

Preface**Soil biology in Australian farming systems**

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Soil is literally teeming with life. A handful of soil contains billions of individual organisms represented by several thousand to millions of species. Despite these vast numbers less than 1% of the soil's total surface area is colonised by microorganisms (Young and Crawford 2004). The distribution of soil biota is heterogeneous within this three-dimensional environment with population increases occurring where substrates are available for growth and activity. Biological processes in soil are therefore inextricably linked to the location, quantity and quality of available organic carbon resources and nutrients in soil. Release of organic compounds into soil by plant roots provides not only an important substrate for microorganisms but also exert significant influence on soil biota by altering their environment within the rhizosphere. This can be both beneficial and detrimental to the plant depending on which species of soil biota proliferate. Plant inputs and soil organic matter turnover provide the available carbon required to maintain soil biological activity. Of particular interest in an agricultural context is the role of microorganisms as a source, sink and regulator of nutrients that may become plant available or lost to the environment. Variability in environmental conditions and, in particular a lack of rainfall for extended periods of time, is a major constraint to the survival and functioning of soil biological communities in many parts of Australia. How soil biota survive, reproduce and die within this complex physico-chemical matrix is still an area of great scientific interest and many questions remain unanswered. However, research has been aided in recent years through advancement in the analytical techniques required to assess specific microscopic, biochemical, functional and molecular characteristics of soil biology. These advances have enabled researchers to shift focus from not only

identifying and classifying the types of organisms present but to an assessment of the contribution of biological processes and community structure to key soil functions and plant growth.

Within the overriding constraints of the environment and inherent soil properties agricultural management practices ultimately seek to increase or optimise plant and animal productivity whilst minimising on-site and off-site environmental impact. Soil biology has always been recognised as a key to this objective in sustainable agricultural systems (Pankhurst *et al.* 1994; Abbott and Murphy 2003; Lines-Kelley 2004) and it is currently enjoying a resurgence of interest particularly within the farming community. The key question to answer for the farming community is to what extent can soil biology contribute to the economic imperative of productivity gains whilst ensuring that agricultural systems maintain environmental integrity. This special edition addresses this key question in light of soil biology research currently underway in Australia.

References

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