Low-carbon opportunities in the agricultural sector

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The Agricultural Sector

- Farm Inputs
  - Land, labour, crop seeds, fertiliser, pesticides, livestock, animal feed
- Farm Production
  - Crops
  - Livestock
- Logistics, trade and distribution
- On-farm Processing
Types of Agricultural Businesses

• Inputs and technology providers – design, assemble or manufacture key inputs (pesticides, fertilisers) or equipment or machinery (tractors, seed drills, combine harvesters) for use in agriculture

• Producers (Farmers) – to sow, farm, and harvest crops, to raise poultry and livestock
The Carbon Problem in Agriculture
The UK as an Example

• The UK agriculture inventory estimates current agricultural emissions to be around 48 MtCO$_2$e or 8% of total UK greenhouse emissions.

• These mainly comprise nitrous oxide (N$_2$O) emissions from the use of fertiliser on soils (54%) and methane (CH$_4$) emissions from enteric fermentation, a process related to digestive systems of cattle and sheep (38%).

• Agriculture is also responsible for CO$_2$ emissions arising from the use of pesticides (0.6 MTCO$_2$e), machinery (e.g. tractors) and consumption of fuel in farm buildings.
Innovative Solutions for the Agriculture Carbon Problem

- SMEs innovate better than large companies
- Agriculture is dominated by large companies – Pesticides and Seeds: Monsanto, Syngenta, BASF, Dow & Dupont and Bayer
  Fertilisers: Agrium, CF Industries, Potash Corp. The Mosaic Company, Yara Int.
- The size and dominance of these companies belies the complexity of the sector
Seed Market Structure

- Size proportional to global seed market share

Phil Howard, Associate Professor, Michigan State University
http://www.msu.edu/~howardp
Opportunities

• Seed: Breeders – 36 UK companies
• Pesticides: Microbes replacing agro-chemicals – 270+ plus companies in Europe
• Animal Feed: 2000+ companies in Europe
• Fertilisers: Micronutrient fertilisers (e.g. nano-nutrients) - 450 companies in Europe, Microbes replacing nitrogen fertilisers e.g. Azotic Technologies Ltd
Azotic Technologies Ltd

- Established in 2012
- Purpose - to develop and commercialise the opportunity offered by the plant intracellular colonisation of crops by a strain of nitrogen fixing bacteria – *Gluconacetobacter diazotrophicus* (Gd)
- Commercialisation based on the research of Prof Ted Cocking at Nottingham University
- R&D Laboratories at BioCity Nottingham with a team of 24 scientists and technical staff
Efficacy of Intracellular Colonisation - Validation

Staple food crops: Wheat, maize and rice

Forage crops:
- Pasture grass
- White clover
- Silage maize

Oilseeds:
- Oil seed rape
- Oil Palm

Commodity crops:
- Tea
- Cotton
- Coffee

Horticultural crops:
- Tomato
- Potato

Ornamental and amenity:
- Turf grass

Every crop species evaluated with N-Fix successfully colonised by Gd!
N-Fix in the Absence of Additional N Fertiliser

Spring sown amenity turf grass – N-Fix treated seed vs untreated (Zero N)
Yield and Fertilizer Benefits
Implications of Azotic N-Fix Technology on the Agriculture Carbon Problem

• Potentially applicable to every major agricultural row crop ... globally!
• Reduction of nitrogen fertiliser use from between 25% - 85% of recommended rates
• Potential implications for nitrous oxide reductions in the UK alone are 13MTCO$_2$e.
• Global potential for agricultural nitrous oxide emissions are immense.
Conclusions

• Agriculture is a major contributor to greenhouse gases particularly methane from livestock and nitrous oxide from nitrogen fertiliser
• The apparent dominance of the agriculture input companies belies a more complex structure of SMEs that are offering innovative sustainable solutions for agriculture
• Solutions are possible in plant and animal breeding, animal feeds, micro-nutrition for plants and use of microbes to replace chemical pesticides and fertilisers
• By way of example Azotic Technologies Ltd has the potential through innovation to reduce nitrous oxide emissions for agriculture on average by ca. 50%.
Thank you

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