food production and food production requires good soil – and soil is the mother of us all."

Significantly, phosphate fertiliser application is an inefficient way of providing phosphorus for plants to convert into food. Cordell's data show that actual crop uptake from applied fertilisers can be as low as 10%-30%, with the balance either locked up in the soil in a bio-unavailable form or washed off, causing eutrophication of the waterways it flows into and even contributing to damage to Great Barrier Reef. By the time the food reaches the consumer, only 2% of the phosphorus in the fertiliser remains.

For broadacre farmers, the problem will be how to produce crops using fertilisers made from lower-quality phosphate rock in the future as supplies of quality rock dwindle or how to minimise their use of phosphate-based fertilisers.

## Organic P problem

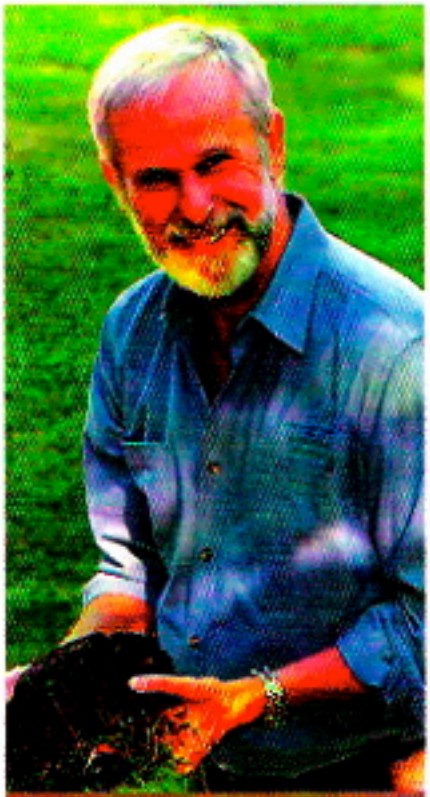
One commonly touted solution is to farm more organically, drastically reducing the demand for complete phosphate-based fertilisers. While in theory this looks a possibility and organic farmers are permitted to use rock phosphate, significant problems are emerging with its use.

According to Professor Peter Cornish, University of Western Sydney, organic crop farmers are witnessing significant depletion of available soil phosphorus and are struggling to maintain grain yields. The major grain production issue with applying rock phosphate is that in most cropping districts rainfall is too low to allow its conversion to plant-available phosphorus.

In a special phosphorus issue of *Crops and Pasture Science* published January this year, Cornish argues that organic-certifying organisations need to relax the rules on the use of superphosphate for grain production if sufficient quantities are to be produced to meet demand.

Better soil management (including increasing the carbon content of soil to improve plant uptake of phosphorus, using plant organic matter to prevent run-off and leaching, and better timing of the application of fertiliser) are all points to be considered and are all deserving of further research. These options were highlighted by Cornish in the May issue of *Australian Farm Journal* as part of his call for a new paradigm in phosphorus management.

Inciter Pivot Ltd (IPL) is promoting Bio-Phos as an alternative to other fertilisers for biological or organic farming systems or farms converting to these systems. It is "a is



Peter Cornish argues that organic food certifying organisations should relax rules on the use of superphosphate because approved sources of phosphate are not meeting grain crop plant requirements even when soil has high organic matter and carbon content.

naturally occurring rock phosphate that is composted with liquid fish nutrients generated from wild-catch fish waste, carbon sources and select naturally occurring fungi".

Yet IPL says its use is not likely to reduce overall phosphate demand. The rock phosphate is derived from the same sources as the phosphate for IPL's other phosphorus fertilisers. It seems likely Biophos is a move by IPL to capture the organic farming market.

## Biosolids

An alternative to fertilisers is the reintroduction of phosphorus to the soil through the application of biosolids. Biosolids – the polite term for animal excreta, particularly human excreta – is used extensively in China and Japan but, surprisingly, is starting to gain favour in Australia. Approximately 150,000 dry tonnes is applied to farmland each year, usually surface spread and then incorporated mechanically into the soil.

Dr Michael Warne is principal research scientist at CSIRO Land and Water with expertise in biosolids. Biosolids are derived from human waste through wastewater treatment plants. In Australia he says they are used predominantly on dryland farming – wheat, sugar cane, oats, and not on vegetables, fruit or dairy farms.

Most Australian states produce biosolids, which vary in texture from wet cake – up to 70% water (NSW) – down to very dry – approximately 5% moisture (South Australia). Each state has its own guidelines for the application of biosolids, which must be incorporated into the soil within 24-48 hours of delivery.

"Farmers have all sorts of reasons for using biosolids but mainly because they see financial and crop yield benefits," Warne says. "Those that are allowed to use them and can obtain them love biosolids. However, some people don't like them. In Western Australia, farmers who were originally all for using biosolids but had low-lying, flood-prone land were not permitted to apply them. They then became very strong opponents of biosolids."

Strangely enough, organic farmers – who are allowed under certification to use rock phosphate – are not permitted to use biosolids in Australia.

While biosolids are an alternative to commercial fertilisers, they are not the whole solution. Humans do excrete almost all of the phosphorus found in the food they eat but Cordell points out that is only 2% of the phosphorus originally applied as fertiliser. "Therefore, even if 100% of human excreta was recirculated, Australia would still have a substantial phosphorus deficit."

She says there are no easy answers to the peak phosphorus problem, only questions for which no co-ordinated research either internationally or nationally is being undertaken, and the consequences for the future of farming and for food security are being ignored by policy-makers.

### Find out more:

Cordell, Dana et al (2009). *The story of phosphorus: global food security and food for thought.* Global Environ Change.
'Peak Phosphorus: the sequel to Peak Oil':
http://phosphorusfutures.net/index
Global Phosphorus Research Initiative:
http://phosphorusfutures.net
Western Sahara Resource Watch:
http://www.wsrw.org
Plate to Paddock – Zero Waste Australia:
http://www.zerowasteaustralia.org/projects
The Australasian Biosolids Partnership:
http://www.biosolids.com.au/index