Urban myths of organic farming

Organic agriculture began as an ideology, but can it meet today’s needs?

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There is a widespread belief that low-yielding organic agricultural systems are more friendly to the environment and more sustainable than high-yielding farming systems. The current aims of organic systems — maintenance of soil fertility, avoidance of pollution, use of crop rotation, animal-welfare concerns and wider environmental aspects — would be hard to quarrel with. But the rules and regulations that have to be followed to achieve these ends caused one leading organic researcher to admit that in that organic farming “there is very little science” and “this gives rise to a great deal of illogicality and confusion particularly in some areas of production”.

Only two principles really distinguish organic farming from other farming methods. Soluble mineral inputs are prohibited (Box 1) and synthetic herbicides and pesticides are rejected in favour of natural pesticides (Box 2, overleaf). But agriculture based on these principles results in a more costly product, mainly because of lower yields and inefficient use of land.

Organic agriculture developed from the philosophical views of Rudolf Steiner and later Lady Eve Balfour, who in the 1940s founded the Soil Association. In the United Kingdom this association licenses about 70% of organic production and sends inspectors to check that its regulations are being followed. Although its supporters assert that organic agriculture is superior to other farming methods, the lack of scientific studies means that this claim cannot be substantiated.

Conventional agriculture is a diverse set of technologies using the best available knowledge, whose ultimate goal is the safe, efficient provision of foods in abundance and at lowest price. As with all technologies, problems often arise in the practices of conventional agriculture — but rejection of a technology because of problems also means losing potential benefits.

There is a widely held belief that organic farming is environmentally superior. But although reduction in pesticide use (Box 2, overleaf) leads to higher reported levels of some insects and reported sightings of birds on organic farms (pages 121–138 of ref. 1), current synthetic pesticides are very unstable; only transient declines of most field insects are reported even at full pesticide dosage. Similarly, the lower levels of aphids observed on organic farms could well reflect lower nitrogen and protein content of organic crops, and lower yield. Expressed as a ratio of crop yield/aphid population, the difference is negligible. It is also often overlooked that some conventional mixed farming can maintain species diversity. For example, conventional mixed farming in smaller plots (providing more field margins) or farming based on the traditional ley system (for example undersowing wheat with legumes) maintains conventional yields and low costs. The benefits for wildlife equal those provided by organic farming but at far lower cost to the consumer.

Nor do organic farming practices necessarily conserve the environment. Competitive organic farmers keep their fields clear of weeds through frequent mechanical weeding — a method that damages nesting birds, worms and invertebrates — and high use of fossil fuels, which greatly increases pollution from nitrogen oxides. A single treatment with innocuous herbicide, coupled with no-till conventional farming, avoids this damage and retains organic material in the soil surface. Similarly, although use of manure means higher, beneficial levels of earthworms in organic fields, there are numerous problems with the use of manure (Box 3, overleaf), including possible effects on human health.

Use of soluble mineral salts prohibited by organic regulations is another contentious issue. The minerals taken out by organic farmers keep their fields clear of weeds through frequent mechanical weeding — a method that damages nesting birds, worms and invertebrates — and high use of fossil fuels, which greatly increases pollution from nitrogen oxides. A single treatment with innocuous herbicide, coupled with no-till conventional farming, avoids this damage and retains organic material in the soil surface. Similarly, although use of manure means higher, beneficial levels of earthworms in organic fields, there are numerous problems with the use of manure (Box 3, overleaf), including possible effects on human health.

Organic proponents assert that better plants are produced from minerals derived from manure breakdown, so that organic food is superior and improves human health. Hundreds of rigorous tests have failed to reveal better-tasting properties or improved nutritional value, but have consistently shown that organic produce has lower nitrate and protein content. Conventionally farmed food seems to be better for children, although rodents apparently favour organic food. Overall cancer rates have dropped 15% during the era of synthetic pesticide use. Stomach cancer rates have dropped 50–60%, probably an effect of plentiful, cheap conventional fruit and vegetables. But this may not be the whole story, because food mycotoxins from contaminating fungi (which can be controlled by specific fungicides) definitely contribute to European cancer rates — fumonisin and patulin are both reported to be higher in organic products, and failure to use effective fungicides on organic farms has led to these farms acting as repositories of disease. Organic farms may be protected from the full effects of disease outbreak because they are surrounded by conventional farms using proper fungicides.

Box 1 Confusion of principles

Organic proponents assert that better plants are produced from minerals derived from manure breakdown, so that organic food is superior and improves human health. Hundreds of rigorous tests have failed to reveal better-tasting properties or improved nutritional value, but have consistently shown that organic produce has lower nitrate and protein content. Conventionally farmed food seems to be better for children, although rodents apparently favour organic food. Overall cancer rates have dropped 15% during the era of synthetic pesticide use. Stomach cancer rates have dropped 50–60%, probably an effect of plentiful, cheap conventional fruit and vegetables. But this may not be the whole story, because food mycotoxins from contaminating fungi (which can be controlled by specific fungicides) definitely contribute to European cancer rates — fumonisin and patulin are both reported to be higher in organic products, and failure to use effective fungicides on organic farms has led to these farms acting as repositories of disease. Organic farms may be protected from the full effects of disease outbreak because they are surrounded by conventional farms using proper fungicides.
Box 2 Problems with pesticides and chemicals

Organic pesticides, it is asserted, work with nature and are environmentally unstable, unlike synthetic pesticides. About 60% of natural and synthetic chemicals are known rodent carcinogens8, and around 20 different chemicals are used to maintain the safety of processed organic food1. Approved pesticides for organic farmers include 
- copper sulphate, which has caused liver damage in vineyard workers, kills worms and is persistent in soil and produce (to be banned by the European Commission after 2002)
- rotenone, recently shown to induce Parkinson’s disease9
- Bacillus thuringiensis spores, causing fatal lung infections in mice10.

Organic pesticides may be used more sparingly, yet more frequent treatments of crops with copper sulphate than good conventional practice have been reported on organic farms. Natural pyrethroids have to be used at much higher doses than some of the prohibited, equally unstable and much more effective synthetic pyrethroids, such as bioresmethrin.

Box 3 Uses and misuses of manure

Soluble minerals are not used on organic farms. Although crude rock phosphate may be allowed, potassium chloride is banned; sylvanite, another form of potassium chloride, may be permitted. The main alternative is superphosphate, which is variable in composition, yielding unpredictable nutrition for crop growth; there is only a poor relationship between available nitrogen for crop growth and organic content of soil. Organic regulations recommend hay for animal feeding, but hay-fed animals infected with Escherichia coli O157 incubate this dangerous organism longer than ‘conventional’ animals fed with grain26.