



Can Organic Farming Feed the World?

Perspectives on a Food Movement's Place in World Food Security

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Advances in crop science and mechanization in the 1940s ultimately led to what is now known as the Green Revolution. Chemical fertilizers and pesticides, hybridization, irrigation technology and motorized farm machinery doubled and sometimes tripled crop yields, achieving unprecedented food security for countless people. However, the high-intensity, high-input techniques have come into serious scrutiny because of concerns over adverse health affects and environmental degradation. With an expected world population of nearly 10 billion by the year 2050, the debate over how to sustainably feed such a multitude of people without destroying the Earth has emerged as one of the most important topics of our time. Some experts believe that a widespread shift to organic farming could both feed the world and restore environmental and human health.¹ Their critics argue that there is no way organic agriculture, or farming without the use of synthetic fertilizers, pesticides, genetically-engineered crops or any other unnatural additives, could feed the world—that it simply could not feed 10 billion people.² For others, the issue is not so simple. Many experts believe that a combination of high-technology and organic techniques provide a more realistic and sustainable solution.³

- 1 Catherine Badgley et al., "Organic agriculture and the global food supply," *Renewable Agriculture and Food Systems* 22, no. 2 (2006): 86-108, www.ebscohost.com and Brian Halweil, "Can organic farming feed us all?" *World Watch* 19, no. 3 (2006): 18-24, www.ebscohost.com. and Ed Hamer and Mark Anslow, "10 reasons why organic farming can feed the world," *The Ecologist*, March 1, 2008, http://www.theecologist.org/trial_investigations/268287/10_reasons_why_organic_can_feed_the_world.html
- 2 Norman E. Borlaug, "Feeding a World of 10 Billion People: The Miracle Ahead," *In Vitro Cellular and Developmental Biology, Plant* 38, no. 2 (2002): 221-228, www.jstor.org. and D.J. Connor, "Organic Agriculture Cannot Feed the World," *Field Crops Research* 106, no. 2 (2008): 187-190, www.sciencedirect.com and John J. Miller, "The Organic Myth," *National Review* 56, no. 2 (2006): 35-37, www.lexisnexis.com.
- 3 Klaus Ammann, "Why Farming With High Tech Methods Should Integrate Elements of Organic Agriculture," *New Biotechnology* 25, no. 6 (2009): 378-388, www.sciencedirect.com and Pamela C. Ronald and Raoul W. Adamchak, *Tomorrow's Table: Organic Farming, Genetics, and*

For those researchers who believe organic agriculture (OA) can feed the world, their arguments are often defensive. Green Revolution agriculture, or what will be referred to as conventional agriculture (CA), has erased hunger problems in many areas. Therefore, rejecting CA puts these researchers in an awkward position. It is common knowledge that in the developed world, OA does not consistently outperform CA; otherwise this issue would be moot. The issue at hand is born of ecological and agricultural sustainability, and therefore, the proponents of a massive conversion to OA must come from the position of defending its viability as a supplier of food for 10 billion people without expanding current agricultural lands.

Each paper reviewed that supported a massive conversion to organic agriculture focused on a few main points. First, they addressed the issue of crop yield—many of their critics claim OA yields could in no way rival CA yields. Catherine Badgley et al. conducted a study comparing average organic yields to average conventional yields.⁴ They calculated a ratio correlating OA yields with CA yields and then applied it to current data on world food supply. Both developing and developed areas were taken into consideration. Although their results indicated a decline in yield for developed nations where inputs are high (about ninety percent of CA yields), their results for developing countries, where current inputs are typically much lower than those of developing nations, suggested a significant increase, in some cases more than fifty percent greater.⁵ Badgley et al. wrote, "Our models demonstrate that organic agriculture can contribute substantially to a more sustainable system of food production."⁶ They add, "[We do not] claim that yields by organic methods are routinely higher than yields from green-revolution methods. Rather, the results show the potential for serious alternatives to green-revolution agriculture as the dominant mode of food production."⁷ Although Pamela C. Ronald and Raoul W. Adamchak's book *Tomorrow's Table* advocates synthesizing genetic modification with organic technology, they wrote that "[...] skilled farmers, using best organic practices and technologies, can achieve high yields while caring for the environment."⁸ Their point is that OA can rival CA in production while bringing the earth back into balance ecologically.

the Future of Food, New York: Oxford University Press, 2008 and Lori Ann Thrupp, "Linking Agricultural Biodiversity and Food Security: The Valuable Role of Sustainable Agriculture," *International Affairs* 76, no. 2 (2000): 265-281, www.jstor.org.

- 4 Badgley et al., "Organic agriculture and the global food supply."
- 5 *Ibid*, 91.
- 6 Badgley et al., "Organic agriculture," 94.
- 7 *Ibid*, 94.
- 8 Ronald and Adamchak, *Tomorrow's Table*, 27.

In the article, “Can Organic Farming Feed Us All?” Brian Halweil asserts the same position, using several studies to support it, including Badgley et al.’s.⁹ He cites a study conducted by Niels Halberg at the Danish Institute of Agricultural Sciences, admitting that OA output would not equal CA output in the developed world, but developing countries would see an increase.¹⁰ Halweil quotes Halberg’s team: “Modern non-certified organic farming is a potentially sustainable approach to agricultural development in areas with low yields due to poor access to inputs or low yield potential because it involves lower economic risk than comparative interventions based on purchased inputs and may increase farm level resilience against climatic fluctuations.”¹¹ Ed Hamer and Mark Anslow, in their article “10 Reasons Why Organic Can Feed the World,” argue that research conducted in the U.S. by the University of Essex found that after a period of lower yields with OA following conversion from CA, crop yields soon returned to normal and even became more productive.¹² These findings suggest that poor OA output in developed countries may only be temporary, boosting the argument for the massive conversion to organic farming by all agriculturalists.

According to Badgley et al., CA farming used approximately 82 million metric tons of synthetic nitrogen fertilizer in 2001.¹³ They argue that nitrogen-fixing cover crops have the potential of providing 58 million metric tons more nitrogen than synthetic sources. Halweil cites their findings at length in an endnote to his article, while Hamer and Anslow go into detail about the dangers of synthetic nitrogen fertilizer’s contribution to global warming. They wrote that, “In fact, the production of one tonne of ammonium nitrate creates 6.7 tonnes of greenhouse gases (CO₂), and was responsible for around 10 per cent of all industrial greenhouse gas emissions in Europe in 2003.”¹⁴ They argue that cover crops, and both animal and green manure fertilizers increase organic matter in the soil.¹⁵ This effectively keeps the damaging carbon dioxide from entering the atmosphere.

Proponents of a massive conversion to OA believe that it would serve an economic and social benefit. Hamer and Anslow point out that “by its nature, organic production relies on labour-intensive management practices.”¹⁶ Their article cites a report finding that organic farms create 32 percent more jobs than conventional ones in the UK.¹⁷ Hence, the question must be: will this labor-intensive process drive up food prices? Brian Halweil addresses the issue by citing Niels Halberg’s study,

which found that a conversion to OA would have a minimal impact on world food prices.¹⁸ He also argues that since OA doesn’t require expensive fertilizers or pesticides, it could open up the industry to small farms, having a particularly positive impact in developing nations.¹⁹

Cuba’s food system presents the most unlikely argument for the conversion to organic farming. When Soviet Russia collapsed in 1991, Cuba was left without access to imports of food, fuel and fertilizer.²⁰ The Cuban people were essentially forced to revert to manually-driven labor and organic inputs in order to feed themselves. In his article, “The Cuba Diet,” Bill McKibben wrote, “In so doing they have created what may be the world’s largest working model of semi-sustainable agriculture, one that doesn’t rely nearly as heavily as the rest of the world does on oil, on chemicals, on shipping vast quantities of food back and forth.”²¹ The point here is to illustrate that feeding a nation of people organically can be done—Cuba does it every day.

In sharp contrast to the previous arguments for a transition to OA, certain experts believe it could never feed the world, and that a massive conversion to OA would require more land to produce enough food to feed the burgeoning population. In the article “Organic Agriculture Cannot Feed the World,” D.J. Connor dives head-first into the argument that OA could never be as productive as CA.²² Connor directly addresses Badgley et al.’s research and claims they’ve misinterpreted their data. He says they seriously overestimated output and “failed to realize that any significant increase in OA from its current small base of world agriculture (0.3%) will increase competition for limited organic nutrients.”²³ Finally, he cites three studies that estimate organic agriculture could only feed a maximum of three to four billion people.²⁴ John J. Miller, in his article “The Organic Myth,” accuses proponents of OA to be “enemies of environmental conservation” because OA is less efficient than CA.²⁵ Miller argues that the only way to feed upwards of 10 billion people is to get more yield from currently farmed land, something he believes OA couldn’t accomplish.²⁶ Nobel Peace Prize laureate, Norman Borlaug, in his article “Feeding a World of 10 Billion People: the Miracle Ahead,” argues that the only way the world will feed such a population is through advances in biotechnology, fertilizer and pesticide technology.²⁷ He wrote that if the world were to produce the same amount of food today without the advances in CA technology since 1961,

18 Halweil, “Can Organic Farming,” 4.

19 *Ibid.*, 4.

20 Bill McKibben, “The Cuba Diet,” *Harper’s Magazine* 310, no. 1859 (2005): 61-69, www.ebscohost.com, 61.

21 *Ibid.*, 62.

22 Connor, “Organic Agriculture Cannot...,” 187.

23 Connor, “Organic Agriculture Cannot...,” 188.

24 *Ibid.*, 187.

25 Miller, “The Organic Myth,” 37.

26 *Ibid.*, 37.

27 Borlaug, “Feeding a World.”

9 Halweil, “Can organic farming feed us all?,” 2.

10 *Ibid.*, 4.

11 *Ibid.*, 4.

12 Hamer and Anslow, “10 reasons,” 1.

13 Badgley et al., “Organic agriculture and the global food supply,” 92.

14 Hamer and Anslow, “10 reasons,” 2.

15 *Ibid.*, 2.

16 *Ibid.*, 4.

17 *Ibid.*, 4.

three times more land in the U.S. and China and two times more land in India would need to be cultivated to match 1992 levels.²⁸

In the article “Saving the Planet with Pesticides,” John Avery simply becomes a clear advocate of Green Revolution techniques. Avery writes that “Researchers continue to achieve major gains from cross-breeding, chemical fertilizers, and other established research approaches.”²⁹ These experts agree that if the world were to go to an all-OA system, agriculture would need to expand into natural areas in order to provide enough calories to feed the world.

John J. Miller goes on to argue that there’s no scientific data to prove that organic food is healthier; and that it is actually less healthy because of fungi, bacteria and animal manure that have been found on organic items.³⁰ He cites several examples of organic foods that were found to have dangerous amounts of these substances on them, and reminds his readers that chemical pesticides would have eradicated those dangers.³¹ “Conventional wisdom says that we should avoid food that’s been drenched in herbicides, pesticides, and fungicides. Half a century ago, there was some truth in this: sprays were primitive and left behind chemical deposits that often survived all the way to the dinner table. Today’s sprays, however, are largely biodegradable,” he assures his readers.³² Avery echoes this sentiment: “Farmers started with DDT and have now progressed to narrow-toxicity, low-volume, rapidly degrading pesticides and Integrated Pest Management.”³³

Critics of OA conversion argue that there is a significant lack of natural sources of nitrogen to fertilize enough crops to feed the world. Connor once again argues against Badgley et al.’s study findings. He says their findings that nitrogen-fixing cover crops could fertilize all world crops are an overestimation.³⁴ Connor states that growing a cover crop would disrupt production because many of the world’s croplands produce cash crops up to 2.5 times per year, especially in tropical and sub-tropical areas like Bangladesh.³⁵ Growing a nitrogen-fixing crop would effectively limit the time those lands had to produce food crops. Miller addresses the issue of fertilizer more plainly: “There just isn’t enough cow poop to go around.”³⁶ He does not consider other natural fertilizers in the article, however. Avery argues that sewage sources of nitrogen could only equate to two percent of the synthetic nitrogen currently used to fertilize crops, and that huge swaths of land

would need to be plowed up to get at new sources of nitrogen.³⁷ He concludes that “Moreover, the world cannot realistically expect organic farming to grow the same amount of food produced by modern agrochemical farming, let alone tripling production for the future.”³⁸

Some experts believe synthesizing OA and CA methods provides the answer to feeding a population of 10 billion people. The common definition of organic agriculture prohibits the use of unnatural pesticides, herbicides, fertilizers and most recently genetically engineered (GE) crops. Advocates of synthesized agriculture, or SA, believe the only way to realistically preserve the environment, promote human health and feed the world is by making compromises. They argue that CA practitioners could adopt certain OA techniques to improve the sustainability of their system and reduce negative ecological impact. Halweil, who figures strongly in the argument for a conversion to OA, admits a “middle path” might be a more reasonable alternative because it offers a less risky option to farmers.³⁹

Certified organic agriculture in the United States and Europe currently prohibits the use of GE crops. Pamela C. Ronald and Raoul W. Adamchak, who co-wrote the book *Tomorrow’s Table*, admit that for organic agriculture to feed the world, changes to OA practices would need to be made.⁴⁰ They argue that allowing GE crops in OA is a solution and that “GE has the potential to increase resistance of plants to insects, diseases, and nematodes, and help plants adapt to environmental stresses like drought, flooding, cold, and salt.”⁴¹ In a response to questions of GE crop safety pertaining to human consumption, Ronald, a plant geneticist, states that “the fluoridated toothpaste on your toothbrush or the soft drinks in your refrigerator likely present greater risks to your health than the genetically engineered papaya you had for breakfast.”⁴²

Klaus Ammann, in his article “Why Farming with High Tech Methods Should Integrate Elements of Organic Agriculture,” agrees that GE crops could boost OA production. He believes that synthesized agricultural techniques should be the goal for attaining a sustainable, environmentally-friendly system. Ammann argues that “transgenic crops and all high technology practices . . . could very well fit into ecoagriculture and, *vice versa*, that ecoagricultural strategies could very well be introduced into high tech agriculture.”⁴³

Ammann recognizes the importance of biodiversity to protecting the world food supply. He argues that mixed cropping, which is a common OA technique, protects crops

28 *Ibid*, 226.

29 Dennis Avery, “From *Saving the Planet with Pesticides*,” in *The True State of the Planet*, ed. Ronald Bailey (New York: The Free Press, 1995), 63.

30 Miller, “The Organic Myth,” 36.

31 *Ibid*, 35.

32 *Ibid*, 36.

33 Avery, “*Saving the Planet*,” 69.

34 Connor, “Organic Agriculture Cannot,” 188.

35 *Ibid*, 188.

36 Miller, “The Organic Myth,” 37.

37 Avery, *Saving the Planet*, 70.

38 *Ibid*, 69.

39 Halweil, “Can organic farming feed us all?,” 6.

40 Ronald and Adamchak, *Tomorrow’s Table*, 37.

41 Ronald and Adamchak, *Tomorrow’s Table*, 37.

42 *Ibid*, 87.

43 Ammann, “Why Farming with High Tech,” 383.

from pests and preserves soil fertility better than the typical CA monoculture system does.⁴⁴ Ammann suggests using seed mixtures containing a variety of genomes that could be applied just as easily as non-varietal seeds on highly-mechanized farms.⁴⁵

Lori Ann Thrupp, in her article "Linking Agricultural Biodiversity and Food Security: the Valuable Role of Agrobiodiversity for Sustainable Agriculture," argues that preserving biodiversity is essential for protecting food security and the environment.⁴⁶ She believes that "the model and patterns of industrial agriculture and the Green Revolution have exacted significant biophysical and socio-economic costs and disadvantages in many parts of the world, in both North and South."⁴⁷ She says CA monoculture makes crops more susceptible to pests and disease, and reminds her readers that many insects and fungi that chemicals kill are actually beneficial to plants.⁴⁸ She believes that moving to an all-OA system is not realistic, but incorporating organic techniques into CA could improve environmental health and make world agriculture a sustainable practice.⁴⁹

The debate over how to increase and maintain world food supply is one of the most important issues of our time. Green Revolution farming has proved to offer the high yields necessary for feeding billions, but its practices undoubtedly contribute to climate change and ecological degradation. Organic agriculture, when practiced responsibly, can help alleviate environmental stresses and contribute to the healing of the earth. However, can it realistically feed the 10 billion people who are expected to live on this earth by 2050? While some people believe it can, others are adamant that it can not, and some people suggest the solution is a synthesized system. Regardless of whether there is one correct answer or several, the issue is very real and present. It must be considered objectively and consistently researched so that the world can come to a solution that successfully perpetuates the human race and preserves the earth for future generations.

44 *Ibid.*, 382.

45 *Ibid.*, 382.

46 Thrupp, "Linking Agricultural Biodiversity," 265.

47 Thrupp, "Linking Agricultural Biodiversity," 269.

48 *Ibid.*, 272

49 *Ibid.*

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