

## Can organic agriculture feed the world? A review of the research

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Keywords: organic farming, global food supply, climate change yields

### Abstract

*In response to the recent debate over whether organic agriculture can feed the world, the Soil Association has reviewed the published research that makes claims about the global productive capacity of organic agriculture. Available data on yields suggests that organic farming does have the potential to produce enough food to feed the world. However, further research, particularly in the South, is needed. Some recent studies have taken a broader view of food security than simply assessing quantity of production. These include studies looking at the capacity for organic agriculture to reduce energy inputs and to feed the rural and urban poor. This research suggests that organic farming can offer a solution to many of the current failures of non-organic farming, such as dependence on high-energy use, high levels of greenhouse gas emissions, and widespread pollution. There is a need to refocus the debate, in line with the current research, from the simple question 'can organic feed the world' to the question of which farming and food system can deliver healthy food, including to those in most need, within the constraints of limited energy availability and the urgent need to reduce greenhouse gas emissions.*

### Introduction

As concerns about climate change and energy scarcity increase, we need to reduce both the energy inputs and greenhouse gas outputs of our current food production system. Organic farming shows proven benefits on each of these counts, but many critics have argued that a large-scale organic conversion would entail dramatic reductions in global food yields, leading to widespread famine. This has led to a surge of interest in the question, 'Can organic farming feed the world?,' resulting in a number of recent studies on the subject. In response to the growing debate, the Soil Association undertook a review of all the recent published research making claims about the potential of organic farming to feed the world. This paper reports the strengths and weaknesses of this research over the past eight years.

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## Materials and methods

The literature review took place in August 2007 and was confined to internet searches using search engines provided by Google, Ingenta, Science Direct, Web of Science, and JSTOR. The literature review found 10 published within the past eight years that make global claims about the productive capacity of organic agriculture and 88 that dealt with organic yields in general.

## Results

All of the studies reviewed showed the potential of organic farming to produce enough food to feed the world's current population, despite the limited research and development it has received over the last 60 years. Examples include studies like Badgley *et al* (2006), which, while limited in scope, did indicate that organic agriculture has the potential to contribute "substantially to the global food supply." Halberg's *et al* (2006) book, though conservative about organic agriculture's potential, provides a good analysis of the strengths, weaknesses, and areas of future development for organic farming. Studies like Halberg *et al* (2006), which deal with additional concerns other than simple yield comparisons, are also useful in pointing out the failure of food distribution under the current system and note the environmental sustainability problems of non-organic farming compared to organic systems. Current evidence suggests is that it is possible to massively cut the amount of chemical inputs used worldwide right now without a drop in food availability, through low-input farming methods that use organic techniques.

In reviewing the current data on organic farming's total productive capacity, results generally differ between North and South. Current figures in the North show organic yields to be around 50-100% of those on non-organic farms, depending on the crop and location. These figures come from a wealth of research throughout Europe and North America. In the US, for example, the Rodale institute (Pimentel *et al*, 2005) has been running a study over 20 years that has consistently shown that organic agriculture delivers almost equal yields, is more environmentally friendly, and uses less energy than non-organic farming. In contrast, published research in Europe, due to the high inputs of non-organic farming practices here, have generally shown less favorable yields comparisons than most US studies. Despite this, the Fliessbach *et al*, (2000) study in Switzerland, which has also been running over 20 years, has consistently shown an average yield of 80% of non-organic plots, while using half the inputs.

In contrast to the intensive agriculture of the North, non-organic farming in the South is typically low-input and low yielding. Here, the introduction of organic agricultural techniques can produce dramatic increases in yield, without financial outlay on new crop varieties, chemical fertilizers, or pesticides. Parrott & Marsden (2002) give an example of comparative yield research in Brazil where a switch to organic increased maize yields by 20-250%, and in Peru where research has shown organic farming to increase yields by 150% for a range of upland crops. As Halberg *et al* (2006) and Parrott & Marsden (2002) have both noted, the majority of the studies so far have been based on the strong but self-reported evidence of the Pretty & Hines (2001) study. However, despite the limited number of studies in the South in tropical climates, an emerging body of data from a multitude of sources is producing similar findings to Pretty & Hines (2001) on the increase in yields achieved by organic systems.

Examples include a current study by Gibbon *et al* (2007) in Uganda and the IFAD (2005) research in Asia. The FAO (2007) has also noted studies in places like Ethiopia, Indonesia, and the Philippines, many with a sample size above, and in some cases well above, 350 farms.

None of the evidence appears to support the conclusions reached by those who suggest that global adoption of organic farming would lead to widespread starvation. However, while organic yields look promising, none of the papers reviewed provided conclusive evidence that organic farming could feed the world. This is primarily due to the unique conditions inherent to local organic systems; in assessing organic yields, it is less easy to generalize than for the more uniform conditions of non-organic farming, and so an enormous amount of data from around the globe would be required to answer the question conclusively. This caveat applies even in the cases of Badgley *et al* (2006), and Halberg *et al* (2006), both studies that comment positively on organic farming's potential to feed the world.

## Conclusions

Overall, studies looking into the comparative yield performance of organic and non-organic systems will surprise many with their findings that organic farming can feed the world. However, any discussion that deals solely with the yields of a food system risks perpetuating the myth that producing sufficient food globally ensures the end of world hunger. What is certain is that yields alone do not feed human populations. Indeed, we are also learning that sufficient food of the wrong type can be a curse, not a blessing, as first developed and increasingly developing countries succumb to epidemics of childhood and adult obesity. In contrast, organic farming in Northern Ethiopia has shown that organic systems can provide a more drought resistant, nutritionally diverse food supply for local people (Araya & Edwards, 2006). In the future, research should focus on the capacity of organic farming to provide a healthy diet for the world's population, in particular for those most in need, in conditions of climate stress, without reliance on expensive external inputs (whether seeds, fertilizers or pesticides), with minimal use of fossil fuels, and greatly reduced greenhouse gas emissions.

Current research clearly shows that basic steps towards the development of organic systems can be employed now on non-organic farms that can drastically reduce chemical inputs while maintaining and even increasing yields and yield sustainability. A review of the current trends in organic agricultural research shows that it is developing beyond a simple comparison of yields. Currently, researchers are trying to create models that take into account many of organic farming's wider benefits as a global food production system. Additionally, existing data on the comparative performance of organic and non-organic systems have looked at organic farms using mainly crop varieties and farm animals bred for non-organic systems. New breeding research, producing varieties, and breeds better adapted to the unique conditions of local organic systems, is showing very significant increases in yields. The lack of research and development over the last 60 years suggests that current organic yield performance may be far lower than its full potential, as was the case for non-organic yields 60 years ago

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