Summary

The approaching ‘perfect storm’ of climate change, resource depletion, food insecurity and population growth, in addition to continuing environmental degradation and biodiversity loss, is forcing us all to think again about how we produce and consume food.

This paper argues that organic, or agroecological, farming systems, combined with a necessary shift in our diets, offer solutions to many of these critical environmental, social and economic challenges facing our current food and farming system.

It provides evidence to support the widely recognised biodiversity and other environmental benefits of organic agriculture, the contribution it can make to mitigating climate change and the impact it can have on achieving food security whilst ensuring a more healthy diet.

Key words: organic farming, agro-ecology, food security, diet.will be added to the global population before its growth levels off later in this century.

Glossary

Permaculture is an approach to designing human settlements and agricultural systems that mimic the relationships found in natural ecologies.

Abbreviations

GHG, greenhouse gas

Introduction

The approaching ‘perfect storm’ of climate change, resource depletion, food insecurity and population growth, in addition to continuing environmental degradation and biodiversity loss, is forcing us all to think again about how we produce and consume food.

The current dominant system of intensive, monoculture agriculture has only been made possible through the use of high levels of artificial fertilisers and pesticides, inputs which will not be sustainable into the future given the greenhouse gas emissions (GHG) from their manufacture and use (Scialabba and Muller-Lindenlauf 2010), as well as predictions of future resource shortages, as exemplified by peak oil.

Neither is our current food system sustainable, as it delivers a diet high in processed food, meat and diary products to the developed world, and increasingly to the developing world.

With concern over the nutrition transition in poorer countries (Lopez 2006) and recognition of the necessity for a substantial worldwide diet change, away from animal products (UNEP 2010) due to the climate impact of livestock products, and the negative effects on ill health, a radical change in both how we farm and what we eat are now needed.

Organic agriculture is based on agroecology - ‘the science of applying ecological concepts and principles to the design and management of sustainable food systems’ (Gliessman 2007:369).

At the core of organic production is a correctly designed and implemented crop rotation. This provides sufficient crop nutrients, minimises their losses and provides nitrogen through leguminous crops (as well as the use of animal manures).

It is also designed to reduce weeds, pests,and diseases and is used tomaintain the soil structure and organic matter content, as well as to provide a profitable output of organic cash crops and livestock.

Thus, the use of artificial fertilisers and pesticides is avoided (Soil Association 2008).

In this paper it will be argued that organic, or agroecological farming systems, combined with a necessary shift in our diets, offer solutions to many of the critical environmental, social and economic challenges facing our current food and farming system.

The biodiversity and environmental benefits of organic agriculture

Over the last 50 years in the UK there has been a steep decline in wildlife in the countryside.

Research, much of it Government funded, has identified that agricultural intensification led to these declines (Defra, 2009).

Organic agricultural systems however, have the ability to reverse this trend. There is now scientific evidence to show the biodiversity and wider environmental benefits of organic farming systems compared to conventional systems (Fuller, Norton, Feber et al. 2005; Hole, Perkins, Wilson, et al. 2005).

In 2005, a review of 66 published studies that compared organic and non- organic farming systems, concluded that on average, wildlife is 50% more abundant on organic farms and there are 30% more species than on non- organic farms (Bengtesson, Anhstrom, Weilbull 2005).

The UK Government has recognised that organic food and farming offer real benefits to the environment: in their 'The Action Plan to develop organic food and farming in England' (Defra 2002) it is stated that "Government financial support for organic farming is justified by the environmental public good which organic farming delivers, which extend to society as a whole and not just to the minority of consumers who choose to purchase organic food."

Indeed, organic farmers are now financially rewarded for the environmental benefits of organic systems through the Organic Entry Level Scheme.

A 2003 study by Defra (Shepherd, Pearce, Cormack et al. 2003) found that organic farming systems had benefits over conventional farming systems according to several environmental indicators, including greater biodiversity, lower environmental pollution from pesticides, greater energy efficiency and control of wastes.

The potential of organic agriculture to mitigate climate change

There is now scientific consensus that urgent cuts in the amount of GHG emissions are needed in order to avoid dangerous changes in global temperature.

In the UK, research has shown that once agriculture related land use change is factored into the accounts, food and farming represents at least 30% of the UK's consumption-related GHG emissions (Audsley, Brander, Chatterton et al. 2009).

A significant contribution to the potential of organic farming systems to mitigate climate change comes from the carbon sequestration in soils.

Several field studies have shown the positive effect of organic farming practice on soil carbon pools (Kustermann, Kainz, and Hulsbergen 2008; Fliessbach, Oberholzer, Gunst et al. 2007;Pimental, Hepperly, Hanson et al. 2005) and on the basis of evidence so far available, a recent review of 39 comparative studies of soil carbon

levels found that organic arable farming practices produce 28% higher soil carbon concentrations than non- organic farming in Northern Europe, and 20% for all countries studied (Azeez 2009).

Current intensive livestock systems in Europe are reliant on imported soy for animal feed which is helping to drive the destruction of South American rainforests.

In the Amazon in the last decade, soybean cultivation, as well as intensive cattle grazing, have been the dominant drivers of land clearing. Between 1990 and 2006 the area used for soybean cultivation quadrupled (Zaks, Barford, Ramankutty et al. 2009).

This process is having a negative impact on biodiversity, but is also releasing GHGs and further contributing to climate change (FoE 2010). A shift away from such systems to grass-based systems avoids this.

Another potential contribution comes from the careful management of nutrients and thus the possibility of reductions of N2O emissions from soils. Artificial mineral fertilisers that currently cause direct N2O in the range of 10% of agricultural GHG emissions are not used in organic systems, whilst catch and cover crops extract plant-available nitrogen unused by the preceding crops and retain it in the system.

Therefore, they further reduce the level of reactive nitrogen in the topsoil, which is the main driving factor for N2O emissions.

The share of reactive nitrogen that is emitted as N2O depends on a broad range of soil and weather conditions and management practices.

Comparisons between soils receiving manure versus mineral fertilisers found higher N2O emissions after manure application compared to mineral fertiliser applications, but not for all soil types.

One study from Brittany found no significant differences between mineral and organic fertilisation (Scialabba and Muller- Lindenlauf 2010).

Organic agriculture and food security

The issue of ensuring food security in the face of climate change, a growing population and future resource scarcity has become a global political concern.

Whilst the focus of political debate has focused on increasing production as the solution to feeding the world, we would do well to remember the words of Amartya Sen (1981:1) that “starvation is the characteristic of some people not having enough food to eat.

It is not the characteristic of there being not enough food to eat.

While the latter can be a cause of the former, it is but one of many possible causes”. Thus, solutions to food security need to rest, not only on agricultural production; but also access (for example what can be afforded) and the ability of the individual to benefit adequately from the nutrients provided (Barrett 2010).

In the developing world, where the majority of the future population increase is expected to occur, evidence exists that “organic agricultural systems achieve equal or even higher yields, as compared to the current conventional practices” (Scialabba and Muller-Lindenlauf 2010:158).

An analysis of 286 projects covering 37 million hectares in 57 countries found that when sustainable agricultural practices covering a variety of systems and crops were adopted, average crop yields increased by 79% (Pretty, Noble, Bossio et al. 2005). A study by Badgeley, Moghtader,

Quintero et al. (2007) found that the average yield ratio (organic: non-organic) was >1 in the developing world.

A survey from the United Nations of 114 projects in 24 African countries found that yields had more than doubled where organic, or near organic practices had been used (UNEP-UNCTAD 2008).

It also found that organic farming increased access to food through the production and selling of food surpluses at local markets which meant that farmers had higher incomes and increased purchasing power, and that it allowed new and different groups in the community to get involved in agricultural production and trade.

These groups had previously been excluded for financial or cultural reasons.

In the context of the developed world, the University of Reading carried out a study into what food could be produced if all of England and Wales was farmed organically (Jones & Crane 2009).

They concluded that beef production could go up 68% and lamb production up 55%.

The output of fruit and vegetables would stay about the same whilst chicken, egg and pork production would fall to roughly a quarter of current levels because of an end to intensive farming systems, which organic standards do not permit.

Dairy production would fall by around 30 to 40%. The amount of wheat and barley produced would drop by around 30%.

However, because we would be feeding far less grain to animals, more than half of the world’s crops are currently used to feed animals (UNEP 2010), we could have as much wheat and barley for human consumption under an organic system.

The necessity of changing diets

The implication of this research is that organic farming practices in the UK could produce sufficient yields to feed the UK population, but that our diet would need to change significantly, towards one that is healthier and more sustainable.

This would include; an overall cut in dairy consumption, with dairy products to be sourced from grass-fed cows from extensive farming systems; more cereals and root crops and more seasonal fruit and vegetables; and less meat overall, but more grass-fed beef and lamb.

Globally, claims are being made of the need to vastly increase food production by 70% by 2050 (FAO 2006) based on projections of further increases in meat and dairy consumption in the developing world, as has been the recent trend.

However, there are widespread concerns about the health impacts that the structural changes in diet have already had in the developed world, and that are increasingly occurring in the developing world.

Such diets are a leading cause of cardiovascular disease, some cancers and Type 2 diabetes (Friel, Dangour, Garnett 2009). Diet-related heart disease and stroke have already taken over as the two leading causes of death in low and middle income countries (Lopez 2006).

Rather than basing policy for food security on the continuation of business-as-usual trajectories, there urgently needs to be a shift in policy attention to considering how a healthy, sustainable diet would be best delivered.

A recent study explored the feasibility of feeding 9 billion people in 2050 under different diet scenarios and agricultural systems and found that for a 'western high meat diet' to be 'probably feasible' 'would require a combination of massive land use change, intensive livestock production systems and intensive use of the arable land' (Erb, Haber, Krausmann et al. 2009: 23).

This would have negative impacts for animal welfare and lead to further destruction of natural habitats.

Significantly, the report provides evidence 'that organic agriculture can probably feed the world population of 9.2 billion in 2050, if relatively modest diets are adopted, where a low level of inequality in food distribution is required to avoid malnutrition' (Erb, Haber, Krausmann et al. 2009: 29).

Conclusions

Current intensive models of farming will not be viable in the future given the challenges of diet related ill health, environmental degradation, resource-use constraints and the need to mitigate climate change.

There is increasing support from international scientists for the view that agroecological methods, such as organic farming, offer the best way forward to feeding the world (UNEP-UNCTAD 2008, OHCHR 2010).

Perhaps most significantly, the International Assessment of Agricultural Knowledge Science and Technology for Development (IAASTD 2008) conducted by over 400 scientists concluded that 'increased attention needs to be directed towards new and successful existing approaches to maintain and restore soil fertility and to maintain sustainable production through practices such as low input resource-conserving technologies based onan understanding of agroecology and soil science (e.g. agroforestry, conservation agriculture, organic agriculture and permaculture).'

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Comments