DEVELOP LOW CARBON AGRICULTURE BY ENHANCING GHG MITIGATION THROUGH MANURE MANAGEMENT IN CHINA

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On September 22, 2020, general secretary Xi Jinping solemnly declared in the general debate of the 75th UN General Assembly:

- China will enhance its National Determined Contribution
- Adopt more effective policies and measures, Strive for
- Carbon dioxide emissions to peak by 2030
- Carbon neutrality by 2060

This important announcement highlights China's ambition and determination to cope with climate change, green and low-carbon development.
Mandate Carbon Index in 14th five year plan of China

- Carbon dioxide emissions per unit of GDP shall reduce by 18% in the 14th Five-Year period
- Make plan to achieve the peaking of carbon dioxide emissions around 2030 and making efforts to peak early
- Build a system to reduce carbon intensity mainly and control total carbon emission
- Make efforts to control CH$_4$ and other GHGs
Livestock is one of major GHG emission sources in China

- The total livestock emission is 373 million tons CO2eq
- Contribute 40% of GHG emission from agriculture, 4% of national emissions
  - Enteric CH₄ emission contribute 60.7%
  - CH₄ emission from manure management is 18.9%
  - N₂O emission from manure management is 20.4%
Agricultural related content in NDC

- To promote the low-carbon development in agriculture, making efforts to achieve zero growth of fertilizer and pesticide utilization by 2020.
- To control methane emissions from rice fields and nitrous oxide emissions from farmland.
- To construct a recycle agriculture system, promote comprehensive utilization of crop wastes and animal manure.
Livestock Production in China

- China provides food for 1/5 of the world population
- 1/2 swine, 1/3 poultry, 1/5 sheep, and 1/10 dairy of the world’s total population.
- 92 million households engaged in the work related to animal production
Manure production in China

- Total manure is around 3.0 billion tons
- TN was 7.4 million tons, TP 1.6 million tons
- Intensive production contribute 35%, household 65%
- Pig was major contributor, share ~40% of manure
Take actions to promote manure utilization and control pollution

**Policy & regulation**

- **2014.01.01** Regulation on the Prevention and Control of Pollution from Intensive animal farms
- **2017.06.31** Opinions of the General Office of the State Council on Accelerating Animal manure Utilization
  - Promote energy and fertilizer utilization
  - Establish a mechanism to promote the integration of crop & livestock production

**Action:** 20 billion RMB

- **Manure utilization In 586 Major livestock counties**
- **Construction of Manure Facilities in Intensive farms**
  - Organic replace chemical fertilization in cash crops
  - Subsidy for manure machines
7 Typical Models of Manure Treatment and Utilization

1. Full Manure Collection and Land Application
2. Specialized Biogas Plants
3. Composting of Solid Manure
4. High-Rise Manure Fermentation Bedding
5. Litter Recycling
6. Wastewater Fertilization
7. Up-to-Standard Discharge of Wastewater

资源化处理典型模式
Contribute to updating China’s NDCs and promoting the incorporation of CH4 emissions mitigation from manure management into the 14th Five-Year (2021-2025) Work Plan:

- Identification of new practice and suitable applied practices for reducing CH4 emissions;
- Quantification of mitigation potentials;
- Provision of policy recommendations for the formulation of the “14th Five-Year (2021-2025)” Work Plan for GHG emission reductions and the updating of NDCs, in China.
Laws, policies and actions related to livestock waste utilization

- Regulations on the prevention and control of pollution from intensive livestock production
- Policy Guidance Suggestions on accelerating the resource utilization of animal manure
- Action plan of replacing chemical fertilizer with organic fertilizer for production of fruits, vegetables and tea
- Law on the prevention and control of air pollution
- Law on prevention and control of water pollution
- Technical guide for calculation of land capacity of livestock manure application
- Specification for the construction of facilities for the manure resource utilization in livestock farms
- Assessment method for resource utilization of livestock manure
- Notice on further clarifying the requirements for manure land application and pollution supervising
- Notice on resource utilization of livestock manure in 2020
- Opinions of the general office of the State Council on promoting the high quality development of animal husbandry

Animal Husbandry Law
Environmental protection law

- Work plan for promoting the whole county’s utilization of livestock and poultry manure (2018-2020)
- Pilot project of resource utilization of livestock manure
- Action plan for the utilization of livestock manure (2017-2020)
- Policy Guidance Suggestions on the system and mechanism of innovating and promoting the green development of Agriculture
- Law on the prevention and control of environmental pollution by solid waste
- Guiding opinions on promoting the land application of livestock manure and strengthening the control of pollution in accordance with the law
- The 14th five year plan for national economic and social development of the people’s Republic of China and the outline of long-term goals for 2035
Meta-analysis of emission reduction potential of technology

Changes in NH₃
emission (%)

-150 -100 -50 0 50 100 150 -100 -50 0 50 100 150

In-house
- LCP diet vs. normal diet
- Feed additive vs. no additive
- Biofilter vs. no biofilter

Outdoor-slurry/lagoon
- Straw cover vs. no cover
- Oil cover vs. no cover
- Plastic cover vs. no cover
- Granule cover vs. no cover
- Cooling vs. no cooling
- Acidified vs. not acidified

Outdoor-compost
- Compost additive vs. no additive
- Compost cover vs. no cover

Land application
- Paddy field
  - Without manure vs. with manure

Upland
- Slurry injection vs. surface spread
- Slurry incorporation vs. surface spread
- Solid incorporation vs. surface spread
- Digested manure vs. raw manure
- N1 additive vs. no additive

Changes in N₂O
emission (%)

0 100 200 300 10000 20000 -150 -100 -50 0 50 100 150

Changes in CH₄
emission (%)

-ns (6/5)
-ns (4/1)

-ns (6/2)

-ns (6/2)

-ns (6/2)

-ns (6/2)

-ns (6/2)

-ns (6/2)

-ns (6/2)

-ns (6/2)
Practical mitigation options--- 8 technologies

Mitigation for feed management, low emission livestock house, manure storage, manure treatment and farmland utilization:

- Low protein diet;
- Separation of feces and urine
- Cleaning of exhaust air housing
- Coverage of manure storage lagoon

- Biological deodorization for composting
- Film mulching composting technology
- Injection of manure for land application
- Anaerobic digestion with biogas recover
Working on Policy Recommendation

- Develop action plan on GHG mitigation
- Demonstrate mitigation technology in large scale intensive animal operations
- Build MRV system for enhance Low carbon agriculture development
- Improve economic benefit of manure utilization through carbon trade
Expectation for future collaboration

The experience on achieving improvement in animal productivity and environmental quality, GHG mitigation simultaneously through manure utilization

- Develop New mitigation technologies (manure utilization, odor, ammonia, greenhouse gas)
- Enhance implementation of mitigation technologies (strategy, practice, pilot study, farm application)
- Take measures to attract private sector to invest in agricultural mitigation technologies
- Develop labeling system for mitigation in animal product (CF, Org.)
- How to MRV the progress of mitigation actions
谢谢

Thanks