simple guide has been produced to provide stakeholder information regarding the supply and application of PAS110/ADQP quality biofertiliser to agricultural and other land in Wales, with the aim of building confidence in the marketplace. It is not intended as a definitive guide but as a springboard to further research by producers and users to enable them to quantify and qualify their own specific situation.

Biofertiliser, also known as digestate, is an end result of the anaerobic digestion (AD) of food and other organic waste. It is rich in highly available Nitrogen and is a good source of Phosphate, Potash and other elements required for healthy crop growth and fertile soil. The product is suitable for a variety of crops where it can be used as a direct replacement for inorganic fertilisers and is becoming more widely available to farmers across the UK as new AD plants become operational.

Throughout this electronic document you will find hyperlinks to various web pages. These are given in (blue) text – once the cursor is over this text press the CTRL key and click the mouse to access the web page.

Food safety and sustainability are amongst some of the most important factors when considering the use of recycled organic materials on agricultural land. WRAP has been working with other agencies to produce national quality standards for compost and...
digestate – BSI PAS 100 and BSI PAS 110 respectively. (environment-agency regulatory position statement)

These specifications give purchasers peace of mind about product quality, since all compost and biofertiliser produced in accordance with them must be consistent, safe and reliable to use.

The specifications are supported by Quality Protocols (QPs), which provide a clear framework for the supply and production of compost and biofertiliser. Compost and biofertiliser that meet the Quality Protocol's requirements can be classed as a product and no longer as waste. This means farmers do not have to pay the charges associated with waste regulations, making it cheaper and easier for them to use.

There are now more than 160 compost producers on the BSI PAS 100 certification scheme and a number of biofertiliser producers are working towards achieving the recently introduced BSI PAS 110 specification.

These publically available standards (PAS) are BSI PAS 100 & Compost Quality Protocol for compost and PAS110 and Anaerobic Digestate Quality Protocol (ADQP) for Anaerobic Digestate. The standards are independently administered by the Association for Organics Recycling (AFOR) for the PAS 100 standard and the Renewable Energy Assurance Ltd (REAL) for PAS 110. To comply with either standard producers will have to be independently certified by a certifying body. Information on BSI PAS 110 and the ADQP can be accessed by following this link:

(WRAP Anaerobic Digestion Page)

**BSI PAS 110 & Biofertiliser Quality**

The introduction of BSI PAS 110 & the Anaerobic Digestate Quality Protocol (ADQP) have been driven by the emergence of AD as a preferred food waste treatment technology in the UK. AD technology is prominent in the emerging framework for sustainable development in Wales (One Wales : One Planet).
What is BSI PAS 110?

A publically available specification (PAS) published by the British Standards Institute for:

‘whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials’

What does PAS 110 require?

1. PAS110 - Acceptable Inputs to AD Plant
   - Source-segregated biowastes
   - Biodegradable non-wastes (manures etc)
   - De-packaged food wastes
   - Bioplastics (if compliant with BS EN13432)

2. PAS110 - Supply agreements (L.A.’s & Commercial)
   - Provide feedstock quality assurances
   - Source of material
   - Physical description
   - Acceptance criteria (qualitative or quantitative)
   - Trigger criteria for rejection
   - Notification of significant changes to quality
   - Declaration of fitness for purpose

3. PAS110 - Plant Process control
   - HACCP (Hazard Analysis & Critical Control Points)
     - System description and flow diagram
     - Identify all Critical Control Points
     - Set Critical Limits
     - Describe corrective actions in event of failures
     - Include digestate storage and despatch

4. PAS110 - Pasteurization step
   - Pasteurization to ABPR specification or equivalent
   - Except when inputs are produced and outputs used on same premises or holding. Such inputs include:
     - Animal manures, slurries and used bedding
     - Crops and crop residues
     - Pasteurization is required if digestates are moved between farms

5. PAS110 - Sampling and analysis
   - Sampling frequencies defined pre- and post-validation


- Related to plant throughput
- Standard set of determinands and limits
  - Include pathogens, PTEs, physical contaminants, VFAs and stability
  - Nutrients contents must be declared, but not limited
  - Reduced set of determinands for within-farm materials
- Quality is primarily controlled at front end of process

What does the ADQP require?

- Use only of approved input materials
- Digestates supplied **only** to designated market sectors:
  - Agriculture, forestry & soil/field-grown horticulture
  - Land restoration (only for fibre fraction)
- That producers show how the QP criteria have been met
  - Must keep customer supply documents that include a declaration confirming conformance with the standard and QP
  - Process must be certified by an approved external Certification Body

**Market Economics for Quality Biofertiliser**

The main economic factor currently driving the use of AD technology is the bio-gas output from the plants. However the other significant output from the AD process is biofertiliser, which can arise in a liquid or solid form depending on the nature of the process and feedstock used.

For any AD plant to be sustainable it should have a long term use for its biofertiliser outputs. Fortunately there are many benefits in using biofertiliser on productive land. Quality biofertiliser is a nutrient rich organic Nitrogen/Phosphorous/Potassium (NPK) fertiliser and can be used as a replacement or supplement for more traditionally used expensive inorganic NPK fertilisers.

The substitution of biofertilisers for inorganic fertilisers can have a significant economic benefit for the producer and the user,
resulting in a reduction in the use of finite resources for inorganic fertilisers, their production costs and delivery vehicle miles. These all contribute towards significant carbon and ecological footprint reductions for the nation.

Scientific trials sponsored by WRAP have shown that using solid biofertiliser or compost made from food and garden waste on barley crops can bring significant cost-savings to farmers.

The trials, which were conducted in Scotland, found that when inorganic fertiliser prices were high, as they were in 2008 for example, farmers could save up to £100 per hectare by using compost or biofertiliser, provided haulage and spreading costs were reasonable.

With inorganic fertiliser prices expected to rise again soon, this could have a significant impact on the spring and winter barley crop market in Scotland, which is worth £180m annually, since nutrient requirements are usually met by inorganic fertilisers.

The trial also found that further financial gains could be made from the liming effect of biofertiliser. Soil lime requirements were reduced where biofertiliser was applied at a high rate, proving that bulky fertilisers with high neutralising values could effectively replace lime.

Soil and crop safety tests conducted with regards to potentially toxic elements and contamination showed that compost and biofertiliser did not pose any risks.

An approximate financial value of biofertiliser for any specific application can be assessed using the NNFCC Biogas Calculator tool (Digestate Value Tab) at the following link:

(National Non-Food Crops Centre : AD cost model (Andersons) )
Agriculture

Using the Andersons modelling tool (above) and waste data from the recent WRAP Cymru survey ‘The Composition of Municipal Waste In Wales’

(wrap : food waste characterisation report-Wales)

The laboratory analysis work undertaken by The University of Glamorgan Centre Of Excellence For AD (CEAD) for the above report suggested an on-farm biofertiliser value of approximately £6.00 per wet tonne.

The value agreed for bio-fertiliser between the producer and the farmer/grower will however need to consider transport economics.

A recent WRAP report ‘Compost and Digestate Market Development in Wales’ (Compost and Digestate Market Development In Wales) indicates that current UK experience identifies a radius of 10-15 miles away from the AD plant as being the current maximum before transport costs may become prohibitive. Due to the small number of AD plants in the UK currently supplying to agriculture, however, these radii are skewed towards the economics for compost supply and it is expected that these economic indicators will change as future production and end markets for digestate increase and stabilise. Also there may be macro transport economic factors in the welsh AD hub situation pertaining to the potential for return loads of digestate from the plants, given that food waste feedstocks from some authorities will need to travel much further than 15 miles.

The higher the value of the bio-fertiliser to the end user, the larger the sphere of influence from the AD plant may be. It is likely that the current values represent transport of liquid and whole digestate and not the drier forms of digestate which may become available as plant numbers increase and processes develop, therefore making digestate more economic to transport further.
The WRAP study also concluded that each region of Wales has sufficient arable land to utilise all projected tonnages of digestate likely to be produced by the planned AD hub plants. That is not to say however that all of the arable land required would be within the current 10-15 mile radius indicated above or that this arable land will be available.

**Applying Biofertiliser to Land**

Biofertiliser can be produced in liquid or ‘dry’ forms depending on the type of plant that has produced the material. Dry biofertiliser is really a sludge when emerging from the plant and can be utilised as biofertiliser direct to land in this form, or can be dried further or even composted in windrows by itself or as a mix with other materials. The composting process has the advantage of odour reduction and stabilisation phases. Liquid outputs can be dried or separated to leave a fibre biofertiliser. The dry fibrous biofertilisers can be applied to brownfield and landscape regeneration projects without environmental permits or exemptions provided that the material is PAS110 and ADQP certified.

Liquid or whole digestate is recognised as being most easily managed by direct application to arable land using the standard techniques often used for sludges, via agricultural best practice codes and the requisite farm nutrient management plans. (Application rates — Renewable Energy Association). Under the requirements of the ADQP producers, growers and consultants must record the application of quality digestate to land and an updated webtool to record compliance is currently being developed by WRAP, AFOR and the REA:
Some farm assurance schemes currently do not allow their members to utilise composts or digestates which have been derived fully or in part from waste food material. Many of these restrictions are historical or based on risk perceptions creating a barrier which WRAP is working to eliminate via detailed scientific risk assessment work and advocacy with the farm assurance schemes and retail bodies.

However, farmers and growers are open to the benefits of biofertiliser use which is borne out by a recent policy statement from the National Farmers Union Wales which states that:

“NFU Cymru is supportive of the use of anaerobic digestate. Use of digestate can help farmers to improve the condition of their soils whilst helping to substitute for conventional fertiliser.

NFU Cymru recognises that some stakeholders in the food chain have concerns over the use of digestate material in certain market sectors. Farmers who are in a farm assurance scheme will need to check with their certification body that digestate material is compliant with the requirements of the scheme. NFU Cymru through NFU England and Wales continues to work with WRAP, the waste management industry and food supply chain to improve confidence in the use of digestates on agricultural land and on the development of industry-agreed standards and guidelines.”
The majority of the arable farm land in Wales is in Pembrokeshire which is a considerable distance from the AD plant hubs. It is likely therefore that application of digestate for other agricultural land uses will be required, again this has very good agronomic potential provided that agricultural best practice codes are adhered to.

Such applications, especially in the case of the most likely application of soil injected bio-fertiliser to grass crops, are going to be more weather dependent. Operators in this situation will require suitable seasonal storage facilities at their plant or on farm etc., similar to the traditional farm slurry storage facilities already widely used on beef and dairy farms.

Other potential markets for biofertiliser

Bio-fertiliser will undoubtedly find markets other than agriculture, although at present there is little example of this in the UK as digestate markets are in their infancy.

There is likely to be potential for the use of quality digestate in the restoration of mineral workings, landscaping and the reclamation of brownfield land.

Currently in Wales there is an ongoing need for restoration soils in mineral workings which outstrips physical availability by millions of cubic metres.

This lack of availability of soils in these locations means that alternative methods of soils manufacture will need to be employed. WRAP are currently engaged in field trial work using a mix of quality composts, digestates and in-situ available inert soil forming mineral materials from quarries and open cast sites across Wales to establish best practice guides for the extraction industries to replicate these soil manufacture techniques.

This research will not be publically available until March 2011 after completion and analysis of the trials.

It should be noted that under the current regulatory regime any use of digestate outside of the specific end markets identified in the ADQP (Page 8) will still be regarded as a waste and will require an environmental permit or exemption from the Environment Agency.
Currently for example only the fibre fraction of any digestate is recognised by the ADQP as a product for application to land restoration. It is hoped that the WRAP trials (above) and other UK experience will feedback to the next PAS110 and ADQP review (currently held every two years) to increase the number and breadth of the approved market sectors.

Further Information

The following hyperlinks are for web pages giving more detailed information on many of the areas covered in this brief guide:-

2. Information Library - Guidance Notes Renewables East
   The renewables east website has a good reference library of downloadable documents, the Biogas Handbook is especially useful (see section 6 ‘utilisation of digestate’)

3. Biofertiliser - Certification - England Wales - Pas110
   Renewable Energy Accreditation Ltd. Webpage for PAS110 scheme – explains all you need to know regarding quality biofertiliser accreditation in the UK.

   Case study & AD Information brochure presented by the Severn-Wye Energy Agency
5. Using Digestate
Web page from England's official portal on anaerobic digestion, site carries lots of very useful information.

6. Organics - WRAP
Link to WRAP's market knowledge portal - keep up with current market prices for fertiliser and biofertiliser in the UK.

7. European Compost Network: EU Biowaste Treatment
Detailed European Knowledge portal for organics recycling, page details technical and market developments for organics recycling across the EU.

8. ie-a-bioenergy-task37 energy from biogas and landfill gas
International Energy Agency pages promoting:

- Exchange and disseminate information on biogas production and energy utilization
- Promote deployment of AD plants
- Stimulate interaction between R, R&D programs, industry and decision makers
- Assist participating and non-participating countries in adopting appropriate waste management practices to improve environmental standards
- Interact and collaborate with appropriate international organisations.
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