

Soil Biology in Farming Systems

D. K Roget and V.V.S.R. Gupta CSIRO

Land and Water, Adelaide, SA

Overview:

- Stubble retention and reduced stocking pressures increase soil microbial activity.
- Activity of soil microbes give soils natural suppression of root diseases.
- Disease suppression has been shown to be substantially increased through retention of stubbles over a 5-10 year period.
- Microbial activity has a strong influence on the availability of soil nutrients to crops, Nitrogen is the nutrient most influenced by microbial activity.
- There are many microbes that can break down chemicals and this break down is often enhanced with increased stubble retention.

Soil biological processes are responsible for a range of important functions in agricultural soils including decomposition of plant residues, suppression of soil borne diseases, nutrient availability, break down of herbicide and pesticide residues, and aggregation of soil particles that reduce erosion potential.

The importance of biological functions in any particular farming system is dependent on the level of inputs into that system. As the level of inputs increase, the importance of biological functions decrease. An extreme example of this would be hydroponics where every requirement of the growing plant is met by inputs ie. nutrients, pesticides etc. In our dryland farming systems the potential for inputs is limited by cost. In these systems the proper functioning of the soil biology can reduce the need for inputs or maximise the benefit of the inputs used.

Stubble Retention

Soil microbes require energy to carry out their functions. The key source of that

energy comes from the plant residues that are returned to the soil. Practices that increase the amount of residues returned to the soil such as stubble retention and reduced stocking pressures will tend to increase soil microbial activity.

Disease Suppression

All soils have a natural level of suppression to root diseases due to the activity of the soil microbes. In many soils microbial activity is not sufficient to prevent the occurrence of diseases. Disease suppression, particularly to fungal based diseases (take-all, rhizoctonia, crown rot, common root rot) has been shown to be substantially increased through retention of stubbles over a 5-10 year period.

Nutrition

Microbial activity has a strong influence on the availability of soil nutrients to crops. Nitrogen is the nutrient most influenced by microbial activity. Nitrogen is accumulated in the soil by microbes that can convert atmospheric nitrogen to soil nitrogen. The

majority of nitrogen fixed from the atmosphere is done by the rhizobia that are associated with legumes, however, there are free living soil organisms that can also fix nitrogen from the air.

Microbes are also responsible for the mineralisation of nitrogen to inorganic forms that the plant can use. The rate of mineralisation and timing of mineralisation has a strong influence on the efficiency of use of the nitrogen available to the crop.

Herbicides

Many farmers are concerned about the fate of herbicides and insecticides that are sprayed on our soils. Two factors need to be considered i) short-term effects ie. disease impacts, mineralisation effects ii) long-term residual effects. Fortunately there are many microbes that can break down these chemicals and this break down is often enhanced with increased stubble retention.