

# **Sustainable Agriculture, the Environment & the Circular Economy: Conceptual and Policy Convergence in the UK & China**

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# Outline

- Examine the conceptual and policy convergence
- Relate the common needs & opportunities for progress on circular agriculture to the objectives and work of the China-UK Sustainable Agriculture Innovation Network (SAIN)
- Consider the multi-functional role of agriculture and the environmental benefits of integrated policy action

# Definition of Circular Economy

- A model of development that replaces the traditional one-way linear pattern of resource use with a closed loop system that re-shapes production & consumption to reduce energy & material inputs
- In summary development based on reduce, reuse and recycle – the 3Rs – to achieve a resource efficient & environmentally friendly society

# Definition of a Low Carbon Economy

An economy which:

- Has the minimum possible emissions of greenhouse gases to the biosphere
- Aims to integrate the development of all sectors of the economy using technologies and management practices that produce energy & materials efficiently
- Maximises waste recycling & minimises waste disposal

# Drivers for change

UK: Responding to climate change & implementing the recommendations of Stern Review on the Economics of Climate Change

China: Responding to resource constraints, population pressure and widespread environmental damage from the current development model

# Convergence & similarities

- High political support
- Holistic view of needs and opportunities for improvement in the 3Rs
- Focus on waste minimisation & recycling
- Stress on raising resource use efficiency
- Importance given to innovation in S&T

# High political support

President Hu Jintao (2005):

“ We must follow a new course of industrialization, endeavor to overhaul the economic structure, ***quickly transform the ways of economic growth by improving its quality and efficiency, vigorously develop the circular economy*** and build a resource-effective and environment-friendly society”

UK Foreign Secretary David Miliband (2008):

“ ***The low carbon transition will be a defining feature of the next phase of industrialisation.*** China has the opportunity to leapfrog the industrialised world and move straight to low carbon development”

# **Greater investment in energy research**

UK: Environmental Transformation Fund;  
Energy Technologies Institute; SUPERGEN

China: NDRC Renewable Energy Plan; NDRC  
Centre for Renewable Energy Development

UK-China Joint Research Consortium on  
Sustainable Electric Power Supply



# Circular Agriculture

Takes the closed system concept and the reduce, reuse and recycle objectives of the circular economy and applies them to the agriculture along the whole production chain from upstream agro-chemical industries to end consumers.

# MoA's action plan for circular agriculture

- Promote energy saving & reduce emissions
- Enhance development of rural biogas
- Establish demonstration villages with fertiliser reduction, sewage treatment & crop residue utilization targets
- Promote resource saving technologies
- Increase biomass energy development

# Common approaches & problems

Although the structure & scale of UK agriculture is different its action plan is similar to Chinas with emphasis on energy saving, GHG reduction.

The promotion of minimal tillage, biofuel & biogas production are being considered or implemented by the UK & China **but** can involve complex trade-offs between environmental impacts.

# **SUPERGEN: Bioenergy Research**

35 primary research tasks including:

- Biotechnology of miscanthus and willow
- Energy crop agronomy
- Biomass supply chains
- Evaluation of marine biomass production
- Co-firing & co-utilisation of biomass & waste materials
- Evaluation of ammonia & fertiliser production from biomass

# **SAIN & cooperation on common needs & opportunities**

Cooperation that:

- Is based on a holistic approach to policy & scientific innovation
- Breaks down the barriers between disciplines & extends the analytical boundaries beyond agricultural production
- Recognises the multi-functionality of agriculture

# **SAIN sub-programmes**

1. Improved soil and crop nutrient management and non-point source pollution.
2. Biomass, gas, liquid biofuels and organic fertiliser production
3. Climate change mitigation and adaption measures and their integration into all agricultural policies
4. Application of the circular economy concept to agriculture

# Multi-functionality & win-win gains from integrated action

Overuse of nitrogen fertiliser in China as:

- An upstream agro-chemical industry issue
- A farm income issue
- A regional seas pollution issue
- A challenge for low carbon agriculture & climate change mitigation

# N fertiliser production in China

- Much of the production is coal based
- Many of the factories are small scale and inefficient
- These factories have high greenhouse gas emissions



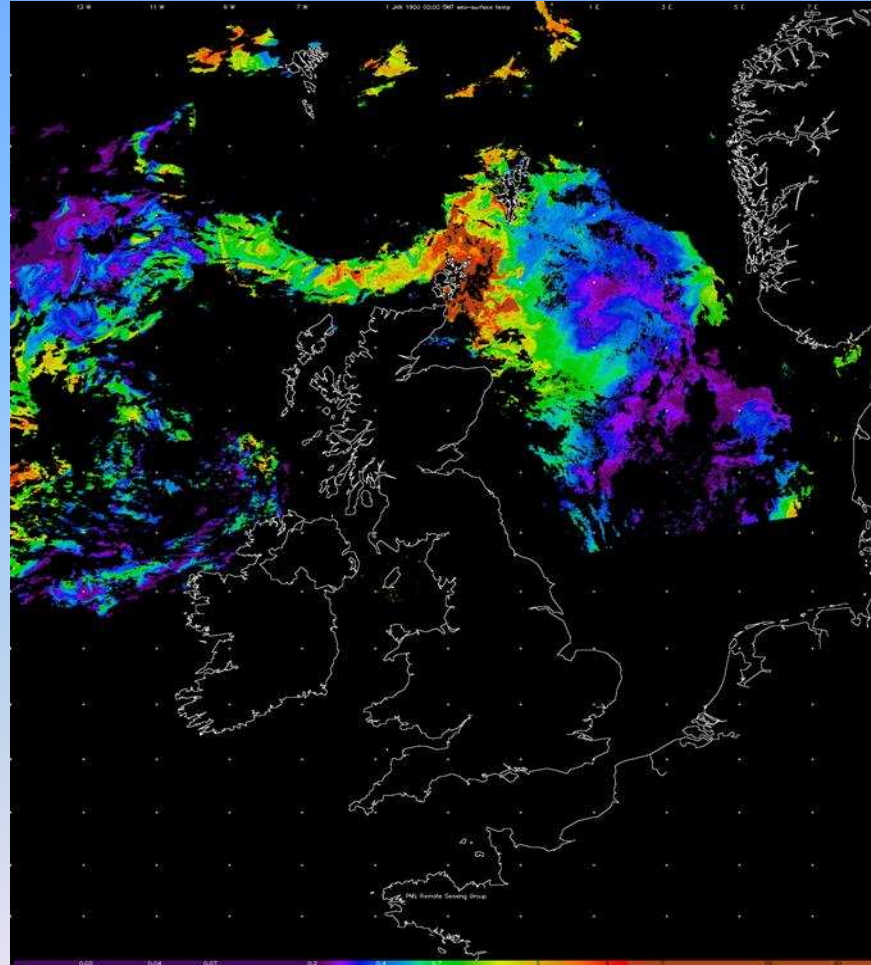
# Income losses from N overuse

Crop	Recommended non-irrigated rate (kg/ha)	Estimated optimum rate (kg/ha)	Overuse Average v. recommended rate (%)	Overuse Average v. est. opt. rate (%)
Wheat	150-225	130-180	25% households 287 v 225 kg/ha Equiv cash loss = <b>266 Y/ha/yr</b>	28% households 272 v 180 kg/ha Equiv cash loss = <b>395 Y/ha/yr</b>
Maize	165-255	80-190	77% household 405 v 255 kg/ha Equiv cash loss= <b>644 Y/ha/yr</b>	90% households 379 v 190 kg/ha Equiv cash loss= <b>812 Y/ha/yr</b>

# N inputs to the China sea & red tides

River	N inputs to rivers/yr		N exports to coastal waters/yr	
	Total inputs kg N km <sup>-2</sup>	% Agric	Total inputs kg N km <sup>-2</sup>	% Agric
Changjiang	11823	92	2237	83
Huanghe	5159	88	214	24

# Red Tides in UK



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# **N fertiliser overuse, low carbon agriculture & climate change**

- N fertiliser use accounts for >75% of fossil energy inputs to crop production
- N overuse results in high direct and indirect emissions of nitrous oxide
- China accounts for 25-30% of global emissions of nitrous oxide from N fertiliser

# Conclusions

- Strong convergence in Chinese & UK models for sustainable agricultural development
- There are many shared problems & opportunities for action that can be tackled by SAIN with win-win benefits
- E.g. Control of N overuse in China is critical to progress on low carbon agriculture with farm income and environmental benefits