

## Organic farming, better for you and the planet?

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*'The technological mindset that would dump billions of pounds of deadly chemicals into the soil, and mix the genetic material of different species, and build factory farms where livestock are treated like industrial commodities ... has a deeply arrogant view of the natural world. It regards Nature as something to be conquered and controlled for short term profit.'*<sup>1</sup>

*'The greatest catastrophe that the human race could face this century is not global warming but a global conversion to 'organic farming'-an estimated 2 billion people would perish.'*<sup>2</sup>

### Introduction

Organic farming, 'farming by biological and ecological means' rather than by 'chemical intensification' using 'mineral fertilizers and synthetic pesticides',<sup>3</sup> originated in Northern Europe in the 19<sup>th</sup> century but is now one of the fastest growing segments of the food industry. In Australia the demand for organic food has grown by 15.4% per annum and is worth \$1.72 billion. In the US in 2014, sales of organic food reached \$US39.1 billion dollars, 5% of the market.<sup>4</sup> Global stakeholders agreed that organic agriculture is based on the principles of health, ecology, fairness and care. However, it will be argued that while conventional farmers can learn from organic farmers, organic farming is not the only alternative to industrialised agriculture and that farming in an ethical manner, using the full range of technologies available, unconstrained by ideology, is also an option.

### Brief History of Organic Farming

While agriculture commenced in an organic fashion and many farmers without the resources to purchase synthetic herbicides, pesticides and fertilisers are potentially organic, this may be by default rather than as the result of a conscious decision. The ideas behind 'organic farming' coalesced from Reform movements, biological farming concepts and traditional Asian farming methods, separately in German and English speaking countries, in the 19<sup>th</sup> century.

A pioneer of organic farming, Albert Howard (1873-1947) observing traditional Indian farming practices and conducting his own research into plant breeding, plant protection and soil fertility, concluded that the health of the soil, plants, animals and people are interrelated. Medical practitioner Robert McCarrison (1878-1960), also working in India, proposed the 'Wheel of Health,' in which properly composted organic residues were used to create a fertile soil, able to grow healthy plants, feeding healthy animals and healthy people.

In Germany 1920s and 30s, crop yields declined by up to 40% despite an increased use of artificial fertilisers. Artificial fertilisers were blamed for weakening plants, acidifying the soil, reducing seed quality and vigour and upsetting the balance of soil organisms thereby leading to an accumulation of harmful organic substances.

Agricultural machinery was considered to have led to soil compaction while the reduced use of organic manuring led to reduce soil water holding capacity. Meanwhile

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on the US and Canadian plains in the mid 1930s a combination of inappropriate ploughing, drought and Depression produced the agricultural and ecological disaster known as the 'Dust Bowl.' Organic farming developed in response to these problems.<sup>3</sup>

In 1962 Rachael Carson published 'Silent Spring' which outlined the environmental destruction caused by misused agricultural and industrial chemicals. 'Silent Spring' was a milestone for the organic farming movement, justifying its stance against artificial chemicals. It also prompted a major reappraisal by the community and resulted in the widespread banning of residual chemicals such as the organo-chlorines and the adoption of much safer, biodegradable chemicals.

The 'Science Wars' commencing in the 1970s and in part a reaction to the War in Vietnam, fuelled mistrust in the 'military industrial complex' and institutional science. Many people responded by seeking to return to a simpler lifestyle that was less dependent on industry. This continuing legacy has seen the demand for organic products become one of the fastest growing segments of the food industry.

### **The Science of Organic Farming**

Many of the agronomic and animal health claims and principles espoused by the organic farming movement are testable and therefore candidates for scientific method. Yet the organic movement is, at its roots, a reaction against industrialised, scientific, chemical based agriculture and 'reductionist', and 'Baconian, Cartesian' scientific method.<sup>3</sup>

Organic farming pioneers such as Howard and McCarrison and Lady Eve Balfour (1898-1990), the founder of The Soil Association, considered that agricultural research should be conducted by researchers with a wide understanding of agricultural systems, a deep respect for local farmers and their traditions and an ability to 'look at the wheel of life as one great subject.' They also recommended that research should be conducted in a working farm context rather than in plot sized experiments.'

In 1938, Balfour, established The Haughley Research Trust, aiming to conduct long term, holistic research. Eighty five hectares of land were divided into three systems, the Organic Section, the Chemical Section and the Mixed Section. Findings from the Haughley experiment included greater seasonal fluctuations in soil nutrients in the Organic Section, little difference in the chemical analysis of crops and livestock from either system (apart from a higher water content in chemically grown fodder), higher barley yields in the Chemical Section and greater lateral root development but less deep root development in the Chemical versus the Organic Section.

Because the Haughley experiment was not replicated, it is now regarded more as a demonstration site than an experiment. It also ran into funding difficulty in the 1950s, illustrating two of the problems faced by researchers attempting long term, farm scale research.

Numerous other research stations from the Biodynamic Research Institute in Sweden, to the Research Institute of Biodynamic Agriculture in Germany to the Rodale Institute in The US, have conducted research into organic and conventional farming systems. More recently, US Land Grant Universities have developed multi-disciplinary teams to study farming systems including organic systems under 'sustainable farming' and 'agro ecosystem management' banners.<sup>3</sup>

### **The Marketing of Organic Farming and its Produce**

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Organic farming has been particularly successful in developing a market segment for produce that consumers trust to have been grown in an ethical manner. According to Australian Organic, consumers are “looking for reassurance” when buying organic food with 70 per cent of all shoppers indicating that an organic certification mark increased their level of trust in a product.

As Monk observed: *‘Irrespective of one’s views and the scientific and philosophical (and sometimes very emotional) debates about organic farming and food versus other forms of production, the traction that this movement has achieved is worthy of study in its own right. It suggests a successful pathway to a meaningful dialogue with stakeholders and the establishment of responsive markets as a driver for change and/or the protection of desirable practices in the field.’*<sup>5</sup>

### **The Health Benefits of Organic Food**

Scientific opinion is divided on the health benefits of organic food. While two recent reviews found no benefit, a meta-analysis of 343 peer reviewed publications concluded that organically produced foods had higher levels of antioxidants, lower concentrations of cadmium and lower pesticide residues than foods produced conventionally.<sup>6</sup>

However, the health benefits of antioxidants have also recently been questioned. Research has shown that people who eat a large quantity of fruit and vegetables have lower levels of tumours, strokes and other cardiovascular diseases. The mechanisms behind this protective effect remain unknown. While antioxidants remain one possibility and *‘scientific rationale and observational studies are convincing, randomised primary and secondary intervention trials have failed to show any consistent benefit from the use of antioxidant supplements on CVD, and some trials suggested possible harmful effects in certain subgroups of patients.’*<sup>7</sup>

More recently, hormesis has been offered as a partial explanation for the beneficial effects of exposure to phytochemicals. Hormesis is the biphasic dose response whereby a low dose of a chemical has beneficial effects while a higher dose is inhibitory or toxic.<sup>8</sup>

Ames et al also questioned the significance of low synthetic pesticide residues in foods. His team studied the carcinogenicity in rodents of a wide range of chemicals, both natural and synthetic that are present in our foodstuffs. They concluded that ‘it is probable that almost every fruit and vegetable in the supermarket contains natural plant pesticides that are rodent carcinogens.’<sup>9</sup>

Ames et al said, *‘caution is necessary in interpreting the implications of the occurrence in the diet of natural pesticides that are rodent carcinogens.’* They considered that the dietary exposure to natural carcinogens is not necessarily of much relevance in human health and *‘indeed, a diet rich in fruit and vegetables is associated with lower cancer rates.’* *‘What is important in our analysis is that exposures to natural rodent carcinogens may cast doubt on the relevance of far lower levels of exposures to synthetic rodent carcinogens.’*<sup>9</sup>

### **Organic Farming and the Environment**

Modern farming and in particular ‘industrial agriculture’ as practised in North America, has been subject to denigration from a range of critics including Michael Pollan (*The Omnivores Dilemma*) Paul Roberts (*The End of Food, The Coming Crisis in the World Food Industry*) and Peter Singer and (*The Ethics of What we Eat*). Australian agricultural practices have also been criticised. Jared Diamond in ‘Collapse’ noted that Proceedings of AVA Annual Conference, Adelaide, 2016.  
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farmers, trapped on over-capitalised properties, were 'flogging the land', 'stocking too many sheep per acre or planting too much land in wheat,' leading to degraded pastures and soil erosion.

Organic farming has been presented as the environmentally sustainable alternative. While the ethos of sound environmental stewardship is fundamental to organic farmers, in practice they face a number of challenges.

Modern herbicides are one of the tools that conventional farmers can use in the integrated management of weeds, reducing the need for soil cultivation. Cultivation is a well know cause of soil degradation, damaging soil structure and exposing the soil to wind and water induced erosion.

Organic farming is often less productive than conventional farming. In Europe, crop yields are 20% lower in systems with livestock (that enable the recycling of nutrients from waste materials and the harvesting of nutrients from pastures) and 33-45% lower in systems without livestock. This yield penalty is exacerbated by the need for longer pasture leys of 4.7 years versus 3.3 years.<sup>3</sup>

In Western, Australia Ryan found that wheat yields were on average 48% lower (ranging from 17-48% lower) in organic plots with yields limited by weeds and phosphorus deficiency. Of interest, Ryan found that mycorrhizal fungi were inhibited by super phosphate but this did not compensate for the overall lack of phosphorus in organic systems.<sup>3</sup>

It has been argued that one consequence of less productive agriculture system is that more land will be required to produce the same amount of food. 'Father of the Green Revolution,' Nobel Prize-winning plant breeder Norman Borlaug espoused this view when speaking at a conference in 2002. "We aren't going to feed 6 billion people with organic fertilizer." "If we tried to do it, we would level most of our forest and many of those lands would be productive only for a short period of time."

## **Discussion**

Agriculture, both in Australia and elsewhere in the world, faces many problems from soil degradation, to chemical residues to rural social decline and declining commodity prices. Organic farming promotes principles that aim to redress these problems.

*'Organic agriculture is associated with sound environmental stewardship and with social justice and improvements in the quality of life for those participating. It is associated with fairness, transparency and 'doing the right thing.' 'It is associated with values that include improved health, safety and quality and worker safety. Finally, it is associated with transforming agriculture from its present system to one in which people live within the bounds of nature.'*<sup>10</sup>

These objectives are laudable but it is debatable whether organic farming is either the best or only way to achieve these goals. Some proponents of organic farming set up a false dichotomy, that farming can either be 'organic' using biological or ecological principles or 'industrial' using mineral fertilisers and synthetic pesticides. Many farmers would consider that they are neither organic nor industrial and that they are aware of biological and ecological principles and yet use biodegradable synthetic chemicals in a considered fashion.

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However, some of the productivity achieved by conventional agriculture is achieved through the use of non-renewable resources particularly fossil fuels, fossil water and nutrients such as phosphorus and potassium. The true cost of the use of non-renewable resources (including positive and negative externalities) must be considered in any economic comparison between organic and conventional farming systems. That said, some organic farmers also rely on non-renewal resources, including by-products and manure that may have been obtained from conventional sources.

Organic farming has an underlying principle, as espoused by Balfour, that healthy soils, lead to healthy plants and therefore healthy animals and people. While this view is regarded as 'holistic' it can also be considered simplistic. Conventional (veterinary) practitioners are criticised for being 'reductionist' rather than 'holistic.' However, while fertile soils and productive plants contribute to animals and people being healthy, disease remains an interaction between the host, the agent/pathogen and the environment and consideration of all these factors is in fact more 'holistic.'

Organic farming principles are admirable and the rapid rise in demand for organic products indicates that these principles have strong consumer support. However, organic farmers face some challenges including the criticism that they too are becoming industrialised and that organic farming is not necessarily sustainable. Conventional farmers can learn from organic farmers (and vice versa), but organic farming is not the only alternative to industrialised agriculture. Farming in an ethical manner, backed by quality scientific research, using the full range of technologies available, in a socially responsible manner, unconstrained by ideology, is also an option.

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