Soils are Alive Newsletter

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The University of Western Australia

Welcome.....

Increasing interest in organic farming practices is opening the debate about the availability of nutrient sources to sustain this form of agricultural and horticultural production.

In this newsletter, we examine the basis of soil fertility in organic farming systems from the point of view of beef production.

The author of this newsletter, Jennifer Davis, is a PhD student in the School or Earth & Geographical Sciences at The University of Western Australia. Her research is funded by the Rural Industries Research and Development Corporation (RIRDC) to investigate organic management during the conversion phase to certified organic practices on a beef farm in south-westen Western Australia.

AUSTRALIAN SOIL CLUB

The Australian Soil Club was established to provide information about soils that is useful to all land users. A new website for the Australian Soil Club is being developed at:

www.soils.org.au

The new version of the newsletter for the Australian Soil Club is more web-friendly. It will be sent by mail to Club members. Please check the website if you are interested in more information.

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Organic Agriculture

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Soil Fertility in Organic Agriculture and Horticulture

Organic farming is a system of farming that aims to harness the beneficial effects of natural processes for production. In Australia, organic farming is regulated by associations that certify (guarantee) that the farming processes meet specified standards.

The process of certifying a farm as 'organic' involves keeping records of farm activities to show that the practices used on the farm agree with the production standards of the certifying organisation.

Production standards include the aims of organic production and contain details of the products that can be used on certified organic farms. An example of production standards can be found at: http://www.affa.gov.au/ (AQIS).

Soil Biological, Chemical and Physical Fertility

The management of soil fertility is different in organic farming systems to that of farming systems which allow inputs of synthetic chemical fertilisers. Increasing inputs of organic matter which is emphasised and organic farming often results in higher levels of soil organic matter, but this is not always the case. Increased throughput of organic matter is usually associated with increases in the physical and biological fertility of the soil because soil organic matter improves soil structure and provides a food and energy source for soil organisms.

The activity of soil organisms is very important in organic farming because they improve soil structure and can increase the availability of nutrients to plants through nutrient cycling. This also occurs in farms managed using chemical fertilisers, but the chemical fertility of soil on organic farms depends to a greater extent on biological activity in soil in association with a balance between nutrient inputs and outputs.

If animal manure is readily available and legume nitrogen is efficiently managed, soil nutrient levels can be maintained. However, most research on the effects of organic farming on soil fertility has taken place in Europe and North America. More research is necessary under Australian conditions.

Soil Fertility in Organic Farming Systems - How are nutrients supplied?

Nitrogen

Nitrogen in organic farms is sourced primarily from biological nitrogen fixation, with additions of sources of liquid nitrogen available to some intensive horticultural situations. During nitrogen fixation, nitrogen from the atmosphere is converted to a plant and microbe available form. This is done either by symbiotic associations between pasture legumes and root nodule bacteria, or by free-living nitrogen fixing bacteria which occur in soil.

The amount of nitrogen fixed in association with legumes depends on the efficiency of the bacterial/legume association. The nitrogen becomes available once the legume plant dies and is degraded by soil organisms. During this degradation process, nitrogen is released into the soil for use by plants. The amount of nitrogen fixed by free living bacteria is variable and can be increased in association with activities of organisms that degrade organic matter - the bacteria gain carbon when the organic matter is degraded, allowing them to grow more rapidly and collectively to fix more nitrogen.

Phosphorus

In Australia, researchers are concerned that organic farming methods will not be able to supply plants with adequate amounts of phosphorus. Animal manures are not readily available in most of Australia, so organic farmers often rely on rock phosphate as a source of phosphorus for plants. However, rock phosphate is highly insoluble in most Australian soils.

Phosphorus availability has become a major limiting factor for organic production in Australia. It is likely to be less of a problem for horticulture because it is more intensive and the use of other sources of phosphorus, such as compost, is feasible. The problem will also be less severe for pasture production in some high rainfall areas because rock phosphate is more soluble in these soils.

Organic Matter

Another issue for organic farming in Australia is the difficulty in increasing levels of organic matter in soil. The high temperatures and low rainfall in Australia mean that relatively little plant material is produced and returned to the soil.

When these conditions occur in association with sandy soils, the rate and extent of degradation of organic matter in the soil is increased. This creates a problem for organic farming in Australia because, without increases in the input of organic matter into soil, the activity of soil organisms cannot be increased sufficiently to support the necessary levels of soil chemical and physical fertility.

Other Sources of Nutrients

Two nutrient inputs that are permitted in organic farming and practical for broadacre production are rock dusts (K, Ca, Mg) and rock phosphate (P, Ca). Field trials indicate that they perform poorly in most soils compared to soluble fertilisers. However, it may be possible to increase nutrient release by 'mechano-milling' and by managing microbial processes in soil that increase nutrient release.

Conversion to Organic Beef Production - RIRDC Research Project

PhD Thesis Summary - Jennifer Davis

Organic beef production has the potential to be a valuable export industry for Western Australia. However, necessary information on organic beef production methods for farmers wishing to convert is not widely available. In particular, little is known about the effects of using rock minerals on pastures in Western Australia.

A project is currently being conducted at The University of Western Australia to investigate aspects of using silicate minerals and rock phosphates as fertilisers in organic beef pastures in Western Australia. These materials are acceptable according to organic certification standards. The research will investigate the effects of silicate rock minerals on plant uptake of nutrients and the possibility that soil microorganisms may increase their dissolution in soil. The research will also address concerns about organic farming and phosphorus by investigating whether rock phosphate can adequately supply pastures in Western Australia with phosphorus.

This research is based on a pasture site in south-western Australia, where cattle graze on mixed clover/grass swards.