Synergies between Food Security, Adaptation and Mitigation

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INTRODUCTION

- Agriculture represents 10–12% of the total global human induced GHG emissions
- High technical mitigation potential (5.5–6 Gt CO2 eq/yr by 2030)

Source: IPCC AR4
Examples of synergy between mitigation and adaptation
Conservation tillage

- The benefit of CT
  - Oil consumption reduced by 18 L ha\(^{-1}\)
  - Wind erosion decreased 31% compared with tillage;
  - From the long-term experiment result, CT can increase 0.24 tC ha\(^{-1}\)a\(^{-1}\);
  - Fertilizer input decreased by 10%;
  - Water saved 500-900 m\(^3\)ha\(^{-1}\);
  - Cost reduced by 270-780 Yuan ha\(^{-1}\) according to different crops;
  - Grain production increased by 0.56—1.68 Mt
Conservation tillage in China

- Chinese government has paid great attention to the expansion of CT practice in recent years.
- Measures have been taken by Chinese government including:
  - Implement CT pilot projects
  - Subsidize the pilot projects
  - Subsidize farming machines for CT
Conservation tillage in China

- MoA proposed CT targets for the 11th five-year period (2006-2010)
  - the area of CT shall exceed 4 million ha, 6% of the cropland area suitable for CT in the northern area of China at the end of the 11th five-year period (2010)
  - to promote the technical support for CT practice, improve the quality of farming machines, and enhance the integrated ecological, economic, and social benefits of CT practice in the regions where conservation tillage is adopted
MoA and NDRC formulated “CT Development Plan” for the period of 2009-2015. Detailed targets are proposed for developing CT practice:

- to establish 600 high-quality and high-yield conservation tillage sites (1.33 million ha) in 6 years
- Total investment, RMB 3.66 billion, of which RMB 1.87 billion will be paid by the governments
- To be carried out in 6 major agricultural areas
CT can increase crop yield.

CT, as an option for mitigation and adaptation, is not effective for all cropping systems.
Impact of different fertilizers on CH$_4$ emission from rice fields

Compared with mineral fertilizer, straw amendment could double CH4 emission from rice paddies
Barriers for extension CT in China

- The technique system is not comprehensive
- The cost of machines for CT activities is higher
- There are negative impacts of conservation tillage
  - Pollution caused by pesticides and herbicides
  - Lower seedling emergence compared with tillage
2. Cropland management

Soil carbon sequestration by different cropland management
2. Cropland management

(1) Chemical fertilizers
- Southeast (35)
- Northeast (39)
- HHH Region (89)
- Upper-middle basins of YZ River (79)
- Northwest (86)

(2) Organic fertilizer
- Southeast (6)
- Northeast (14)
- HHH Region (28)
- Upper-middle basins of YZ River (32)
- Northwest (21)

(3) Combined fertilizers
- Southeast (28)
- Northeast (32)
- HHH Region (40)
- Upper-middle basins of YZ River (45)
- Northwest (66)
- Southwest (25)

(4) Straw application
- Southeast (34)
- Northeast (23)
- HHH Region (27)
- Upper-middle basins of YZ River (23)
- Northwest (33)
China initiated soil measurement-based fertilization programme across the country. It sent out 100,000 technicians to villages and trained 50 million farmers. The programme covered 60 million hectares of arable land. Fertilization rate reduced about 10%. Such initiative reduce 28,000 tons of nitrous oxide emission per year.
4. Water management for rice paddies

Intermittent flooding practice is widely applied in China. It can increase about 10% of rice yield.
5. Grassland management

- The degraded grassland reached 133 million ha, accounted for about 50% of total usable grassland area
- Grazing prohibition, grazing land resting, rotational grazing practices can increase grass yield and enhance soil carbon sequestration
Impact of grassland management on SOC

Over grazing

- Overgrazing
  - A, B, C, D, E, F, G, H, I, G, K represent different type of grassland
  - Fix
    - $-2.34 \text{ tC}\cdot\text{hm}^{-2}\cdot\text{a}^{-1}$

Ranging

- Fix
  - $0.48 \text{ tC}\cdot\text{hm}^{-2}\cdot\text{a}^{-1}$
  - $0.19 \text{ tC}\cdot\text{hm}^{-2}\cdot\text{a}^{-1}$
Key Messages

- Many agricultural practices have synergies between food security, adaptation, and mitigation
- Large potential for mitigation, enhancement of carbon sinks, and adaptation
- Cost of some practices is higher, difficult to be adopted by household farmer if without external support;
- One side does not fit all, taking actions according to local circumstances
- Same practice produces different results under different conditions
- Less complex, low cost practices should be further identified and deployed
Thanks for your attention