

Outcomes and Impacts

The ultimate outcomes of the 'N-Circle' Centre will be (i) greater understanding of the mechanisms underpinning agricultural management for sustainable N cycling, (ii) a rigorous evaluation of the potential for sustainable N cycling to deliver future sustainable intensification of Chinese and UK agriculture and (iii) an agenda and the infrastructure to achieve this. Exciting technological synergies are feasible if the power of multiple innovations in molecular, chemical, micro-biological, agronomic and engineering technologies can be integrated and up-scaled into economically viable systems at field, farm and regional scales.

The Consortium

The N-Circle Centre is a collaboration between the Universities of Aberdeen, Cambridge and East Anglia, SRUC, and ADAS in the UK, and the Chinese Academy of Agricultural Sciences, China Agricultural University, Chinese Academy of Sciences, Beijing Normal University, Capital Normal University, Nanjing Agricultural University, Nanjing Normal University, and Zhejiang University in China.

The N-Circle Centre is working in partnership with the UK-China Sustainable Agriculture Innovation Network (SAIN).

The Funders

Over the three years from 2016 the N-Circle Centre will receive almost £3 million from the BBSRC, NERC and Newton Fund as well as over £4 million from sources in China.

Contacts

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N-Circle: UK China
Virtual Joint Centre for
Closed-Loop Cycling of
Nitrogen in Agriculture

Funded by:



Issues to be Addressed

China's agriculture is increasing its productivity rapidly, but low efficiency of nitrogen (N) use through over-fertilization and mismanagement increasingly threatens its sustainability.

Agriculture in the UK, by contrast, has had static production for twenty years but has a strong knowledge-base and infrastructure for pollution control. This China-UK Virtual Joint Centre will deliver realistic short-to-medium term solutions for both countries: intensified productivity supported by near-closed-loop N cycling. The key challenge to be tackled is integrating and developing synergies between disparate technologies.



N-Circle Approaches

The 'N-Circle' Centre will create a dynamic and lasting multi-disciplinary hub, with a clear vision, to attract, integrate and harness the relevant skills and expertise from the UK and China, to create infrastructure to deliver tight agricultural N cycling. In particular, environmental, biological and genetic scientists will combine with specialists in agronomic extension to form teams to develop a lasting multi-scale perspective, implemented through the Cool Farm Tool

(CFT) for both commercial and scientific purposes in both China and the UK.

The central objective underlying 'N-Circle' is to quantify the interdependence between N_2 fixation for agriculture (both industrial or biological), and agricultural emissions of ammonia (NH_3), nitrate (NO_3) and nitrous oxide (N_2O) i.e. how N inputs cause N emissions. Sustainable intensification of agriculture in China depends on reducing both, whilst continuing to enhance production.

N-Circle will set an agenda for 'closing' agricultural cycling of N in China by employing ensemble modelling to estimate N inputs, transformations, transfers and emissions for China's principal farming systems, and by identifying points for technological intervention, so to set targets for innovation. N-Circle's bilateral research teams will then focus on the key targets expected to provide the largest or most synergistic impacts on N inputs and N emissions, such as fertiliser formulation, soil management, crop genetics and management, feed formulation, and manure treatment and manure distribution.

The specific objectives of N-Circle are:

1. Define a range of options to deliver closed-loop N cycling in Chinese agro-ecosystems
2. Define practices to enhance recovery of applied N, both from fertiliser & manure
3. Provide options to reduce GHG emissions due to N applications
4. Devise rotations and cropping practices that maximise leguminous N fixation and uptake
5. Define mechanisms to reduce crop N demand, by
 - (a.) Predicting canopy N demand;
 - (b.) Maximising C & N fixation & harvest;
 - (c.) Minimising grain N demand (by grain protein manipulation)
6. Quantify the role of reducing end-user demand for N and N excretion by livestock
7. Demonstrate impacts of objectives 1-6 through case studies at farm, catchment & regional scales
8. Provide multi-level (farmer, extension service, regional / national policy-maker) out-reach and dissemination.

Each of these objectives will be addressed in a dedicated Work Package (WP). The conceptual diagram for the N-Circle Centre shows how WPs are specifically charged with achieving impacts at key points:

