

AGRICULTURAL SYSTEMS

Organic beef lets the system down*Environ. Res. Lett.* **15**, 045004 (2020)

Organic agriculture is a holistic system that could provide a more sustainable alternative to conventional agriculture systems (J. P. Reganold and J. M. Wachter, *Nat. Plants* **2**, 15221; 2016). However, there is still debate in the literature on the benefits of organic agriculture for the sustainability agenda in terms of greenhouse gas emissions, yields and land use. Organic systems promote nitrogen recycling, while conventional systems rely on nitrogen inputs, but the extent to which both systems lose reactive nitrogen (Nr) is unclear. Therefore, Laura Cattell Noll from the University of Virginia and colleagues set out to calculate Nr loss per unit of food from conventional and organic agricultural systems.

The researchers utilized data from crop and livestock production systems, and modelled virtual Nr loss in conventional and organic systems. Organic systems have 10–35% lower yields than conventional systems, so Nr loss was calculated on a per unit production basis. The team observed very little difference between organic and conventional Nr losses per unit of food produced, with the exception of beef, where Nr losses are higher in organic systems. The researchers then calculated the nitrogen

footprint for a 100% organic US diet versus a 100% conventionally produced diet, finding that organically produced diets have a higher nitrogen footprint than conventionally produced diets — but this was due to the higher nitrogen footprint of organic beef production.

These findings point to variability in Nr loss between organic and conventional production systems rather than a clear difference between them. Livestock production has higher Nr losses than crop production, particularly beef production, which is almost twice as inefficient as conventional production due to the low Nr content of pasture feeding resulting in poor feed conversion ratios. The authors conclude that there is very little Nr loss difference between 100% conventional and 100% organically produced diets. Based on these findings, dietary choices, such as reducing meat consumption, seem to be more effective at reducing individual consumers' dietary nitrogen footprint than switching to organically produced diets.

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