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Towards a low-emission agrifood sector in the People's Republic of China

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Key messages

- The agrifood sector in China accounts for 14.2% of national greenhouse gas (GHG) emissions (1.9 $GtCO_2eq$ in 2020). This relative share is decreasing due to the rapid development of other economic sectors and related emissions.
- Rice and beef production are the primary sources of China's farmgate GHG emissions (i.e., emissions directly produced by farms). Together, enteric fermentation (livestock digestive process which releases methane as a by-product), rice cultivation, synthetic fertilizers and on-farm energy use account for more than 76% of farmgate emissions.
- Emissions beyond direct "farmgate" GHG emissions (e.g., emissions associated with processing, distribution, household consumption and waste management) now dominate (accounting for about 60% of total agrifood system emissions) and are increasing. This highlights the need to adopt an integrated perspective that spans the whole food value chain, to effectively reduce agrifood system emissions.
- China has committed to reaching carbon neutrality by 2060. This requires a drastic cut in GHG emissions from all sectors, including agriculture and the agrifood system as a whole. China has made significant progress in the research and implementation of low-emission agriculture nationwide.
- Effective practices already exist, but their implementation and scaling-up raise numerous challenges. Such challenges can be overcome by effective policies, financial incentives, education and capacity building, technical and organizational innovations, and strong governance mechanisms involving multiple actors, sectors and scales.

GHG emissions from China's agricultural sector

According to FAOSTAT data, net GHG emissions from China's agrifood systems were 1.9 $GtCO_2eq$ in 2020, accounting for 14.2% of national GHG emissions. Agrifood systems' share of total GHG emissions nationwide continuously declined from 36% to 14.2% during 1990–2020 (Figure 1); this is due to rapid development in other economic sectors, including the energy sector. Land-use change emissions were close to zero and are not shown in Figure 1.

Farmgate GHG emissions in China represented 784 million tCO_2eq in 2020; a 12% increase when compared to 699 million tCO_2eq in 1990. The relative share of farmgate emissions in total agrifood system emissions has declined because of agrifood industry development; this has in turn generated increased GHG emissions beyond the farm.

Rice and beef production are the primary sources of China's farmgate GHG emissions. In 2020, key emission sources at farmgate were, by decreasing order of importance (Figure 2): Enteric fermentation (23.8% of total farmgate emissions), Rice cultivation (18.9%), Synthetic fertilizers (18.1%), and On-farm energy use (15.5%). Together, these accounted for more than 76% of farmgate emissions.

By contrast, emissions from pre- and post-production activities (beyond farmgate) more than doubled over 10 years, growing from 478 $MtCO_2eq$ tons in 1990 to 1,080 $MtCO_2eq$ in 2020 (Figure 3). Their share of total agrifood system emissions increased from 41.3% in 1990 to 58.5% in 2020, exceeding farmgate's emissions share since 2009. This highlights the need to adopt an integrated food system perspective that spans the whole food value chain, to effectively reduce agrifood system emissions.

In 2020, key emission sources beyond the farm were, by decreasing order of importance: household food consumption (43% of total non-farm emissions), food systems waste disposal (19.2%), fertilizer manufacturing (12.2%), food packaging (10.2%) and on-farm energy use (9.9%). The share of emissions from food transportation increased from 1.5% of pre- and post-production emissions in 1990 to 3.9% in 2020.

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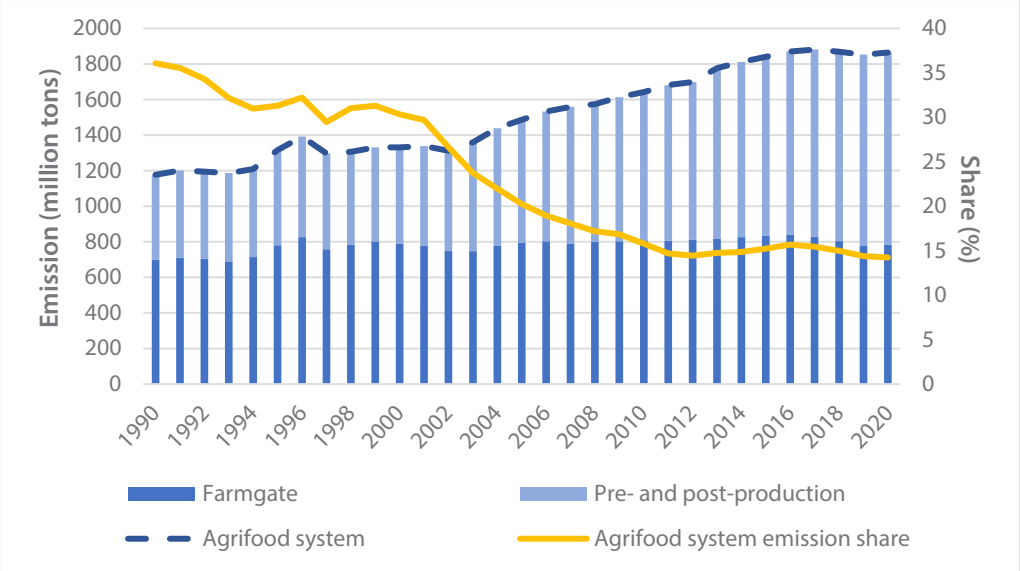

Figure 1. GHG emissions from agrifood systems in China, 1990-2020

Note: The emission data in $MtCO_2eq$ refers to the left-hand axis. The percent share of China's total emissions (yellow line) refers to the right-hand axis.
Source: FAOSTAT.

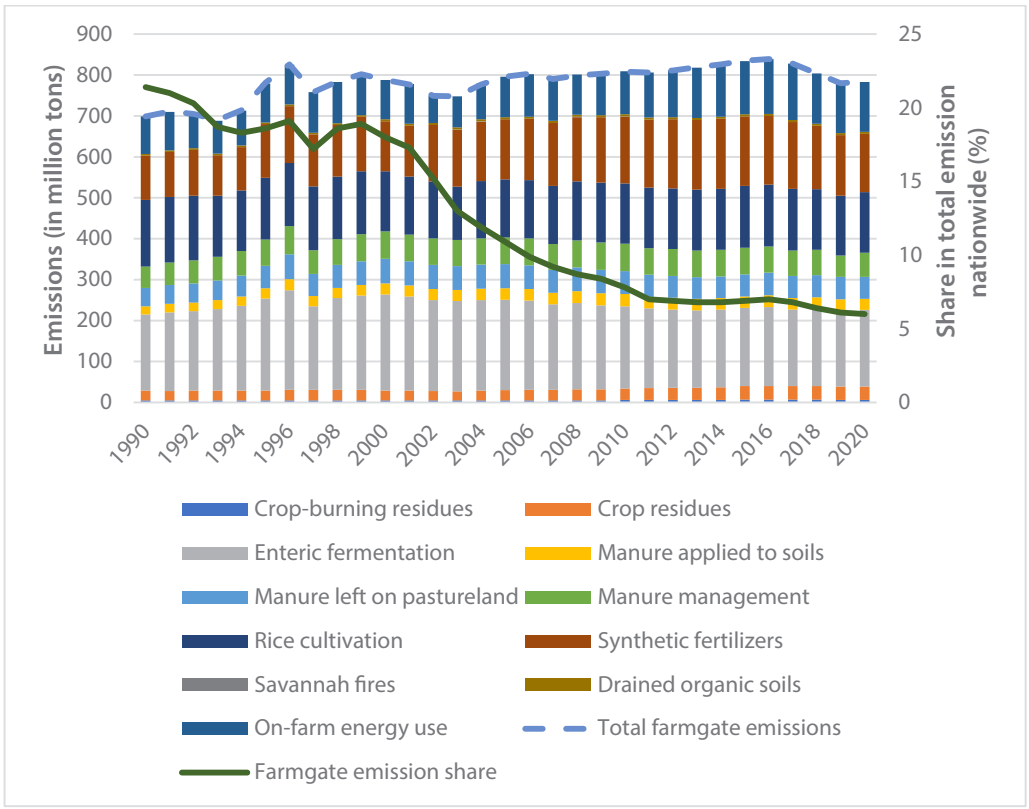

Figure 2. China's farmgate GHG emissions and their share in the country's total emissions, 1990-2020

Source: FAOSTAT.

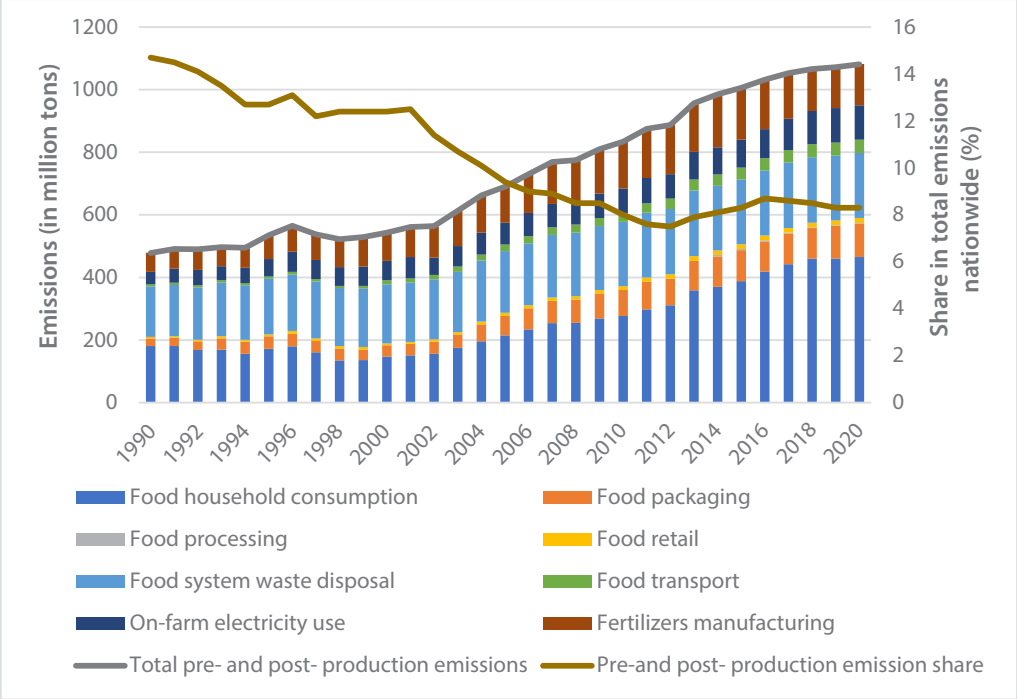

Figure 3. GHG emissions from pre- and post-production in agrifood systems in China, 1990-2020

Source: FAOSTAT

Supporting the transition to low-emission agriculture in China

China has committed to reaching carbon neutrality by 2060. This requires a drastic cut in GHG emissions from all sectors, including agriculture and the agrifood system as a whole. Here we focus on agriculture. China has made significant progress in the research and implementation of low-emission agriculture nationwide.

At the national level, several regulations and plans have been issued to support low-emission transformation in the agricultural sector.[1] Some main measures have also been successfully scaled to support the transition toward low-emission agriculture, including:

- Adoption of protective cultivation practices, such as no-tillage, crop residue retention and crop rotation to improve the ability of soils to sequester carbon.
- Enhancement of carbon sequestration in forest, grassland and wetland ecosystems.
- Use of innovative low-emission technologies, such as renewable energy and energy-saving technologies and practices (i.e., re-use of crop residues), a combination of organic and chemical fertilizers, and a climate-smart agricultural system.

Challenges and policy options

Although low-emission techniques, practices, regulations and policies already exist, scaling them up raises enormous challenges. Challenges include: insufficient government supervision and coordination of policies relating to low-emission agriculture transformation; lack of national standards for agricultural GHG emission accounting; limited adoption of low-emission agricultural practices by farmers; insufficient stakeholder engagement regarding scaling; lack of attention to smallholder farmers and their heterogenous production patterns; unclear investment returns; and insufficient financial incentives.

Addressing these challenges will require effective policies, financial incentives, education and capacity building, technical and organizational innovations, and strong governance mechanisms involving multiple actors, sectors and scales. This brief highlights seven specific policy recommendations:

1. Strengthen governmental supervision and coordination on low-emission agriculture transformation, e.g., by establishing a cross-ministerial coordination mechanism and including low-emission agriculture in the performance rating of all government institutions.

1 These include the 14th Five-Year Plan for National Agricultural Green Development, the National Agricultural Sustainable Development Plan (2015–2030), the Agricultural Resources and Ecological and Environmental Protection Project Plan (2016–2020), and the Implementation Plan for Emission Reduction and Carbon Sequestration in Agriculture and Rural Areas.

2. Establish a national standard for measuring agricultural GHG emissions, in collaboration with national research agencies, international organizations like the CGIAR, and relevant stakeholders.
3. Enhance agriculture extension services, incorporating them into policies promoting low-emission agriculture, innovating methods for channelling policies to farmers, and facilitating the adoption of new services.
4. Facilitate the low-emission transformation of smallholder farmers by promoting examples of integrated and locally-adapted agriculture, e.g., environmentally-friendly family farms that combine planting and breeding.
5. Conduct a cost-benefit analysis of low-emission technologies, for the purpose of informing farmers and other stakeholders of best-bet technologies and their returns on investment; facilitate the adoption of these new technologies.
6. Reform fiscal policies on low-emission agriculture, e.g., by increasing financial support for stakeholders through subsidies and ecosystem service payments, and by taxing high-emitting agricultural practices.
7. Use green financing to support low-emission agriculture development to increase the financial volume from both public and private sources; this has potential to cover the high costs of low-emission agriculture activities and distribute investment risks.

The One-CGIAR Initiative for Low-Emissions Food Systems (Mitigate+), in collaboration with national research partners, will advance research on these issues and contribute to collect evidence, to help better understand the dynamics at stake in China's agrifood systems and open new pathways towards low-emission agriculture and food systems in China.

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