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considers particularly important is ‘the humanitarian side of just helping people out of a bit of a bind’. Most Filipino farmers cannot often afford farm chemicals, and soil diseases like bacterial wilt can wipe out 60% of crops every year.

‘Whereas Australian farmers might say “30% reduction? Come back when you can do 90%”, Filipinos are saying “30% is 30% more food on the table”’, says Dr Kirkegaard.

Numerous factors are pushing people away from harsh synthetic chemicals, and Dr Kirkegaard is pleased that biofumigation research has provided some practical solutions. A number of commercial seed companies now sell mixtures of brassica plants under the label ‘biofumigant’. Pelletised mustard-seed meal is also being used in areas of horticulture where people want to minimise exposure to synthetic chemicals, such as the cut-flower industry and on golf courses.

One major recent development has been increasing the amount of ITC released. Compared to using a rotary hoe, mulching plant tissue and then irrigating can provide as much as a 100-fold increase in ITC release. As understanding of the mechanisms behind biofumigation develops, the next step is selecting and marketing the best plants to use as biofumigants.

‘We’ve taken a lot of the guess work out of it and started other researchers on a path that’s liable to lead to other success … Growers can now trial options for themselves to test the effectiveness of biofumigation for their particular pest and crop combination,’ says Dr Kirkegaard.

Questions remain as to which brassica plants are most suitable for controlling various pests in different farming systems. Funding may become available for further research looking at more diseases, in more areas and other crops. With increasing concerns over synthetic chemical use, biofumigants may have a significant role in integrated pest management.

● **Garth Lamb**

More information
Biofumigation research overview
www.ento.csiro.au/research/pestmgmt/ biofumigation/newsletter_list.html

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Enticing mat cleans up – fast

PRECIOUS BODIES of groundwater are vulnerable to contamination by fertilisers, pesticides, industrial waste and other pollutants. Cleaning them up is usually a very complex and costly business.

But Dr Bradley Patterson of CSIRO Land and Water and Dr Allan McKinley of The University of Western Australia have developed a polymer-mat system which, when immersed in the groundwater, can be used to deliver oxygen, ethanol or other reagents to beneficial microbes which will quickly decontaminate polluted water free of charge.

The inputs promote the action of the countless harmless bacteria in the water because the oxygen and the energy in the carbon-rich ethanol allows them to multiply and increases their metabolic activity. This means they can be enticed to remove a range of contaminants.

In six-month long laboratory experiments on columns of slow-moving groundwater, the researchers found that addition of these substances via a series of permeable polymer-mat barriers led to sequential remediation of water that had suffered contamination with ammonium.

As the water passed through the barriers, the additional oxygen induced microbes on the mats to convert the ammonium (NH_4) to nitrates (NO_3) and nitrites (NO_2), while infusion of ethanol caused the microbes to then turn these into nitrogen gas – a completely benign product. This left the water largely free of the original contaminant within just days of the system stabilising.

CSIRO Land and Water

In field trials, mat barriers of woven polymer tubing (shown) were installed in flow-through treatment boxes dug into groundwater-bearing sand.

The conventional solution when groundwater is contaminated with ammonium or nitrates due to industry, sewage treatment lagoons, or fertiliser use, is to pump large volumes of the dirty water to the surface and subject it to prolonged treatment, before returning it underground. ‘Permanent reactive barriers’, however, such as the CSIRO–University of WA system, can be used underground and should be cheaper overall because natural hydraulic pressure gradients push the water through the cleansing barriers, removing the need for pumping.

Wider tests have shown that the system can also deal with herbicide contamination.

‘We have now completed a field trial using our system and this successfully removed 90% of the ammonium from an underground plume of badly polluted water at a site in Perth,’ says Patterson. ‘It entailed burying, by vibration, a 20-metre-long barrier system in saturated sand to a depth of seven metres and letting the bugs do their work. We are confident that the technique can be further scaled-up by use of many such modules.’

Wider tests have shown that the system can also deal with herbicide (atrazine) contamination. With some further refinement of the innovative method, Patterson and McKinley say it will be ready for commercial application.

● **Steve Davidson**

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