University of Nottingham
Institute for Policy and Engagement

COP26 Policy Brief:
Fixing the Climate Impact of Nitrogen from Global Farming

A revolutionary technology developed at the University of Nottingham challenges farming's reliance on greenhouse gas-emitting synthetic fertilizers

KEY POLICY RECOMMENDATION:

For cleaner air, reduce agricultural nitrous oxide greenhouse gas emissions by incentivizing farmers to take up sustainable biological nitrogen fixation (BNF) technologies.

Background

Synthetic nitrogen fertilizers are the key issue in soil management in terms of nitrous oxide emissions. Nitrous oxide is a greenhouse gas which has a 300x higher global warming potential (GWP) than carbon dioxide and stays in the atmosphere for about 114 years. Agricultural soil management accounts for about 75% of total nitrous oxide emissions. Currently, synthetic nitrogen fertilizers ensure the production of basic cereal staples which the world depends on. There is therefore a reticence by policymakers to regulate their use in any way which will potentially reduce crop yield and therefore threaten global food security. The good news is, there is an alternative provided by biological nitrogen fixation (BNF), and a revolutionary approach developed at the University of Nottingham is transforming the growing industry in this sector.

Research at Nottingham

The University of Nottingham has developed a specific technology which uses the special characteristics of a naturally occurring, non-GMO, organic bacterium known as Gd. This special characteristic is called biological nitrogen fixation (BNF), which is how certain bacteria species can convert Nitrogen from the air and fix it in the leaves, in a form that can be taken up and used by plants.

The bacteria are applied to crop seed and colonize the plant by release of enzymes creating micro-punctures that allow entry to the germinating root. Inside the root the bacteria multiple and move intracellularly within the plant up into the leaves to sit alongside the chloroplasts where it fixes nitrogen. The bacteria form a symbiotic relationship using some of the sugar from photosynthesis and delivering nitrogen to in return to where it is most needed in the leaves.

Implications for Climate Change

This new technology delivers a more sustainable way of significantly reducing the use of synthetic nitrogen fertilizers without a yield penalty for crops, farmers, or consumers. Extensive international field trials have demonstrated that nitrogen fertilizers can be reduced by between 50- 85% and still maintain crop yields. The technology has now been on sale in North America and Canada. Only by systematically rolling out BNF technologies will it be possible to reduce our reliance on synthetic nitrogen fertilizers and mitigate against the harm caused by agricultural nitrous oxide greenhouse gas emissions.

Further Reading

Read the full research

Read Professor Ted Cocking's COP26 blog

Contact the Researcher

Professor Ted Cocking

Emeritus Professor of Botany and Director of the Centre for Crop Nitrogen Fixation in the School of Biosciences.

Email: Edward.Cocking@nottingham.ac.uk