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Mitigating greenhouse gas emissions in China's agriculture: from farm production to food consumption

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Greenhouse gas (GHG) emissions from agriculture could be mitigated from both supple side and demand side. Assessing carbon footprint (CF) of agricultural production and food consumption could provide insights into the contribution of agriculture to climate change and help to identify possible GHG mitigation options. In the present study, CF of China's agricultural production was firstly assessed from site scale to national scale, and from crop production to livestock production. Data for the crop and livestock production were collected from field survey and national statistical archive, and both life cycle assessment and input-output method were employed in the estimations. In general, CF of crop production was lower than that of livestock production on average. Rice production ranked the highest CF in crop production, and the highest CFs of livestock production were observed in mutton and beef production. Methane emissions from rice paddy, emissions from fertilizer application and water irrigation exerted the largest contribution of more than 50% for CF of crop production; however, emissions from forage feeding, enteric fermentation and manure treatment made the most proportion of more than 90 % for CF of livestock production. In China, carbon efficiency was shown in a decreasing trend in recent years. According to the present study, overuse of nitrogen fertilizer caused no yield effect but significant emissions in some sites and regions of China, and aggregated farms lowered the CFs of crop production and livestock production by 3% to 25% and 6% to 60% respectively compared to household farms. Given these, improving farming management efficiency and farm intensive development is the key strategy to mitigate climate change from supply side. However, changes in food consumption may reduce GHG emissions in the production chain through a switch to the consumption of food with higher GHG emissions in the production process to food with lower GHG emissions. Thus, CFs of different food consumption were also assessed. As indicated in this study, as large as one half of GHG emissions reduction could be gained if the current dietary habit is turned into suggested reasonable dietary. The current work highlights opportunities to gain GHG emission reduction from both supply side and demand side with good management and reasonable consumption in China.