



This healthy soil has been exposed to organic practices for several years.

Replacing nutrients safely

In a review in the book *Organic Agriculture: a Global Perspective*, edited by A Taji and P Kristensen (to be published by CSIRO Publishing later this year), Jennifer Davis and Lyn Abbott consider the long-term prospects of maintaining soil fertility under organic farming systems.

Clearly, nutrients are lost from organic farming systems when produce is sent to market. Thus, inputs are necessary to replace these nutrients, especially in many Australian soils that are relatively old and highly weathered, compared with other parts of the world (such as in areas of western Europe and North America).

The challenge is to replace nutrients in a manner that does not minimise the activities of beneficial biological processes. It is ironic that adding nutrients can decrease some components of biological activity in soil, so it is necessary to select the right amount and kind of nutrients that stimulate rather than inhibit microbial activity.

In Australia there is relatively little scientific investigation of the way nutrient inputs registered for organic farming affect soil biological processes.

Although it is common knowledge that organic farming practices provide a beneficial environment for soil microbial processes, this has not been well-researched in Australian soils.

Indeed, evaluating the biological state of soils is not easy because there are so many processes that could be measured and the levels of activity and abundance of organisms involved can change quite suddenly (say, after rain).

Thus, the time of sampling soil to measure activities and abundance of organisms needs to be considered carefully. ■

10 KEY PRINCIPLES

Professor Abbott has summarised 10 key principles of soil biological fertility (see the soilhealth.com website) and noted the corresponding soil management practice associated with each:

1 Soil organisms are most abundant in the surface layers of soil, therefore soil erosion should be controlled to minimise loss of soil organisms.

2 Soil organic matter is necessary for nutrient cycling and soil aggregation, therefore plant organic matter should be retained to maximise nutrient cycling and soil aggregation processes.

3 Maximum soil biological diversity depends on diversity of organic matter and habitats, therefore some disturbance of soil is necessary to maximise soil biological diversity.

4 Nitrogen-fixing bacteria form specific associations with legumes under specific conditions, therefore nitrogen-fixing bacteria should be selected that match the host, soil characteristics (such as pH) and environmental conditions.

5 Nitrogen is released during organic matter breakdown, either into soil or into the soil microbial biomass, therefore inputs of nitrogen fertiliser should be calculated to complement nitrogen cycling from organic matter.

6 Arbuscular mycorrhizal fungi can increase phosphate uptake into plants in P-deficient soils, therefore inputs of phosphorus fertiliser should be calculated to complement and enhance the activities of arbuscular mycorrhizal fungi.

7 Soil amendments can alter the physical and chemical environment of soil organisms, therefore any substance added to soil should be assessed in terms of its effects on soil biological processes and soil biological diversity.

8 Some crop rotations and tillage practices decrease the suitability of soil for plant pathogens, therefore crop rotations and tillage practices should be selected to avoid development of soil conditions that enhance growth and survival of plant pathogens.

9 Production systems based on soil biological fertility can be profitable, therefore the capacity of a management practice to produce a commercial product should be considered in parallel with its capacity to maintain and/or increase soil biological fertility.

10 Soil biological processes develop slowly, and the time required will differ for different soils, environments and land management practices, therefore sufficient time should be allowed for establishing or restoring a level of soil biological fertility appropriate for particular soils and land management. ■