



If your politics are green, you like your medicine 'holistic' and you're deeply worried by economic globalization, the chances are your fridge is full of organic produce. Today, support for organic farming is frequently part of a bigger social and political mindset — one that holds that 'natural' is best, and that naked capitalism is a threat to the health of the planet and its people.

But the origins of organic agriculture, in 1940s Britain, are more down-to-earth. Its pioneers were concerned, above all else, about the soil beneath their feet. Their philosophy was centred on practices designed to improve the richness and stability of the soil by restoring its organic matter and avoiding synthetic fertilizers, pesticides and herbicides. Wider concerns about biodiversity, social justice and animal welfare have grown from this core concept about how to manage our farmland's key resource.

These ideals have always set the organic movement squarely against intensive farming and chemical-based agribusiness. And, at least in public and in the media, those arguments rage more fiercely today than ever before. Yet behind the harsh rhetoric, a little-noticed convergence of views is taking place. For decades, the study of organic farming sat on the fringes of the green revolution in agriculture, as intensive techniques marched across the world, sending yields skyrocketing. But mainstream agronomists are becoming concerned about the long-term sustainability of this approach, and are focusing increasingly on soil integrity. Could it be that both sides of agriculture's great divide now want the same thing?

"It's been a huge move," says Mark Alley, an agronomist at Virginia Tech in Blacksburg,

ORGANIC:

Is it the future of farming?

In its pure form, maybe not. But elements of the organic philosophy are starting to be deployed in mainstream agriculture. *Nature's* reporters analyse this trend, assess the extent of organic farming worldwide, and frame the questions on which its wider adoption will depend.

"Twenty-five years ago, yield was everything. But in the past ten years, there's been a major recognition of the need to maintain organic materials in soil." And with the turn of the millennium, farmers have started to embrace approaches that keep soil structure intact and cut the high level of inputs — energy, fertilizer, pesticides and herbicides — that characterize intensive agriculture.

Going green ... again

These new methods diverge significantly from the purist organic vision. In particular, they rely heavily on 'low tillage' methods, which help to improve the soil but depend partly on the use of herbicides, fertilizers and pesticides. Those remain anathema to

the organic movement. But the change that is taking place — sometimes referred to as the second green, or doubly green, revolution — stems from a growing acceptance of the organic critique of the first one. Mainstream agronomists now acknowledge, for example, that intensive farming reduces biodiversity, encourages irreversible soil erosion and generates run-off that is awash with harmful chemicals — including nitrates from fertilizers that can devastate aquatic ecosystems.

For the organic movement, caring for the soil involves interspersing each harvest with a cover crop such as clover or rye that can fix nitrogen from the atmosphere. Cover crops keep down weeds, retain moisture and pre-



Organic principles are proving, at least in part, to be attractive to mainstream farmers, who have adopted a pesticide-free approach to controlling codling moth larvae (right).

vent erosion. Ploughing them into the soil at the end of the season restores the soil's organic content, and boosts its nitrogen content without the need to use synthetic fertilizer.

The low-till approach borrows heavily from these principles. Low-till farmers ensure that their soil is not left open to erosion by growing nitrogen fixers between rows of their cash crops and between seasons. But low-till farmers don't completely unhitch their wagon from conventional inputs. They still use nitrate fertilizers and pesticides as needed. Before each planting, they kill the previous crop with a broad-spectrum herbicide such as Roundup, made by Monsanto of St Louis, Missouri. This lets them punch the new seed directly into the ground through the decaying plants without tilling.

Till life

Low-till agriculture is taking root in both rich and poor countries. Pat Wall, head of conservation agriculture at CIMMYT, the International Maize and Wheat Improvement Center in Mexico, estimates that about 70 million hectares of arable land — something like 2% of the global total — is now using the method, with about a third of that in the United States.

Brazil has been in the vanguard of the change in the south, says Cheryl Palm, an ecologist specializing in tropical agriculture at Columbia University in New York. "It's swept through the country, and cut down soil erosion dramatically," she says.



Although many of the farms that are converting to low-till agriculture are large-scale operations, the approach is also rapidly gaining acceptance on smallholdings in places such as Ghana and India. On the Indian subcontinent, the area where low-till is being implemented has grown from nothing in 1997, through 100,000 hectares in 2001, to one million hectares this year.

Besides conserving soil structure, low tillage also reduces energy inputs. Farms in India that grow rice in the summer and wheat in the winter have cut their number of annual tilling operations from eight to one, Wall reports, reducing fuel use by 70%. "When I was there, the only people complaining about the change were the petrol station owners," he says.

Low-till farming also substantially reduces the need for chemical fertilizers. Cover crops provide some nitrogen initially, and then, as organic matter builds up in the soil, nitrates and other nutrients are less readily leached out of it, further decreasing

the requirement for added fertilizer.

But for organic purists, any approach to maintaining soil integrity that incorporates regular sprayings with Roundup and continued applications of nitrates is heresy. Peter Melchett, policy director of Britain's Soil Association, the world's oldest organic farming organization, scorns low-till approaches. "They tend to be something you can do for two or three years until you get grass weeds that aren't well-controlled by Roundup," he says. "Then you have to resort to ploughing."

Wall disagrees. He argues that the need for herbicide applications tails off after the first few years of low-tillage, as weed seeds disappear from the top layer of soil. "I think it is possible to get to no tillage and almost no herbicides," he says.

Such disputes might be resolved more readily if there was an abundance of data comparing pure organic methods with the low-till approach to soil conservation. "But there aren't a lot of long-term studies," says Mark David, a biogeochemist at the University of Illinois at Urbana-Champaign. "It isn't a simple comparison to make."

Chemical cuts

Some of the other ideas being borrowed from the organic movement — in particular a reduction in pesticide inputs — are resulting in a closer meeting of minds.

For instance, farmers have been forced to discard methyl bromide, the main soil fumigant that has been used to kill soil pests, as it will be phased out by 2005 under the Montreal Protocol to close the ozone hole. This has led farmers to experiment not only with other fumigants but with organic methods of killing insect larvae as well, including flooding fields between plantings and allowing the Sun to bake the soil through clear plastic sheeting.

Farmers are also bowing to consumer pressure. "People don't want pesticides in their food," says Diana Wall, director of the Natural Resource Ecology Laboratory at Colorado State University in Fort Collins. US orchards, for instance, have largely adopted organic methods for controlling the codling moth (*Cydia pomonella*), the larvae of which bore into ripening fruit and can destroy 80% of an apple crop without control.

In this case, concerns about pesticide residues on apples and pears led to legal restrictions on the use of organophosphates, the most effective class of pesticides, under the 1996 Food Quality Protection Act. Organic control of the codling moth disrupts mating by releasing sterile males and spraying female sex pheromones to confuse the rest.

The doubly green revolution doesn't necessarily embrace the broader aspects of organic ideology, such as social justice and animal welfare. But if the organic movement wants to change the world, it is making a reasonable start.

Colin Macilwain