



# **Nutrients from biowastes: opportunities and challenges**

**David Tompkins, WRAP**



# About Zero Waste Scotland

Zero Waste Scotland works to maximise the efficient use of some of Scotland's most valuable resources – materials, energy, and water – to achieve economic and environmental benefits

**Regulators**

**Consumers**

**Retailers**

**Recycling industry**

**Policy makers**

**Producers**



# 'Biowastes' to agriculture

|                   | Quantity<br>(Mt) | DW /<br>FW | Ref<br>year |
|-------------------|------------------|------------|-------------|
| Farmyard manure   | 90.0             | FW         | 1999        |
| Biosolids         | 1.15             | DW         | 2008        |
| Paper crumble     | 0.70             | FW         | 2005        |
| Industrial wastes | 3.90             | FW         | 2009        |
| Digestate         | 1.30             | FW         | 2012        |
| Compost           | 2.43             | FW         | 2012        |



# Quality recycled products

PAS 100:2011

Specification for composted materials



PAS 110:2010

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





## Production and use (Mt)

|                  | Scotland | England | UK   |
|------------------|----------|---------|------|
| <b>Digestate</b> | 0.11     | 1.31    | 1.44 |
| <b>Compost</b>   | 0.21     | 3.06    | 3.47 |

- ~70% compost to agriculture
- >90% digestate to agriculture





# Opportunities

- Nutrients
  - GHG savings
- Organic matter
  - Soil quality

# Challenges

- Logistics
- Agronomic predictability
- Perceptions of quality





# What is the nutrient benefit?

|                                 | N             |               | P <sub>2</sub> O <sub>5</sub> |               | K <sub>2</sub> O |               |
|---------------------------------|---------------|---------------|-------------------------------|---------------|------------------|---------------|
|                                 | Scotland      | UK            | Scotland                      | UK            | Scotland         | UK            |
| Fertiliser use (kt) (2012)      | 125           | 1,000         | 43.0                          | 188           | 56.0             | 259           |
| Nutrients in HH food waste (kt) | 2.49          | 56.4          | 1.14                          | 25.7          | 0.79             | 17.9          |
| <b>Value</b>                    | <b>£1.97M</b> | <b>£44.5M</b> | <b>£0.75M</b>                 | <b>£17.0M</b> | <b>£0.41M</b>    | <b>£9.32M</b> |

Assumes N: 7.83kg/t; P<sub>2</sub>O<sub>5</sub>: 3.57kg/t; K<sub>2</sub>O: 2.49kg/t



## But...

| <b>Nutrients in<br/>kg/t</b> | <b>DM<br/>(%)</b> | <b>N</b> | <b>P<sub>2</sub>O<sub>5</sub></b> | <b>K<sub>2</sub>O</b> |
|------------------------------|-------------------|----------|-----------------------------------|-----------------------|
| Food-based<br>digestate      | 4                 | 4.0      | 0.25                              | 1.6                   |
| Green compost                | 60                | 0.00     | 1.5                               | 4.4                   |
| Green / food<br>compost      | 60                | 0.55     | 1.9                               | 6.4                   |





## But...

| Values in £/t        | DM (%) | N     | P <sub>2</sub> O <sub>5</sub> | K <sub>2</sub> O | Total        | A/R* (t/ha) |
|----------------------|--------|-------|-------------------------------|------------------|--------------|-------------|
| Food-based digestate | 4      | £3.14 | £0.17                         | £0.82            | <b>£4.13</b> | 34          |
| Green compost        | 60     | £0.00 | £1.01                         | £2.27            | <b>£3.26</b> | 33          |
| Green / food compost | 60     | £0.43 | £1.26                         | £3.30            | <b>£4.98</b> | 23          |

\*Theoretical maximum to apply 250kg N-tot/ha

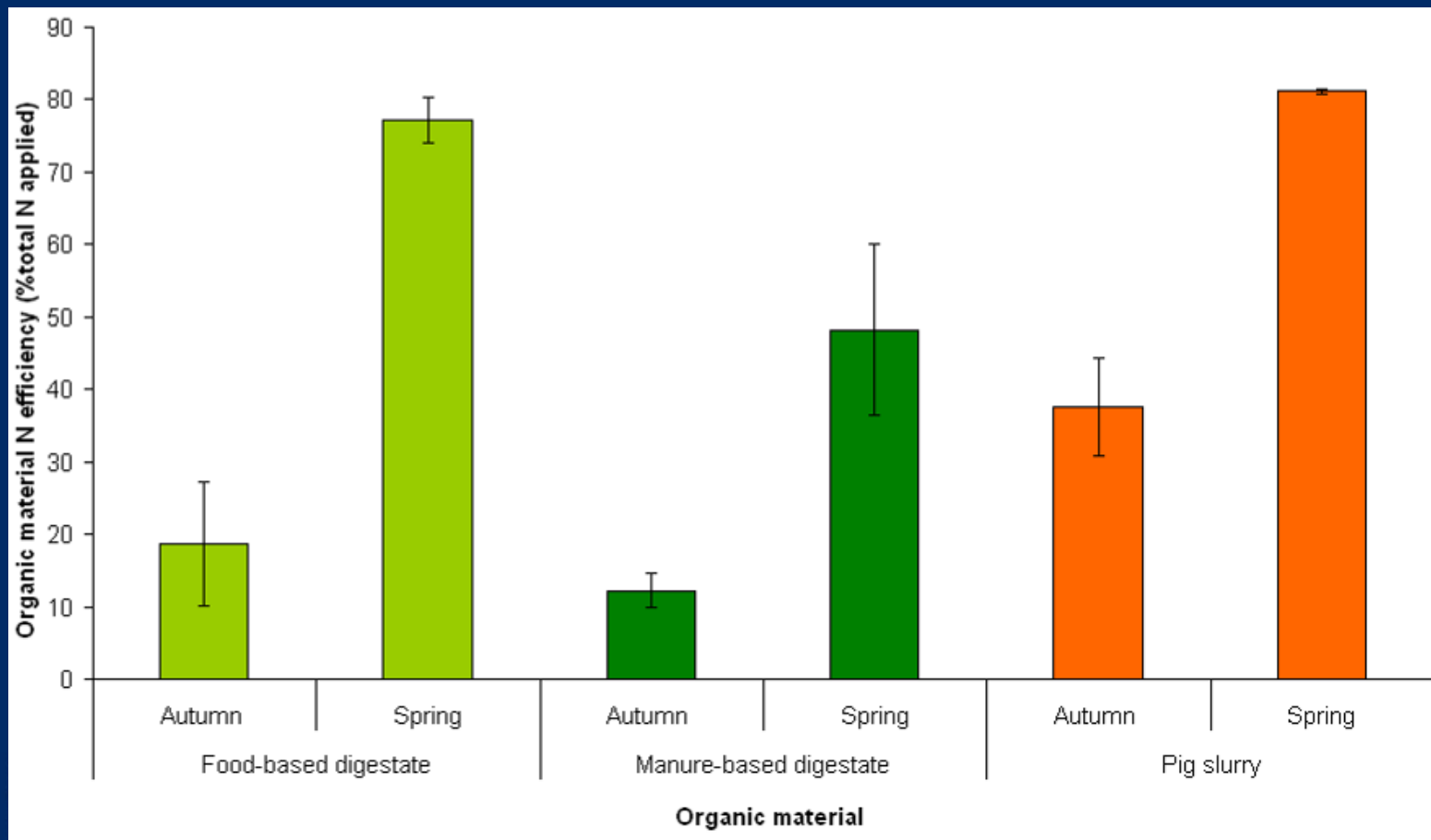


## So...

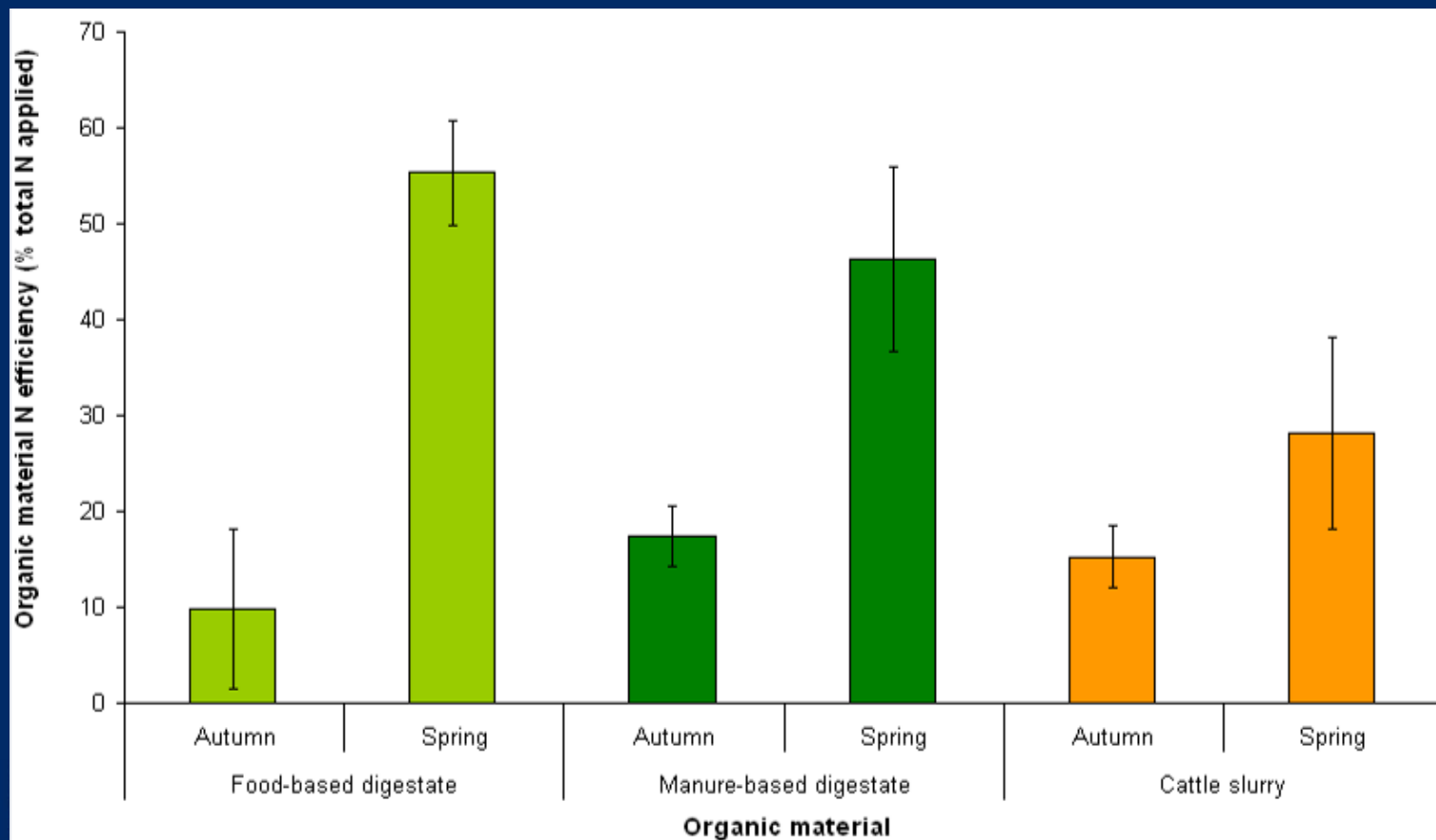
- In theory, you can meet the entire crop N-demand with digestate
  - 130kg N Spring Barley      ~33t/ha
  - 150kg N Winter Barley      ~38t/ha
- The nutrient content offers carbon savings
  - Upwards of 500kg/ha



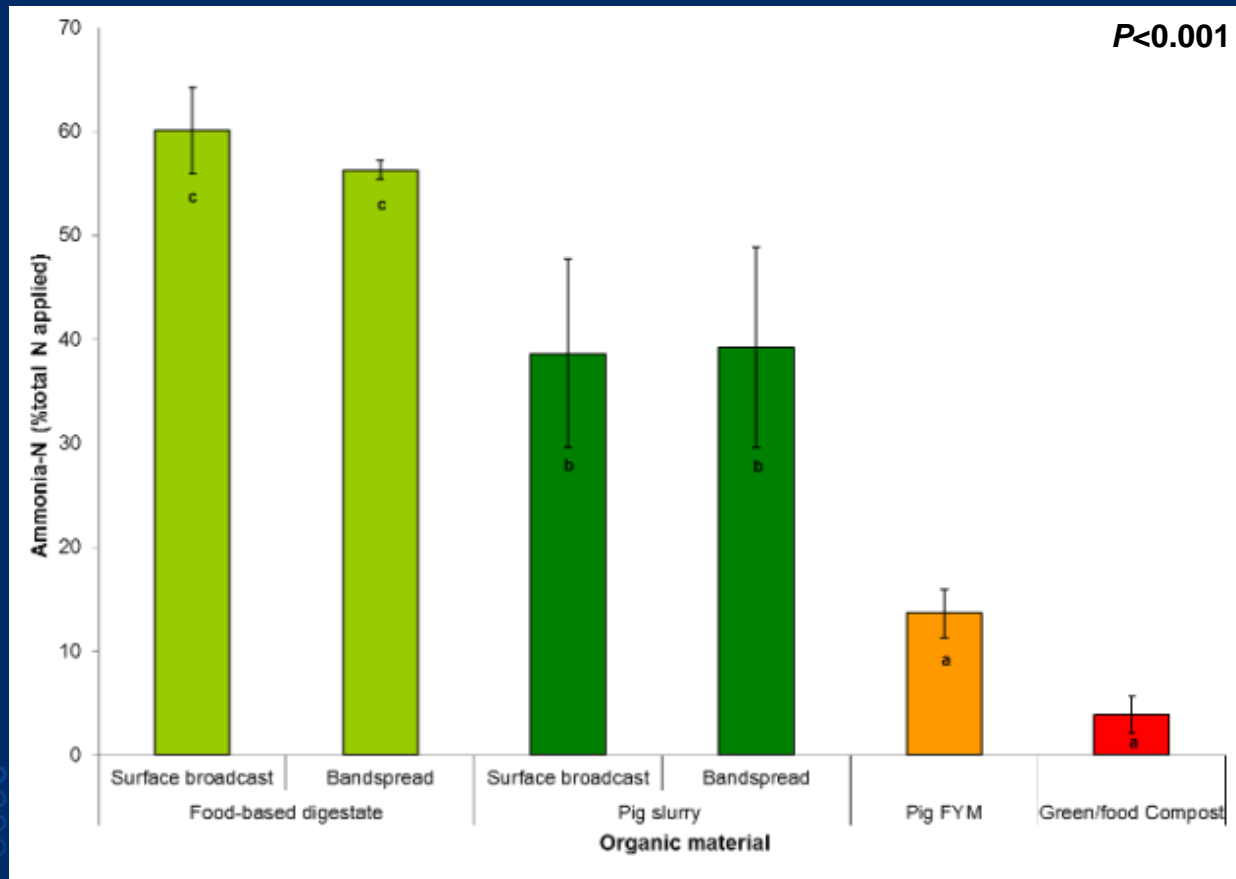
# Wensum: N use efficiency



# Pwllpeiran: N use efficiency



# Wensum: ammonia emissions (August 2011)



# Even de-watering is tricky...





## Is it safe?

- Do some toxins in plants survive composting or AD to then be eaten by livestock?
- Could permitted heavy metals result in crop accumulation?
- Are there risks from persistent organic pollutants?
- Are there risks to grazing livestock from physical contaminants in surface-applied materials?





Biological

H, A, P pests  
and diseases

Allergens

Shellfish  
toxins

Toxic plants

Physical

Plastic,  
glass, metal

Chemical

PTEs

PCBs,  
PCDD/Fs

Herbicides

Other

Taints

Retail  
acceptability





## In short...

- Biowastes have nutrient benefits
  - These can be difficult to realise
- Market-specific evidence is often scarce
- Perceptions of safety can be difficult to manage
  - Even with regulations and standards





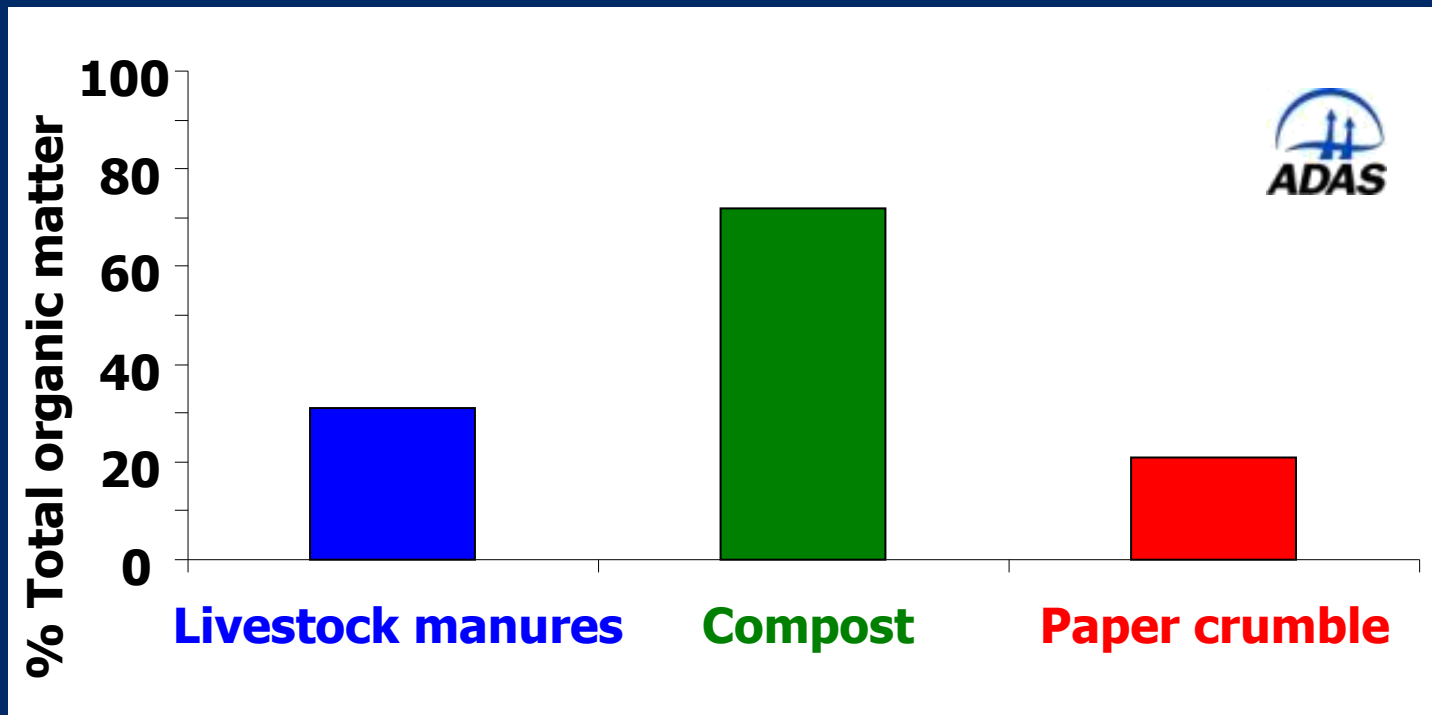
Thank you

David.Tompkins@wrap.org.uk

01295 817896

07703 331947

# Lignin as % of total organic matter



Source: Defra SOIL-QC project