Increasing nitrogen use efficiency in agriculture reduces future coastal water pollution in China

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Background

Food Security

- Food demand
- Food production

Environment Pollution

- Air pollution
- Coastal Eutrophication
Take home messages

- Current policy – ‘Zero Fertilizer Growth 2020’ is not enough.
- Available Integrated Soil-Crop System Management may help.
- There is a hope:
  - Animal manure recycling
  - Wise use of synthetic fertilizer
Modelling Framework

Nitrogen Use Efficiencies food chain

NUFER model
NUtrient flows in Food chains, Environment and Resources use

Nitrogen fluxes from land to sea

MARINA
Model to Assess River Inputs of Nutrients to seAs
### Scenarios

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- Available Integrated Soil-Crop System Management may help.

There is a hope:
- Animal manure recycling
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NUFER model

NUtrient flows in Food chains, Environment and Resources use

\[ h \times 100\% \]
**Scenario analysis: 2013-2020-2050**

- Business As Usual (BAU)
- **Zero Fertilizer (ZF) growth after 2020**
- Improved Nutrient *Management* (INM)
  - Zero Fertilizer (ZF) growth
  - Balanced Fertilization
  - Precision Feeding
  - Manure Management
Nitrogen (N) use efficiency and N losses to waters
Take home messages

- Current policy – ‘Zero Fertilizer Growth 2020’ is not enough.

- Available Integrated Soil-Crop System Management may help.

There is a hope:
- Animal manure recycling
- Wise use of synthetic fertilizer
- Basin scale
- 1970, 2000, 2030, 2050
Scenarios: 2050

**GO (worst case): Global Orchestration**
- Globalization trends in socio-economy
- Reactive approach for environmental problems
- Industrialization of animal production
- Urbanization

**ISSM: Integrated Soil-Crop System Management**
- Reduce fertilizer need

**ISSM-MR: ISSM** with improved manure management
- Replacing synthetic fertilizer with animal manure
Nitrogen export to the Chinese seas (%)

**Bohai Gulf**
- 2000: 0%
- GO: 200%
- ISSM: 200%
- ISSM-MR: 200%

**Yellow Sea**
- 2000: 100%
- GO: 150%
- ISSM: 150%
- ISSM-MR: 150%

**South China Sea**
- 2000: 80%
- GO: 120%
- ISSM: 120%
- ISSM-MR: 120%
Take home messages

- Current policy – ‘Zero Fertilizer Growth 2020’ is not enough.
- Available Integrated Soil-Crop System Management may help.
- There is a hope:
  - Animal manure recycling
  - Wise use of synthetic fertilizer
Model to Assess River Inputs of Nutrients to seas

- Based on Global NEWS
- Sub-basin scale
- 1970, 2000, 2050
Optimistic Scenarios

GO (worst case)

- Globalization trends in socio-economy
- Reactive approach for environmental problems

OPT (best case): OPTimistic

- Manure recycling on land
- Balanced fertilizer use
- Improved sanitation
Optimistic Scenarios

Nitrogen export to the Chinese seas (kt/yr)

Northern rivers

Central and southern rivers

- Human waste from sewage systems
- Direct discharge of uncollected human waste to rivers
- Direct discharge of animal manure to rivers
- N fixation and deposition on agricultural and non-agricultural land
- Use of synthetic fertilizers, animal manure and human waste on land
Thank you!

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