The profound impact of COVID-19 on China's agricultural carbon emissions

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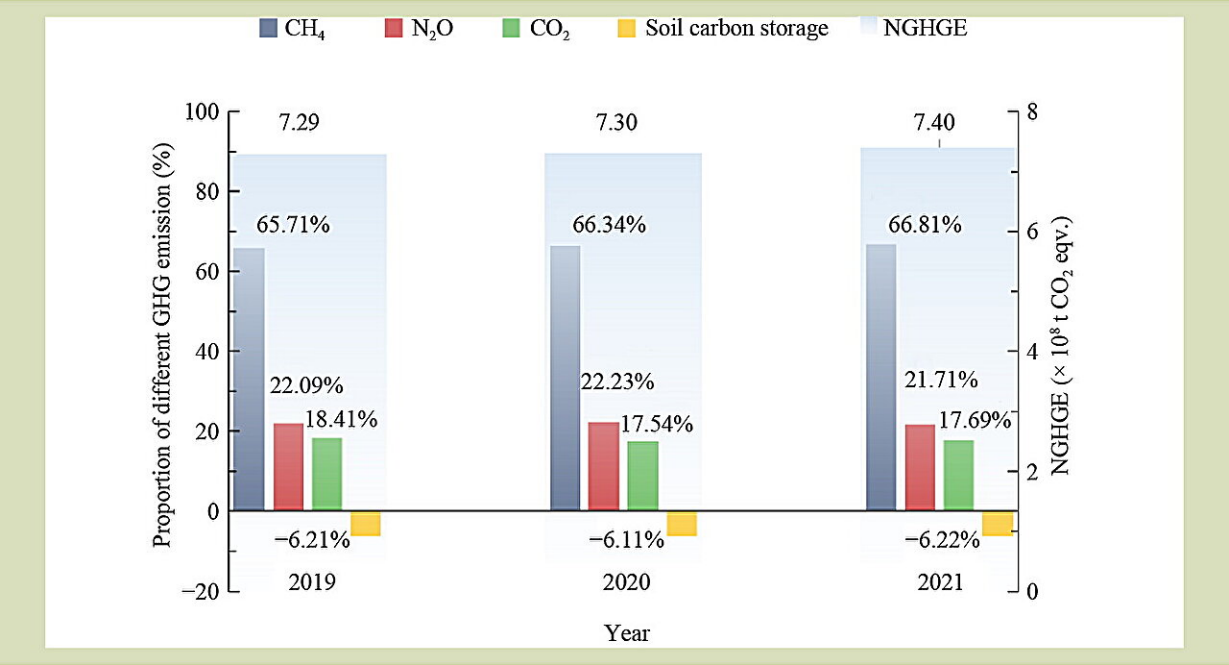

Credit: *Frontiers of Agricultural Science and Engineering* (2024). DOI: 10.15302/J-FASE-2024558

As global climate warming becomes increasingly severe, scientists are delving deeper into greenhouse gas emissions across various industries. Recently, a study from Duke Kunshan University and Yangzhou University on the changes in China's agricultural carbon emissions during the COVID-19 pandemic has garnered widespread attention.

A study published in the journal *Frontiers of Agricultural Science and Engineering* systematically calculated the greenhouse gas emissions from agricultural activities in China from 2019 to 2021, including crop and livestock production, as well as agricultural inputs and energy consumption. The research found that China's net greenhouse gas emissions (NGHGE) from agriculture showed an increasing trend over these three years, with methane (CH_4) emissions accounting for the highest proportion, exceeding 65%, primarily due to livestock enteric fermentation and rice cultivation.

Methane emissions as the dominant factor

According to the study, CH_4 emissions played a leading role in the increase in net greenhouse gas emissions during the pandemic. Livestock enteric fermentation and rice cultivation were the main sources of emissions, with CH_4 emissions accounting for more than 65% of the total.

The study revealed that in 2019, the net greenhouse gas emissions from China's agriculture were 729 million tons of carbon dioxide equivalent (CO_2-eq), increasing to 740 million tons by 2021. Although the annual growth rate fluctuated slightly, the overall trend was upward, with a growth rate of 1.34% in 2021.

Changes in the livestock industry during the pandemic were a major factor in the variation of net greenhouse gas emissions. The disruption of the supply chain and reduced demand due to COVID-19 significantly impacted the pig farming industry, leading to a substantial increase in CH_4 emissions from manure management.

The study found that from 2019 to 2021, CH_4 emissions from pig manure management increased by 26.3%, further rising to 69.2 million tons in 2021. The contribution of pig manure management to CH_4

emissions increased from 75.3% to 81.0%.

Nitrous oxide and carbon dioxide emissions

In the structure of greenhouse gas emissions, nitrous oxide (N_2O) and carbon dioxide (CO_2) accounted for 22% and 18% of the total emissions, respectively. N_2O emissions mainly originated from fertilizer application and manure management, with emissions decreasing during the study period. The study highlighted that optimizing fertilizer use and manure management practices is crucial for reducing N_2O emissions.

CO_2 emissions primarily came from diesel use and agricultural electricity consumption, accounting for more than 60% of CO_2 emissions. The study showed that CO_2 emissions varied across regions due to differences in agricultural inputs and energy usage, underscoring the need for region-specific mitigation measures. For instance, in modern agricultural areas like Jiangsu and Guangdong, CO_2 emissions from agricultural electricity usage require special attention.

Improving diesel engine efficiency, adopting clean energy, and controlling electricity consumption are effective strategies for reducing CO_2 emissions.

Significant regional emission differences

The study results also indicated significant regional differences in China's agricultural greenhouse gas emissions, leading to varying regional characteristics of net greenhouse gas emissions. Heilongjiang, Hunan, Guangdong, and Sichuan were the regions with the highest NGHGE, concentrated in key agricultural areas in the northeast, central, southern, and southwestern regions.

In contrast, the net emissions in less developed agricultural areas in the west and central regions were relatively low. Hunan province, with its extensive rice cultivation, had the highest CH_4 emissions. The significant contribution of pig manure management to CH_4 emissions also reflected the impact of the pig farming industry scale on regional carbon emissions.

The potential of soil carbon sequestration

In addition to greenhouse gas emissions, the study explored the potential of soil carbon sequestration. The results showed that from 2019 to 2021, over 6% of agricultural carbon emissions were offset through soil carbon sequestration. Soil carbon sequestration is an important carbon sink in agricultural ecosystems.

By increasing soil organic carbon content, it can not only reduce atmospheric CO_2 concentrations but also enhance soil fertility and crop yields. The study suggested that practices such as no-till farming, fallowing, and utilizing crop residues and manure resources could further enhance the effectiveness of soil carbon sequestration.

Recommendations for future emission reduction strategies

The study's conclusions provide a scientific basis for future low-carbon agricultural policies. It emphasized that reducing agricultural greenhouse gas emissions requires energy conservation, reduced fertilizer use, and the establishment of comprehensive agricultural databases.

For CH_4 emissions, optimizing livestock management and rice cultivation methods are key strategies; for N_2O emissions, innovative fertilizer use and manure management practices are essential; CO_2

emissions should focus on energy use in modern agricultural areas, achieving reductions through increased energy efficiency and the promotion of clean energy.

The study highlighted the close link between agricultural greenhouse gas emissions and regional structures in Hunan province, underscoring the urgency of targeted measures. Understanding and addressing these changes is crucial for achieving a low-carbon transition in agriculture, especially in the context of the significant impact of the pandemic on agricultural production, particularly the livestock industry.

In conclusion, this study reveals the profound impact of the COVID-19 pandemic on China's agricultural greenhouse gas emissions, providing scientific guidance for a greener and more resilient agricultural future. It is hoped that through scientific policies and innovative technologies, China's agriculture can take more solid steps towards greenhouse gas reduction and climate change mitigation.

More information: Greenhouse gas emissions during the COVID-19 pandemic from agriculture in China, *Frontiers of Agricultural Science and Engineering* (2024). DOI: 10.15302/J-FASE-2024558

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