

What 40 Years of Science Tell Us About Organic Agriculture



Photo: Jim Richardson

John Reganold
Regents Professor of Soil Science & Agroecology
Washington State University

39th Annual EcoFarm Conference
23-26 January 2019
Asilomar, Pacific Grove, CA

Organic agriculture: History of being contentious

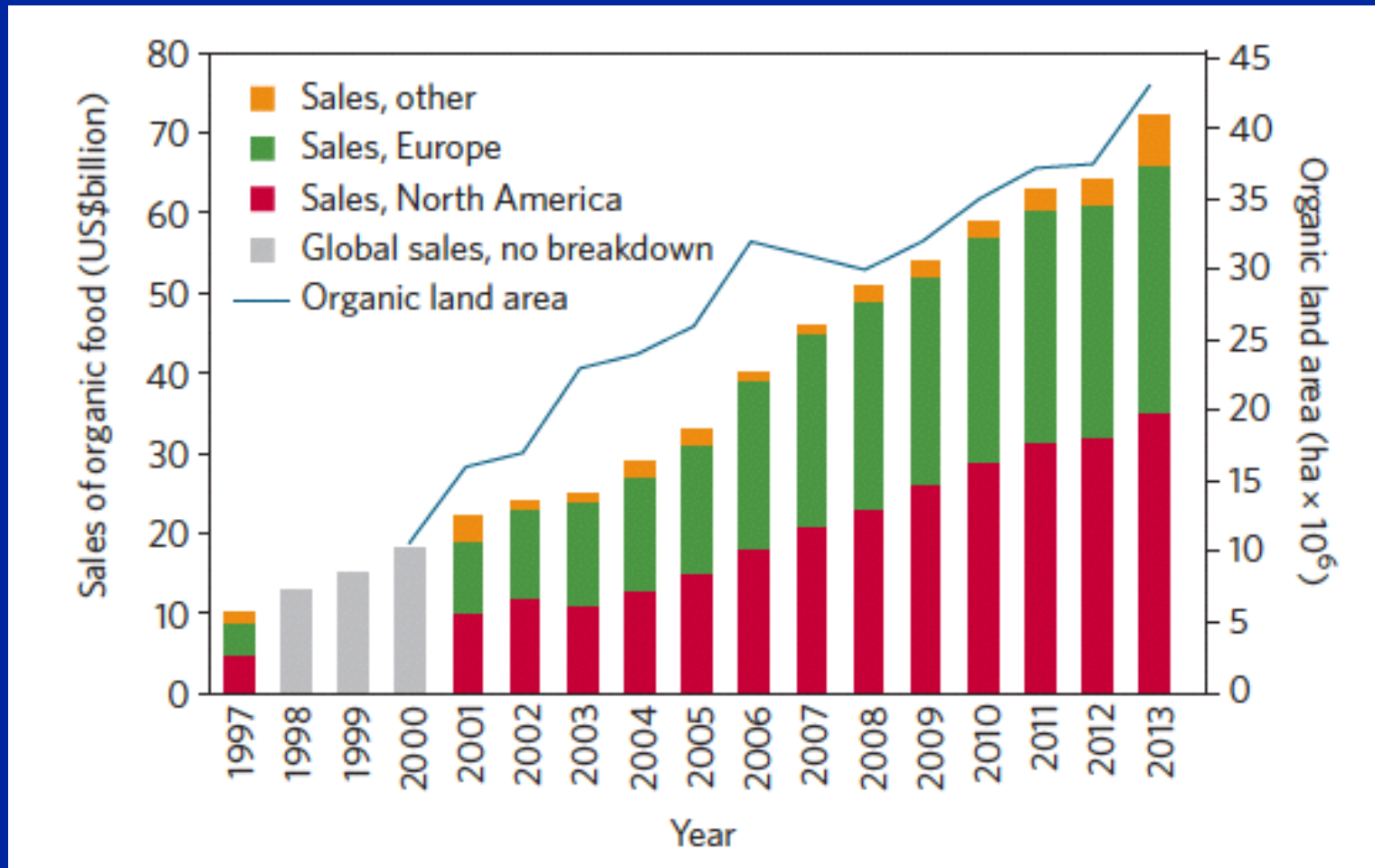


In 1971, then US Secretary of Agriculture Earl Butz: “Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry”.

Critics argue that organic agriculture relies on more land to produce the same amount of food as conventional agriculture and that adopting organic agriculture on too large a scale could potentially threaten wildlife, forests, and biodiversity.

How's organic agriculture doing?

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 (~US\$90 billion in 2016) have steadily increased.



How's organic agriculture doing?

- Organic food and beverage sales in 2017 represented 5.5% of U.S. food and beverage sales (up from 0.8% in 1997).
- Recent international reports recognize that organic agriculture balances multiple sustainability goals and will be of increasing importance in global food and ecosystem security.



Metrics of Sustainable Farming



- Adequate Yields of High Quality
- Environmentally Safe
- Economically Viable
- Socially Responsible

Organic and conventional farming systems are like bookends on a shelf with other systems* in between.

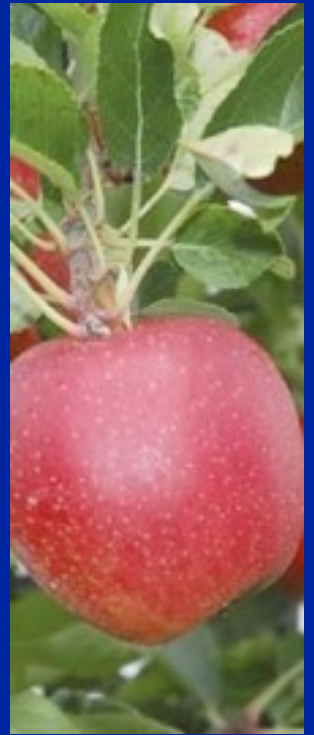


Other systems = alternative, diversified, innovative, or agroecological farming systems.

Crop Yields

(per hectare)

- Under favorable climate and soil conditions, organic crop yields are generally lower (8-25%) (from 5 reviews and meta-analyses).
 - 27–28% less for fruit and wheat
 - 6–11% less for rice, soybeans, corn, & grass-clover
- Equal to higher yields under severe drought
- Improvements with organic-specific breeding



Food Quality



- **14 of 17 reviews or meta-analyses have found some evidence of organic food—produce, grains, milk, and meat--being more nutritious.**
- **That evidence generally shows organic food to have higher concentrations of vitamin C, total antioxidants, and total omega-3 fatty acids.**
- **The other 3 studies concluded that there were no consistent nutritional differences between organic and conventional foods, with 1 finding conventional chicken and pork to have a 33% higher risk for contamination with antibiotic-resistant bacteria.**



Food Quality



- Little to no pesticide residues are found on organic foods (from 4 reviews or meta-analyses).

French Study (Baudry et al. 2018. *JAMA Internal Medicine*)

- People who ate more organic produce, dairy, meat and other products had 25 percent fewer cancer diagnoses overall, especially lymphoma and breast cancer.
- The most frequent consumers of organic food had 76 percent fewer lymphomas, with 86 percent fewer non-Hodgkin's lymphomas, and a 34 percent reduction in breast cancers that develop after menopause.

European Parliament Report (Dec 2016)

- **The report reviews existing scientific evidence regarding the impact of organic food on human health, including in vitro, animal, and epidemiological studies.**
- **Epidemiological studies found that women's exposure to pesticides during pregnancy was associated with negative impacts on their children's IQ and neurobehavioral development, and with ADHD diagnoses.**
- **Human studies indicate that organic food may reduce the risk of allergies and obesity--not conclusive as consumers of organic food tend to have healthier dietary patterns overall.**



Taste Tests



- While there are popular reports or local discussions indicating that organic fruits and vegetables taste better than their conventional counterparts, the scientific findings comparing the two for sensory qualities are inconsistent.
- This conclusion is based on 16 studies (published between 1976 and 2015) that compared specific organic and conventional fruits and vegetables for their organoleptic (sensory) properties.
- More studies need to be done.

Environmental Quality

(from 15 reviews or meta-analyses)

- Organic systems have better soil quality and less soil erosion.
- Organic systems have little to no risk of synthetic pesticide pollution of ground and surface waters
- Nutrient leaching, greenhouse gas emissions
 - Organic systems generally performed better per area
 - Often the same or opposite when expressed per unit of production
- Organic systems are usually more energy efficient
- Organic systems need more land to grow same amount of food



Environmental Quality: Diversity

- Often more habitat and landscape diversity on organic farms.
- Organic farms have greater below- and above-ground biodiversity (birds, insects, soil fauna and microbes).
- They have more diverse functional groups, such as herbivores, pollinators, predators, and producers (plants)



Economic Performance



- **With price premiums, organic agriculture was significantly more profitable (22 to 35% greater net present values) and had higher benefit/cost ratios (20 to 24%) than conventional agriculture.**
 - Premiums were 29–32%
 - Breakeven premiums were 5–7%
 - 10–18% lower yields
- **Total costs were the same; labor costs higher (7 to 13%)**

Externalities and Ecosystem Services

- **Putting a price on negative externalities caused by farming, such as soil erosion or nitrate leaching into groundwater, would make organic agriculture even more profitable.**
- **The few studies done with ecosystem services generally show that organic practices increase the ability of farms to provide some economically significant ecosystem services relative to conventional practices.**

Social Wellbeing

- Both organic and conventional farming systems need to make significant progress to meet social sustainability goals.
- Organic farming has been shown to have some sociocultural strengths.
 - Increased social interactions between farmers and consumers
 - Greater employment of farm workers and cooperation among farmers.
 - Reduced exposure of farm workers to pesticides and other chemicals.

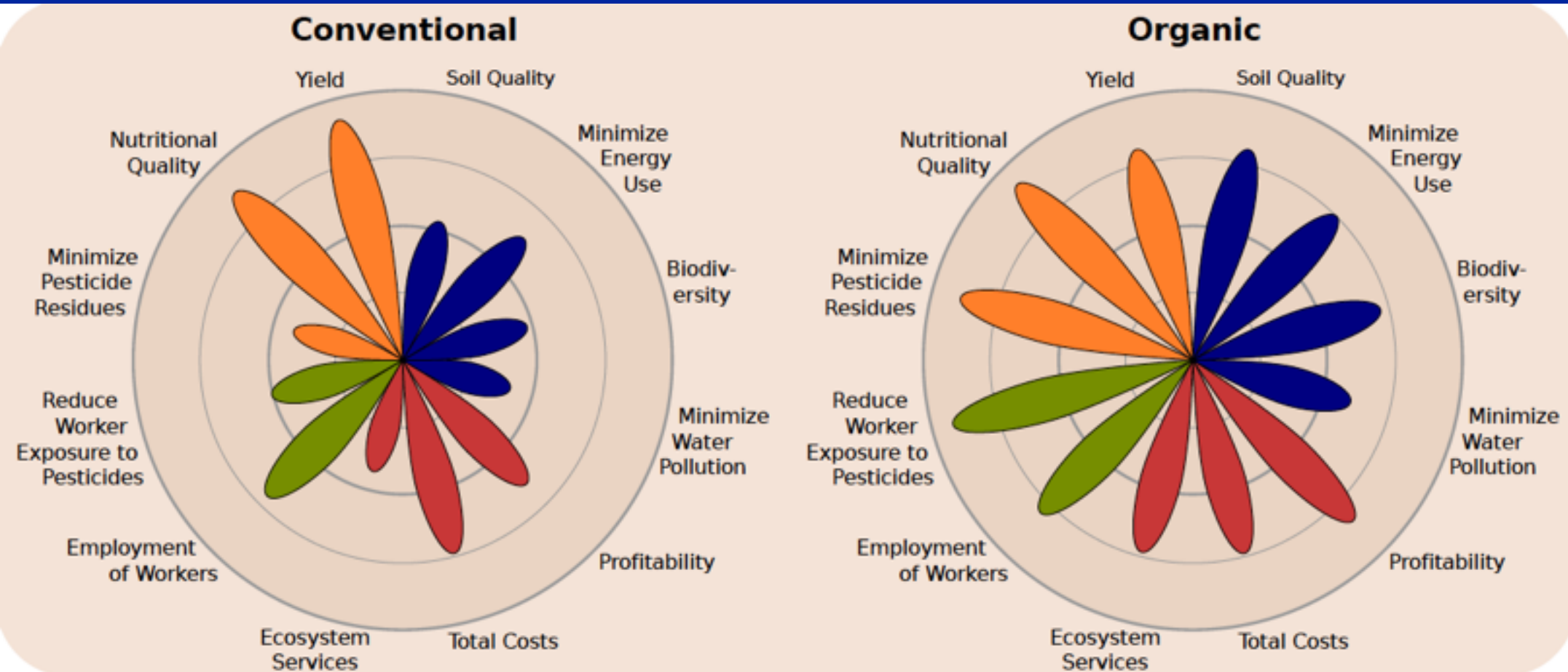


Social Wellbeing

- Organic farming can improve food security by diversifying on-farm crop and livestock operations, and thus income sources and diets.
- Organic certified animals must have access to open air; sick animals must be treated as needed.



Assessment of Organic Farming relative to Conventional Farming in the Four Major Areas of Sustainability



(Reganold & Wachter, *Nature Plants*, 2016)

Future of Organic Agriculture

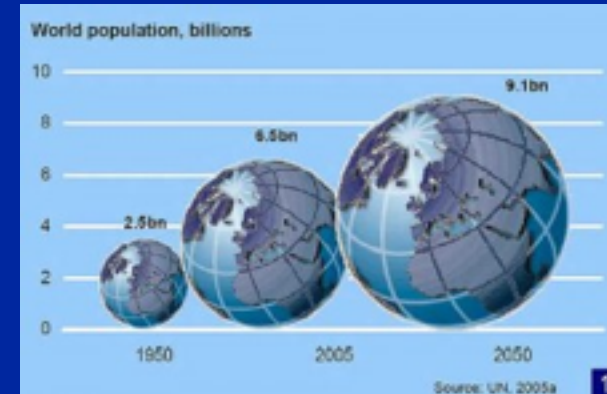


US Secretary of Agriculture Tom Vilsack in 2013: “Organic agriculture is one of the fastest growing segments of American agriculture and helps farmers receive a higher price for their product as they strive to meet growing consumer demand.”

- **The global organic market is expected to increase from about US\$90 billion in 2016 to US\$140-160 billion by 2020.**
- **Organic farming has room for growth: From 1% of the cropland today being organic to maybe 10-15% by 2050.**

Helping to Feed the World

Can organic farming systems play a significant role in feeding the human population?



Yes. And so can other innovative farming systems, such as conservation agriculture, integrated farming, and perennial systems like evergreen agriculture.

These other innovative farming systems share common practices and values with organic farming.

Shepherd's Grain



- **Shepherd's Grain growers use no-till operations and harvest wholesome grains from farms across the Inland Northwest.**
- **Shepherd's Grain was founded by two Palouse no-till farmers.**



Shepherd's wheat flours are sustainability brand products certified by the Food Alliance.

Coexistence of Different Farming Systems

- No one farming system will safely feed the planet, but rather a blend of multi-functional farming systems will be needed.
- Adoption of these more innovative systems is hindered by market structures, policy incentives, and uneven development and availability of scientific information that guide farmers' decisions.



Consumers have responsibility

- Consumers play a vital role in the foods they choose to eat.
- Consumers should eat a mostly plant-based diet—yes, reduce meat consumption.
- Consumers should reduce their food waste and eat appropriate portions, too.



What kind of agriculture do we want?

