

Excess nitrogen fertilizer increasing warming in China

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Halving the amount of nitrogen fertiliser used in certain areas of China would substantially decrease greenhouse gas emissions without affecting crop productivity and the area's natural carbon sink.

This is according to a new study, published today, 1 November, in IOP Publishing's *Environmental Research Letters*, which showed that a 60 per cent reduction in fertiliser use would significantly reduce emissions from areas that are, anyway, "over-fertilised", such as the North China Plain and middle and lower reaches of the [Yangtze River](#) Basin.

China is currently tasked with meeting the food demands of 22 per cent of the world's population; however, its over-reliance on nitrogen-based fertiliser has dramatically increased its emissions of nitrous oxide (N₂O) – the most [potent greenhouse gas](#).

According to the study, since 2002, the warming effect caused by [N₂O emissions](#) has been significantly greater than the cooling effects from the [croplands](#) storing carbon dioxide (CO₂).

Looking at the past six decades, the researchers found that between 1949 and 1990 nitrogen fertiliser increased the rates of [crop production](#) and the storage of soil carbon; however, from 1990 onwards, they found that the rate of soil carbon storage stopped and the rate of crop production slowed.

In the 1990s, nitrogen fertiliser was contributing to 53 per cent of the

crop production but since then has contributed to 49 per cent, even though more of it was being used, suggesting it had become less effective.

Nitrogen fertiliser can be beneficial to the climate, providing crops with [essential nutrients](#) so they can grow and create a larger natural carbon sink in soils, taking in excess carbon dioxide (CO₂) that is released into the atmosphere. As a result of this balance, the warming effects of N₂O can be less impactful.

When applied to crops and plants, nitrogen enters the soil and reacts with bacteria, which gives off N₂O as a waste product. N₂O is the third highest contributor to [climate change](#) behind CO₂ and methane but is the most potent of the greenhouse gases as it absorbs infrared radiation more readily.

According to the researchers, the warming effects of nitrogen fertiliser-induced N₂O emissions in China are now much greater than the cooling effects of nitrogen-stimulated CO₂ uptake, resulting in overall warming.

Co-author of the study, Dr Hanqin Tian, said: "Nitrogen fertiliser has become less efficient in recent years as the nitrogen input has surpassed nitrogen demands of plants and microbes. Excess nitrogen is not stimulating plant growth but leaving the system through leaching and nitrous gas emissions.

"We need to advance education programs to inform Chinese farmers of both the economic and environmental costs of excessive nitrogen fertiliser use. Effective management practices such as compound fertiliser use and optimised irrigation and tillage should be advanced to increase nitrogen use efficiency."

More information: Food benefit and climate warming potential

induced by nitrogen fertilizer uses in China,
iopscience.iop.org/1748-9326/7/4/044020/article

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