The role of digestate in the location of AD plants & the industry’s future

Will McManus, WRAP
WRAP’s **vision** is a world in which resources are used sustainably.

WRAP’s **mission** is to accelerate the move to a sustainable, resource-efficient economy through:

**re-inventing** how we design, produce and sell products.
**re-thinking** how we use and consume products.
**re-defining** what is possible through re-use and recycling.
Location of AD sites influenced by a number of factors
  - Using digestate is just one of these
  - Is it commercially significant?
- Changing financial drivers in the sector
- Understanding digestate’s fertiliser replacement value is a useful part of the equation
Five year research programme

22 experimental sites across England, Scotland and Wales

WP1: To quantify the effects of repeated compost and digestate applications on soil and crop quality

WP 2: To quantify the nitrogen supply characteristics of contrasting digestate products

WP 3: farmer focussed training

DC-Agri - world leading research
A little context...
Food waste arisings & utilisation in AD
Feedstock projections
• ASORI 2013 figures on the value of digestate supplied to agriculture
  – *average cost to operator of £3.73 per tonne*
  – *range of -£13 to +£3 per tonne*
  – based on limited data
DC-Agri results
‘Typical’ nutrient content of food-based digestate and comparator organic materials

Readily available nitrogen (RAN) content of food-based digestate

DC-Agri data: nitrogen content
DC-Agri data: nitrogen use efficiency
To water (NO$_3$-N, NH$_4$-N, P, FIOs etc).

**Nitrogen gas**

**Plant uptake**

**Nitrous oxide gas**

**Digestate nitrogen supply and losses**

**Ammonia gas**

**Volatileisation**

**Nitrogen gas**

**Soil Organic N**

**Organic N**

**Ammonium N**

**Ammonium**

**Immobilisation**

**Nitrate**

**Nitrification**

**Denitrification**
Air samples (from N\textsubscript{2}O chambers and NH\textsubscript{3} tunnels) were analysed for:

- N\textsubscript{2}O, CH\textsubscript{4} and CO\textsubscript{2}
- NH\textsubscript{3}

Water samples (from Teflon cups)

- Nitrate-N
- Total phosphorus
- E.\textit{coli}
Nitrate leaching losses

I = standard error

Anova: $P < 0.001$

Nitrate-N leached (% total N applied)

<table>
<thead>
<tr>
<th>Method</th>
<th>Treatment</th>
<th>Nitrate-N leached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface broadcast</td>
<td>Food-based digestate</td>
<td>b</td>
</tr>
<tr>
<td>Bandspread</td>
<td></td>
<td>b</td>
</tr>
<tr>
<td>Surface broadcast</td>
<td>Pig slurry</td>
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<tr>
<td>Bandspread</td>
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<td>b</td>
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<td>Pig FYM</td>
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<td>Green/food compost</td>
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</table>
Cross-site ammonia emissions curve
Bandspread application (trailing shoe)
Shallow injection application
Ammonia losses from application techniques

<table>
<thead>
<tr>
<th>Method</th>
<th>Ammonia-N (% of total N)</th>
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<tbody>
<tr>
<td>Surface broadcast</td>
<td>30</td>
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<tr>
<td>Trailing shoe</td>
<td>20</td>
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<tr>
<td>Shallow injected</td>
<td>15</td>
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<tr>
<td>Surface broadcast</td>
<td>10</td>
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<tr>
<td>Trailing shoe</td>
<td>5</td>
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<td>Shallow injected</td>
<td>2</td>
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</table>

I = standard error

Anova: P<0.001

Food-based digestate

Cattle slurry
The benefit was valued at £55-160/ha, taking into account the value of bagged fertiliser saved and the cost of spreading, but not sourcing.
How does this relate to the location of AD sites?
<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
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<tbody>
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<td>Cereals</td>
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<td>Winter Oilseed rape (incl NVZ's)</td>
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<td>Grass</td>
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<td>NVZ Closed period tillage land sandy or shallow soils</td>
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<td>NVZ Closed period grassland sandy or shallow soils</td>
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<td>NVZ Closed period tillage land all other soils</td>
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<td>Organic holdings max 150 kg total N/ha to end Feb</td>
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<td>Oilseed rape (end Oct) asparagus, grass, onions, parsley</td>
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If a crop is sown on sandy or shallow tillage land on or before 15 September you may apply organic manure between 1 August and 15 September inclusive.

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*Spreading windows = how much storage?*
1. Location of AD sites influenced by a number of factors
   - Using digestate is just one of these
   - Is it commercially significant?
2. Journey from waste collection to renewable fertiliser
   - Minimise length
   - Where to place AD plant on this journey?
3. Optimising digestate requires investment
   - In the UK, market drivers exist, but aren’t strong
4. Changing financial drivers in the sector
   - Increased pressure on AD businesses
   - Disposal alternatives are expensive
   - Understanding digestate’s fertiliser replacement value is a useful part of the equation

Some final thoughts…
• Translating research into practical advice
  – Trained 3,256 people, helping farmers make informed decisions
  – 35% committed to taking action
• Increased impact by working with the biggest names in farming
• Project legacy & online resources
Visit www.wrap.org.uk/dc-agri

For the DC-Agri research summary, Good practice guides, and range of training resources