100 per cent organic farming risks greenhouse gas emissions increase

A 100 per cent shift to organic farming in England and Wales would yield up to 40 per cent less food if the diet did not change its diet, leading to increased imports and a net increase in greenhouse gas emissions, researchers have found.

The study, published in Nature Communications, was principally conducted by Dr Laurence Smith, whilst at Cranfield University (now of the Royal Agricultural University), with Professor Guy Kirk and Dr Adrian Williams of Cranfield University and Philip Jones of Reading University.

Although organic farming generally creates lower greenhouse gas (GHG) emissions per commodity, up to 20 per cent lower for crops and four per cent for livestock. It also produces less food energy output per hectare.

Dr Adrian Williams, Reader in Agri-Environmental Systems at Cranfield University, says: “We predict a drop in total food production of 40 per cent under a fully organic farming regime, compared to conventional farming, if we keep to the same national diet. This results from lower crop yields, because yields are restricted by a lower supply of nitrogen, which is mainly from grass-legume leys within crop rotations or manure from cattle on pasture.”

Assessing the need for imports to make up the shortfall, and assuming that food diets and demands stay the same, the academic team estimates that the overseas land area needed to be changed to food production for England and Wales would increase by a factor of five. This additional land would likely be of sub-optimal quality and therefore not as productive as higher-quality land.

Dr Laurence Smith, Lecturer in Agroecology at the Royal Agricultural University, says: “Although resource use can be improved under organic management, there is a need to consider the potential effect on land-use. Under a 100 per cent organic scenario in England and Wales, a net-reduction in greenhouse gases would only be achievable if accompanied by a major increase in organic yields or widespread changes to national diets.”

Rates of carbon sequestration – where atmospheric carbon dioxide is captured by plants and stored in the soil – are higher under organic farming because of greater use of manures and longer crop rotations. However, this is limited to the first decade or two following conversion to organic farming, as the soil will eventually reach a steady-state when carbon sequestration rates fall to zero. Overall in the 100 per cent organic farming modelling, it was found that sequestration only offsets a small part of the higher emissions from overseas land use.

The research concluded that net GHG emissions under a 100 per cent organic farming production method could increase by 21 per cent over conventional farming baselines – under the assumption that only half the extra overseas land was converted from grassland – going up to 170 per cent if the Carbon Opportunity Cost is added in.

Guy Kirk, Professor of Soil Systems at Cranfield University, says: “Although there are undoubtedly local environmental benefits to organic farming practices, including soil carbon storage, reduced exposure to pesticides and improved biodiversity, we need to set these against the requirement for greater production elsewhere.”

Dr Adrian Williams concludes: “The assumption about diets is crucial: today’s organic consumers are a self-selecting group and not typical of the nation. Whether a different national diet could be provided by the same land area under all organic production is a different study.”

“This was aimed at understanding limits to production. The study was based on rigorous modelling that had its foundations in establishing the biophysical limits of crop production without manufactured nitrogen.”

The greenhouse gas impacts of converting food production in England and Wales to organic methods was published in the journal Nature Communications on Tuesday October 22 by academics from Cranfield University, the Royal Agricultural University and the University of Reading.