

Seconde, DNL, How to feed the world debate : **Is organic food able to feed the world population?**

Debate 3: "Is organic food able to feed the world population?"

Sources available on dnlrenoir.fr too.

Videos

Video from science over coffee :

<https://www.youtube.com/watch?v=aSYFhgJxuPw>

Video from Groworganic Peaceful valley : <https://www.youtube.com/watch?v=CxFQEdI3XvU>

Video from Voice of America : The Limits to Organic Farming in Feeding the World

<https://www.youtube.com/watch?v=XYY-pp0cFbQ>

Articles

Can we feed 10 billion people on organic farming alone?

John Reganole, *The Guardian*, 14 aug 2016

<https://www.theguardian.com/sustainable-business/2016/aug/14/organic-farming-agriculture-world-hunger>

Will Organic Food Fail to Feed the World?

David Bellio, *Scientific American*, 25 april 2012

<https://www.scientificamerican.com/article/organic-farming-yields-and-feeding-the-world-under-climate-change/>

Organic farming can feed the world if done right, scientists claim

Tom Bawden, *The independent*, 10 december 2014

<https://www.independent.co.uk/environment/organic-farming-can-feed-the-world-if-done-right-scientists-claim-9913651.html>

Organic farming cannot feed planet

Carol Keiser, Truth About Trade & Technology | Mar 29, 2012

<https://www.westernfarmpress.com/management/organic-farming-cannot-feed-planet>

Can we feed 10 billion people on organic farming alone?

John Reganold, *The Guardian*, 14 aug 2016

In 1971, then US Secretary of Agriculture Earl Butz uttered these unsympathetic words: "Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry." Since then, critics have continued to argue that organic agriculture is inefficient, requiring more land than conventional agriculture to yield the same amount of food. Proponents have countered that increasing research could reduce the yield gap, and organic agriculture generates environmental, health and socioeconomic benefits that can't be found with conventional farming.

American farmers are struggling to feed the country's appetite for organic food

Organic agriculture occupies only 1% of global agricultural land, making it a relatively untapped resource for one of the greatest challenges facing humanity: producing enough food for a population that could reach 10 billion by 2050, without the extensive deforestation and harm to the wider environment.

That's the conclusion my doctoral student Jonathan Wachter and I reached in reviewing 40 years of science and hundreds of scientific studies comparing the long term prospects of organic and conventional farming. The study, *Organic Agriculture in the 21st Century*, published in *Nature Plants*, is the first to compare organic and conventional agriculture across the four main metrics of sustainability identified by the US National Academy of Sciences: be productive, economically profitable, environmentally sound and socially just. Like a chair, for a farm to be sustainable, it needs to be stable, with all four legs being managed so they are in balance.

We found that although organic farming systems produce yields that average 10-20% less than conventional agriculture, they are more profitable and environmentally friendly. Historically, conventional agriculture has focused on increasing yields at the expense of the other three sustainability metrics.

The flower petals and the labels represent different sustainability metrics that compare organic farming with conventional farming. They illustrate that organic systems can better balance the four areas of sustainability: production (orange), environment (blue), economics (red) and social wellbeing (green).

The flower petals and the labels represent different sustainability metrics that compare organic farming with conventional farming. They illustrate that organic systems can better balance the four areas of sustainability: production (orange), environment (blue), economics (red) and social wellbeing (green).

Illustration: John Reganold and Jonathan Wachter

In addition, organic farming delivers equally or more nutritious foods that contain less or no pesticide residues, and provide greater social benefits than their conventional counterparts.

With organic agriculture, environmental costs tend to be lower and the benefits greater. Biodiversity loss, environmental degradation and severe impacts on ecosystem services – which refer to nature's support of wildlife habitat, crop pollination, soil health and other benefits – have not only accompanied conventional farming systems, but have often extended well beyond the boundaries of their fields, such as fertilizer runoff into rivers.

Overall, organic farms tend to have better soil quality and reduce soil erosion compared to their conventional counterparts. Organic agriculture generally creates less soil and water pollution and lower greenhouse gas emissions, and is more energy efficient. Organic agriculture is also associated with greater biodiversity of plants, animals, insects and microbes as well as genetic diversity.

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Despite lower yields, organic agriculture is more profitable (by 22–35%) for farmers because consumers are willing to pay more. These higher prices essentially compensate farmers for preserving the quality of their land.

Studies that evaluate social equity and quality of life for farm communities are few. Still, organic farming has been shown to create more jobs and reduce farm workers' exposure to pesticides and other chemicals.

Organic farming can help to both feed the world and preserve wildland. In a study published this year, researchers modeled 500 food production scenarios to see if we can feed an estimated world population of 9.6 billion people in 2050 without expanding the area of farmland we already use. They found that enough food could be produced with lower-yielding organic farming, if people become vegetarians or eat a more plant-based diet with lower meat consumption. The existing farmland can feed that many people if they are all vegan, a 94% success rate if they are vegetarian, 39% with a completely organic diet, and 15% with the Western-style diet based on meat.

Realistically, we can't expect everyone to forgo meat. Organic isn't the only sustainable option to conventional farming either. Other viable types of farming exist, such as integrated farming where you blend organic with conventional practices or grass-fed livestock systems.

More than 40 years after Earl Butz's comment, we are in a new era of agriculture. During this period, the number of organic farms, the extent of organically farmed land, the amount of research funding devoted to organic farming and the market size for organic foods have steadily increased. are rapidly growing in the world, increasing almost fivefold between 1999 and 2013 to \$72bn. This 2013 figure is projected to double by 2018. Closer to home, organic food and beverage sales in 2015 represented almost 5% of US food and beverage sales, up from 0.8% in 1997.

Scaling up organic agriculture with appropriate public policies and private investment is an important step for global food and ecosystem security. The challenge facing policymakers is to develop government policies that support conventional farmers converting to organic systems. For the private business sector, investing in organics offers a lot of entrepreneurial opportunities and is an area of budding growth that will likely continue for years to come.

In a time of increasing population growth, climate change and environmental degradation, we need agricultural systems that come with a more balanced portfolio of sustainability benefits. Organic farming is one of the healthiest and strongest sectors in agriculture today and will continue to grow and play a larger part in feeding the world. It produces adequate yields and better unites human health, environment and socioeconomic objectives than conventional farming.

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Will Organic Food Fail to Feed the World?

David Bellio, *Scientific American*, 25 april 2012

Food for hungry mouths, feed for animals headed to the slaughterhouse, fiber for clothing and even, in some cases, fuel for vehicles—all derive from global agriculture. As a result, in the world's temperate climates human agriculture has supplanted 70 percent of grasslands, 50 percent of savannas and 45 percent of temperate forests. Farming is also the leading cause of deforestation in the tropics and one of the largest sources of greenhouse gas emissions, a major contributor to the ongoing maul of species known as the "sixth extinction," and a perennial source of nonrenewable groundwater mining and water pollution.

To restrain the environmental impact of agriculture as well as produce more wholesome foods, some farmers have turned to so-called organic techniques. This type of farming is meant to minimize environmental and human health impacts by avoiding the use of synthetic fertilizers, chemical pesticides and hormones or antibiotic treatments for livestock, among other tactics. But the use of industrial technologies, particularly synthetic nitrogen fertilizer, has fed the swelling human population during the last century. Can organic agriculture feed a world of nine billion people?

In a bid to bring clarity to what has too often been an emotional debate, environmental scientists at McGill University in Montreal and the University of Minnesota performed an analysis of 66 studies comparing conventional and organic methods across 34 different crop species. "We found that, overall, organic yields are considerably lower than conventional yields," explains McGill's Verena Seufert, lead author of the study to be published in *Nature* on April 26. (Scientific American is part of Nature Publishing Group.) "But, this yield difference varies across different conditions. When farmers apply best management practices, organic systems, for example, perform relatively better."

In particular, organic agriculture delivers just 5 percent less yield in rain-watered legume crops, such as alfalfa or beans, and in perennial crops, such as fruit trees. But when it comes to major cereal crops, such as corn or wheat, and vegetables, such as broccoli, conventional methods delivered more than 25 percent more yield.

The key limit to further yield increases via organic methods appears to be nitrogen—large doses of synthetic fertilizer can keep up with high demand from crops during the growing season better than the slow release from compost, manure or nitrogen-fixing cover crops. Of course, the cost of using 171 million metric tons of synthetic nitrogen fertilizer is paid in dead zones at the mouths of many of the world's rivers. These anoxic zones result from nitrogen-rich runoff promoting algal blooms that then die and, in decomposing, suck all the oxygen out of surrounding waters. "To address the problem of [nitrogen] limitation and to produce high yields, organic farmers should use best management practices, supply more organic fertilizers or grow legumes or perennial crops," Seufert says.

In fact, more knowledge would be key to any effort to boost organic farming or its yields. Conventional farming requires knowledge of how to manage what farmers know as inputs—synthetic fertilizer, chemical pesticides and the like—as well as fields laid out precisely via global-positioning systems. Organic farmers, on the other hand, must learn to manage an entire ecosystem geared to producing food—controlling pests through biological means, using the waste from animals to fertilize fields and even growing one crop amidst another. "Organic farming is a very knowledge-intensive farming system," Seufert notes. An organic farmer "needs to create a fertile soil that provides sufficient nutrients at the right time when the crops need them. The same is true for pest management."

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But the end result is a healthier soil, which may prove vital in efforts to make it more resilient in the face of climate change as well as conserve it. Organic soils, for example, retain water better than those farms that employ conventional methods. "You use a lot more water [in irrigation] because the soil doesn't have the capacity to retrain the water you use," noted farmer Fred Kirschenmann, president of Stone Barns Center for Food and Agriculture at the "Feeding the World While the Earth Cooks" event at the New American Foundation in Washington, D.C., on April 12.

At the same time, a still-growing human population requires more food, which has led some to propose further intensifying conventional methods of applying fertilizer and pesticides to specially bred crops, enabling either a second Green Revolution or improved yields from farmlands currently under cultivation. Crops genetically modified to endure drought may also play a role as well as efforts to develop perennial versions of annual staple crops, such as wheat, which could help reduce environmental impacts and improve soil. "Increasing salt, drought or heat tolerance of our existing crops can move them a little but not a lot," said biologist Nina Fedoroff of Pennsylvania State University at the New America event. "That won't be enough."

And breeding new perennial versions of staple crops would require compressing millennia of crop improvements that resulted in the high-yielding wheat varieties of today, such as the dwarf wheat created by breeder Norman Borlaug and his colleagues in the 1950s, into a span of years while changing the fundamental character of wheat from an annual crop to a perennial one. Then there is the profit motive. "The private sector is not likely to embrace an idea like perennial crop seeds, which do not require the continued purchase of seeds and thus do not provide a very good source of profit," Seufert notes.

Regardless, the world already produces 22 trillion calories annually via agriculture, enough to provide more than 3,000 calories to every person on the planet. The food problem is one of distribution and waste—whether the latter is food spoilage during harvest, in storage or even after purchase. According to the Grocery Manufacturers Association, in the U.S. alone, 215 meals per person go to waste annually.

"Since the world already produces more than enough food to feed everyone well, there are other important considerations" besides yield, argues ecologist Catherine Badgley of the University of Michigan, who also compared yields from organic and conventional methods in a 2006 study (pdf) that found similar results. Those range from environmental impacts of various practices to the number of people employed in farming. As it stands, conventional agriculture relies on cheap energy, cheap labor and other unsustainable practices. "Anyone who thinks we will be using Roundup [a herbicide] in eight [thousand] to 10,000 years is foolish," argued organic evangelist Jeff Moyer, farm director the Rodale Institute, at the New America Foundation event.

But there is unlikely to be a simple solution. Instead the best farming practices will vary from crop to crop and place to place. Building healthier soils, however, will be key everywhere. "Current conventional agriculture is one of the major threats to the environment and degrades the very natural resources it depends on. We thus need to change the way we produce our food," Seufert argues. "Given the current precarious situation of agriculture, we should assess many alternative management systems, including conventional, organic, other agro-ecological and possibly hybrid systems to identify the best options to improve the way we produce our food."

Organic farming can feed the world if done right, scientists claim

Tom Bawden, The independent, 10 december 2014

Organic farming is much more productive than previously thought, according to a new analysis of agricultural studies that challenges the conventional "biased" view that pesticide-free agriculture cannot feed the world.

The study says that organic yields were only 19.2 per cent lower, on average, than those from conventional crops and that this gap could be reduced to just eight per cent if the pesticide-free crops were rotated more frequently.

Furthermore, in some crops - especially leguminous plants such as beans, peas and lentils - there were no significant differences in yields, the researchers from the University of California, Berkeley found.

"In terms of comparing productivity among the two techniques, this paper sets the record straight on the comparison between organic and conventional agriculture," said Claire Kremen, professor of environmental science, policy and management at Berkeley.

The study comes amid rising concerns that intense farming practices are damaging the environment, with the widespread use of nerve agent pesticides frequently blamed for declining populations of bees and other pollinators. Meanwhile, fertilisers are producing smaller and smaller increases in yields because they are now so effective they are difficult to improve upon.

"With global food needs predicted to greatly increase in the next 50 years, it's critical to look more closely at organic farming because, aside from the environmental impacts of industrial agriculture, the ability of synthetic fertilizers to increase crop yields has been declining," said Prof Kremen.

The researchers based their findings on a meta-analysis of 115 studies – a dataset three times greater than any previous such paper – comparing organic and conventional agriculture.

In addition to finding a smaller – 19.2 per cent – productivity difference between the two than previously calculated, the researchers also found that optimising organic productivity through different techniques could further reduce the gap.

Multi-cropping, or growing several crops together on the same field, would cut the yield difference to nine per cent, with crop rotation reducing the gap to eight per cent.

The study, published in the journal Royal Society B, suggested that the gaps could be even smaller than they have calculated because existing studies were "often biased in favour of conventional agriculture".

"Our study suggests that through appropriate investment in agroecological research to improve organic management and in breeding cultivars for organic farming systems, the yield gap could be reduced or even eliminated for some crops or regions," said the study's lead author, Lauren Ponisio, a graduate student in environmental science, policy and management.

The researchers suggest that organic farming can be a very competitive alternative to industrial agriculture when it comes to food production.

"It's important to remember that our current agricultural system produces far more food than is needed to provide for everyone on the planet," said Prof Kremen.

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"Eradicating world hunger requires increasing the access to food, not simply the production. Also, increasing the proportion of agriculture that uses sustainable, organic methods of farming is not a choice, it's a necessity. We simply can't continue to produce food far into the future without taking care of our soils, water and biodiversity," she added.

Organic farming cannot feed planet

Carol Keiser, Truth About Trade & Technology | Mar 29, 2012

Organic farming will remain a healthy sub-sector of the agricultural industry. But it won't ever be more than this. It can't ever be more than this if we're serious about feeding the world.

Woody Allen won an Oscar for the screenplay to his film *Midnight in Paris* on Sunday night, but he didn't collect his golden statue in person. He's semi-famous for not attending the Academy Awards, which is odd because he also once said that 80 percent of success is just showing up.

There's a lot of wisdom in that statement, but let's face it: 80 percent usually isn't good enough. The rest of your success depends on more than showing up. After you show up, you have to perform.

That's why a new study in a scientific journal has so much to teach about food security. If we're going to succeed in feeding a global population of billions in the 21st century — one of the greatest challenges of our time — we're going to need every tool and technology available so farmers around the world can choose what will work best on their farm. This must include new farming technologies. Farmers cannot be limited to the methods that were used in the past.

The researchers discovered an important truth: Organic agriculture can't feed the world.

"Our results show that organic yields of individual crops are on average 80 percent of conventional yields," write Tomek de Ponti, Bert Rijk, and Martin K. van Ittersum of Wageningen University in the Netherlands, in the latest issue of *Agricultural Systems*, a peer-reviewed academic publication. They examined 362 studies that compared organic and conventional crop yields, creating what they call a "meta-dataset." That's a fancy way of saying their work was comprehensive.

Organic foods make up only a small percentage of overall food production, but sales have boomed in the last 15 years. Although they can be pricey, many consumers have expressed a preference for them, and so farmers have met the demand. Opportunities are about to increase, following the announcement in February that the United States and European Union will accept each other's organic standards.

So organic farming will remain a healthy sub-sector of the agricultural industry.

Perpetual sub-sector

But it won't ever be more than this. It can't ever be more than this if we're serious about feeding the world.

Most analysts believe we must double our food production by 2050, to meet the needs of a growing population as well as the desires of people in developing countries who simply want to eat better.

Unfortunately, we don't have an unlimited supply of farmland. We have to get more from the land we already cultivate. That means improving not only conventional farming practices, but utilizing every technology available, including biotechnology, and making the most of its promise so that yields will rise.

Farmers are doing this right now: Almost 17 million of them plant GM crops, 90 percent of those are smallholder, resource-poor farmers in developing countries, according to the International Service for the Acquisition of Agri-Biotech Applications (ISAAA). In 2011, biotech crops took up nearly 400 million acres of farmland, up 8 percent from a year earlier.

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If we're to meet the food objectives of 2050, we'll need to see growth like this for years to come.

Organic crops may continue to find a market among choosy buyers in wealthy countries, but their yields won't meet the needs of the world: 80 percent just won't cut it.

In a basketball game, if you score 80 percent as many points as your opponent, you get blown off the court, 100 to 80. That's not March Madness; it's March Badness.

In school, 80 percent usually earns a grade of B-minus, which is so-so at best and pretty close to a C-plus, which is heading toward not-great. It means you probably should do more homework.

If you show up for work 80 percent of the time, your boss will fire you. If your boss pays you 80 percent of your wages, you'll quit your job—because it just isn't good enough.

Yields of 80 percent fall too short as well. That means skipping one meal out of every five, or one out of every five people in the world not receiving the food they need to survive.

Any volunteers? I didn't think so.

Organic food is a choice. Those with the means to choose it have every right to do so. Farmers have every right to supply what these consumers want.

But let's also recognize that it's a luxury, and our needs are urgent: more food, better technology, and widespread awareness of what must be done.

Showing up isn't good enough.

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