

Digestate & Compost in Agriculture, Bulletin 3 – March 2012

Field experiments focus on crop available nitrogen supply from digestate

Digestate is a particularly valuable source of readily available nitrogen (N) and provides a 'low-carbon' alternative to manufactured nitrogen fertiliser. Laboratory analysis has shown that typically 80% of the total nitrogen content of food-based digestate is present in a readily available form, compared with around 70% for pig slurry and 45% for cattle slurry.

Nitrogen is the single most important nutrient influencing crop yields and, when applied at the optimum economic rate, will typically double crop yields. It is therefore very important to provide farmers with the information necessary to quantify how much crop available nitrogen will be provided by digestate to optimise yields and profits, maintain crop quality, and minimise the potential impacts on the environment.

New evidence from field experiments

Crop available nitrogen supply from digestates (food and manure-based) and livestock slurry was quantified at four sites during harvest year 2010/11:

- Gleadthorpe, Nottingham (potatoes)
- Brawdy, Pembrokeshire (winter wheat)
- Loddington, Leicestershire (winter wheat)
- Ayr, Ayrshire (grassland)

Digestate applications were made in autumn 2010 and spring 2011, compliant with the closed periods for spreading organic manures with high readily available nitrogen content (>30% in readily available form) in Nitrate Vulnerable Zones (NVZs).

Commercial band spreaders (*i.e.* trailing hoses or shoes) were used to replicate good commercial practice, and to reduce ammonia emissions (and odour nuisance) compared with surface broadcasting (Photo 1). Yield and crop N off-take measurements were made at harvest from the replicated treatments. Fertiliser N replacement values and N efficiencies of the digestate and slurry applications were quantified through direct comparison with the different rates of manufactured N applied.



Photo 1: Precision band spreading application of digestate

Experiments show spring application ensures most efficient use of nitrogen

Laboratory analysis indicated that 74% of the total N in the food-based digestate was in a mineral form that is readily available to crop plants. When this digestate was applied in spring to the potato crop at Gleadthorpe, the crop yield data indicated that 64% of the total N applied was equivalent to manufactured fertiliser N, producing yield increases in the range 11-15t/ha above the untreated control (Figure 1). Potato yields at the optimum economic N rate of 164 kg N/ha were 74.8t/ha, based on a break-even tuber to fertiliser price ratio of 10:1. The fertiliser N replacement value of the 30m³/ha food-based digestate application was £83/ha, based on a manufactured fertiliser N price of £1/kg.

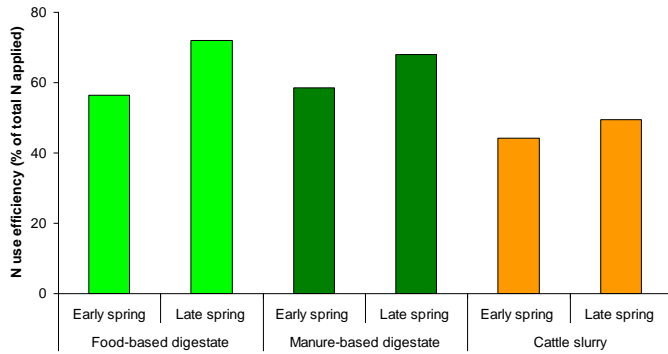


Figure 1: N use efficiency of organic amendments applied to a potato crop at Gleadthorpe (% of total N applied)

At the Brawdy and Loddington sites (both winter wheat), the autumn digestate (and slurry) applications had much lower N use efficiencies (<10%) than the spring application timings, as a result of over-winter N losses through nitrate leaching (Figure 2). The results clearly demonstrate that, unless there is a crop N requirement in the autumn (e.g. oilseed rape), applying digestate in the spring will ensure most efficient N use. The fertiliser N replacement value of the 40m³/ha spring food-based digestate application at Brawdy was worth £76/ha and at Loddington £62/ha. There was no response to nitrogen application at the Ayr grassland site, which was a reflection of a higher than anticipated soil N fertility.

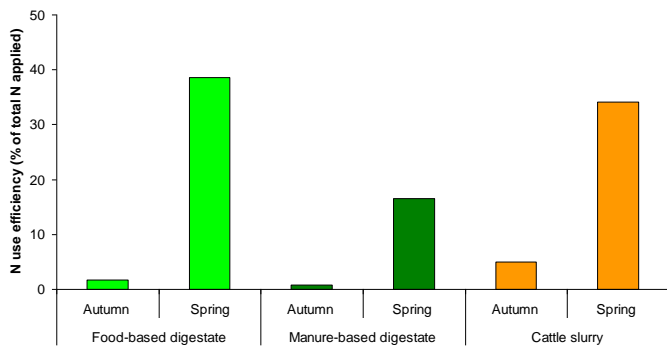


Figure 2: N use efficiency of organic amendments applied to a winter wheat crop at Brawdy (% of total N applied)

Results from the experiments, *i.e.* those completed to date and others currently underway/planned (including measurements of emissions of nitrous oxide and ammonia to air, and potential nitrate and phosphorus losses to water), will be used to help farmers integrate the nutrient supply properties of digestate into their farm nutrient management plans. The findings will also be used to support guidance on digestate use within future revisions of the RB209 Fertiliser Recommendations, and the nutrient management tools PLANET and MANNER.

Focus on digestate nitrogen supply and emissions

Field experiments were established in autumn 2011 at three sites:

- ADAS Pwllpeiran, Ceredigion (grassland)
- North Wyke, Devon (grassland)
- Wensum Demonstration Test Catchment, Norfolk (winter wheat)

Detailed measurements of the nitrogen supply properties of digestate and compost are being undertaken, including emissions to air (ammonia and nitrous oxide) and leaching losses to water (nitrate, phosphorus and common indicator bacteria), in addition to crop N utilisation (Photo 2).



Photo 2: Ammonia wind tunnels and nitrous oxide chambers at the Pwllpeiran Nitrogen Hub – autumn 2011

Results from these detailed measurements will be available in winter 2012/13. The data will contribute to quantifying the carbon footprint of using these materials and enabling comparisons to be made with mineral fertilisers.



Photo 3: Ammonia wind tunnels measurements at Wensum Nitrogen Hub – autumn 2011

Experiments taking the longer-term view

In addition to the nitrogen experiments (detailed above), seven experimental sites have been established throughout Britain on a range of soil types to investigate the soil and crop quality effects of *repeated* organic material applications. The assessments include the impacts of green and green/food composts, digestates and livestock manures on soil fertility (e.g. available nutrients), soil health (e.g. earthworm numbers) and soil structure (e.g. water holding capacity) (Figure 3). The experimental sites will receive annual organic material applications for three years, with detailed soil and crop quality measurements being made in spring/summer 2013. These results will contribute to improving our understanding of the benefits of organic manures in relation to sustainable soil and water management.

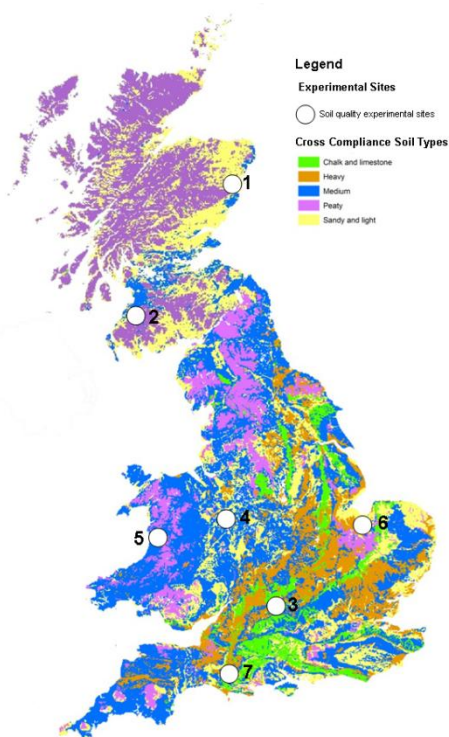


Figure 3: Location of soil and crop quality sites throughout Britain

Dates for your diary

The Digestate & Compost in Agriculture project team have been running a series of events across Britain, attracting farmers, advisers and students to learn about the project and how to get the most out of these materials. The response has been overwhelmingly positive with plenty of lively discussion.

New events are being booked all the time; here are some forthcoming opportunities to catch up with the project team:

- 29 March 2012 – *Quality digestate and compost in agriculture, Bryn Compost, Treharris, Wales*
- 30 May 2012 – *North Wyke nitrogen hub field experiments focus on using organic manures*
- 20 June 2012 – *FACTS/WRAP training event on digestate and compost use, Harper Adams*
- 28 June 2012 – *Digestate and compost in agriculture Cockle Park, Newcastle upon Tyne*
- 5 July 2012 – *Organic cereals Event 2012, Blandford Forum, Dorset – Digestate and compost use in the organic sector*

We will also be going back to college this spring to deliver a series of lectures to the “farmers of tomorrow”.

Please get in touch if you would like details of these and future events – look out for an event in your area, or contact anna@earthcaretechnical.co.uk

Results update

The next edition of this bulletin will provide an update on the latest project developments. Copies of this and previous bulletins can be downloaded from the project website at:

www.wrap.org.uk/dc-agri

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**Waste & Resources
Action Programme**

The Old Academy
21 Horse Fair
Banbury, Oxon
OX16 0AH

Tel: 01295 819 900
Fax: 01295 819 911
E-mail: info@wrap.org.uk

Helpline freephone
0808 100 2040

www.wrap.org.uk/dc-agri

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