

# tips & tools

## NATURAL RESOURCE MANAGEMENT

# Managing soils to keep them healthy and productive

Soil organisms are important for degrading organic matter, releasing nutrients back to the soil and enhancing soil structure for productive pasture species. Grazing management affects soil organisms at ground level and below.

### Key benefit

- Using grazing management can promote soil organisms contributing to healthy and productive soils.

### Tactics

#### Grazing and pasture management

For healthy soils, the amount and quality of organic matter available as food for soil organisms is important. Productive well managed pastures fertilised with superphosphate and incorporating productive plant species supply a valuable feed source of high quality organic matter.

Pastures must be allowed to recover after grazing to restore plant energy reserves and encourage deeper roots. These roots provide a valuable source of organic material for soil organisms.

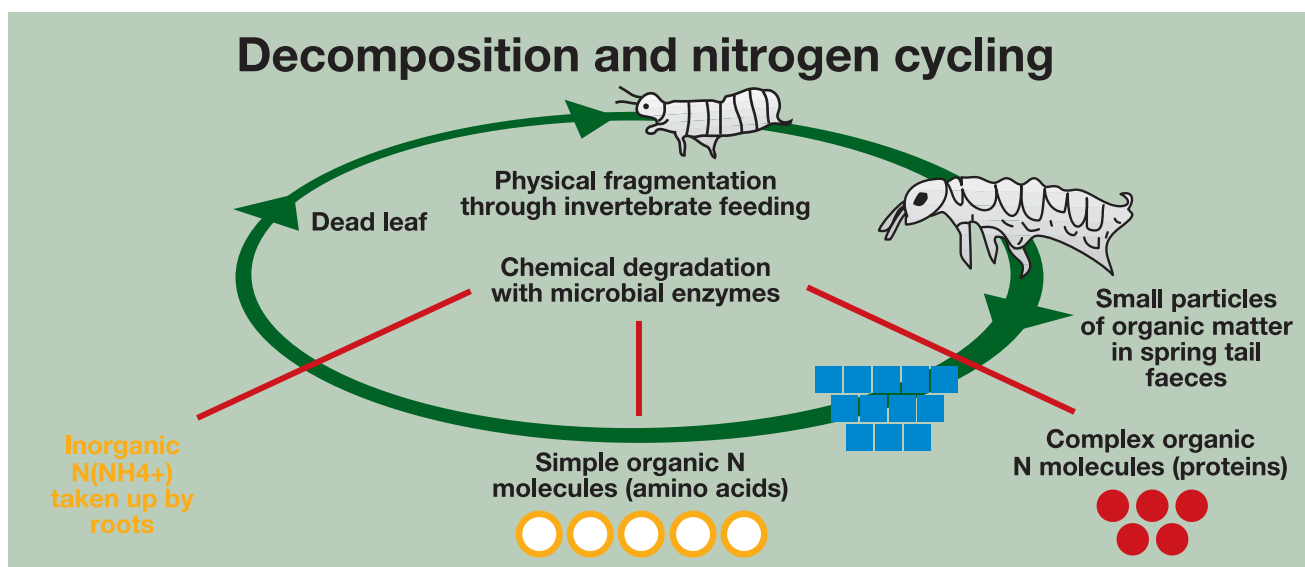
Another tactic is to apply grazing management that reduces stock camping, spreading dung across the paddock to stimulate plant growth.

#### Plant litter layer

Plant litter provides organic food and living space for decomposer organisms, and protects the biologically active topsoil against extremes of soil temperature and evaporation. To retain plant material as a litter layer at the soil surface, overgrazing should be prevented and a strategic pasture-spelling program applied.

It is important to de-stock pastures before excessive removal of plant material occurs. Litter layers need to be several millimetres thick to provide optimal benefit.

Always aim to maintain at least 1000kg DM/ha of litter and dead matter on the soil surface ie: 2-3 handfuls per 0.1m<sup>2</sup> (30cm or one foot square quadrat).



Grazing systems that utilise most of the annual pasture growth and spread dung for rapid decomposition by soil organisms contribute to retaining plant litter.

### Fertiliser

Fertilisers can be applied to improve soil nutrient status, with evidence of increased soil organisms following inorganic fertiliser application. This is probably because of increased plant productivity and herbage quality, which can also improve soil physical properties (stability and strength).

Lime can be applied to raise the pH of acid soils, with a pH value of around 6 optimal for most soil organisms. In a soil pH of 4.5 or lower, springtails and mite populations are lowered by 75%, but some fungi can cope.

Nitrogen is supplied to most pasture soils through legume fixation. Nitrogen fertilisers can be used strategically to boost pasture production but cause short-term reductions in some soil organisms.

### Compaction

Overgrazing of paddocks should be avoided as this causes compaction by animal hooves. Compaction acts as a barrier to root growth and squeezes soil pores closed. Overgrazing also removes the protective litter layer. Rotational grazing allows soil that can become compacted during grazing a chance to recover.

Cultivation reduces the stability of soil structure and lowers soil organism numbers because their habitat is physically disrupted and organic matter reduced. Therefore, mechanical tillage of soils in grazing paddocks should be minimised.

### Drainage

Poorly drained and waterlogged soils restrict nutrient availability and aeration. A lack of oxygen (anaerobic conditions) can affect soil organisms and severely damage roots. This makes it important to improve drainage (surface and sub-surface) in low-lying pasture areas.

Vigorous, deep-rooted pastures should be maintained for soil porosity and high water infiltration rates. Root growth creates channels through the soil that remain when the roots decay.

### Burning

The burning of plant residue should be avoided. Burning consumes organic matter and releases valuable nutrients into the air where they are unavailable to the grazing system.

### Chemicals

Some anti-parasitic drugs can have a negative effect on organisms that encounter dung pats containing these chemicals.

### Soil facts

Soil organisms include bacteria, fungi, protozoa, nematodes, micro arthropods (springtails and mites), and large invertebrate animals (insects, millipedes, earthworms) that live in the soil or the litter layer. They consume the organic matter in roots, leaves and stems of plants and the material that has passed through grazing animals and excreted as dung. Soil microbes can occur in great abundance. For every one sheep grazing improved pastures, there are soil microbes equivalent to the weight of four sheep below ground.

The burrowing activities of larger soil organisms, such as worms, create tunnels to form a network of pores. These pores improve aeration and water infiltration, and provide access for plant roots.

Soil organisms live in the soil and litter/dung layer that overlies the soil. Biological activity is greatest in the litter and dung layer and in the top 10cm of soil.

Soil animals assist the rapid decay of organic matter by chewing it into smaller particles, and mixing and burying organic material. Organic material under the ground decomposes faster than on the surface because soil provides a more stable environment. Soil animals also consume the nutrient-rich bodies of microbes, releasing nutrients for plant uptake.

Soil organisms are most active in moist soil. Plant litter can reduce evaporation of soil moisture by shading and insulating the soil from heat, and reducing wind speed at the soil surface.

Soil organisms also have an important role in improving soil structure. Microbial gums and fungal filaments cement tiny soil particles together to form larger aggregates (clusters of particles), which are more stable to the action of water. A healthy soil therefore has wider environmental benefits in helping to address deep drainage.

### Acknowledgments

Kathleen King, University of New England, Armidale, NSW

Kathy Junor, technical editor

## Further information

This *Tips & Tools* is one of a series on grazing and pasture management. For further reading, copies of *Towards Sustainable Grazing* can be purchased from MLA. To order MLA publications visit [www.mla.com.au](http://www.mla.com.au), phone 1800 675 717, or email [publications@mla.com.au](mailto:publications@mla.com.au)

For further assistance contact your local pasture or livestock advisor.



Level 1, 165 Walker Street  
North Sydney NSW 2060  
Ph: 02 9463 9333  
Fax: 02 9463 9393  
[www.mla.com.au](http://www.mla.com.au)