



## Managing wet soils: renovation of damaged pastures and soils

Updated: January 2006

AG0944

ISSN 1329-8062

Ashleigh Michael, Maffra and Graeme Ward, Warrnambool

*Grazing wet paddocks usually causes varying degrees of damage to pasture and soil. Some form of renovation is often required to return the pasture and soil to its full productive state. This Note provides guidelines for effective renovation of damaged pasture and soil.*

### Damage caused by pugging

Stock treading on wet soils will cause:

#### Pasture damage

- Crushing and bruising of plants leading to a reduction in plant density and yield. Research in South West Victoria has indicated that a single pugging event can reduce ryegrass tiller density by as much as 52%.
- Burying and fouling herbage, reducing pasture utilisation.
- Creating bare space allowing weed invasion.

#### Soil damage

- Making the soil surface rough, resulting in management problems.
- Destroying soil structure and pore space reducing infiltration rates, further compounding the poor drainage of the soil.
- Causing soil compaction (increasing soil bulk density), further reducing plant and root growth and the water holding capacity of the soil. New Zealand research has shown infiltration rates to be ten times slower in compacted soils. The connection system between soil pores is damaged which results in reduced aeration and water storage.
- Hoof impact kills earthworms.
- Increasing risk of erosion and nutrient run off.

### Renovation aims

Renovation should address one or more of the following:

- Reduce soil surface roughness.
- Increase plant density of improved species back to acceptable levels.
- Repairing soils by correcting compaction and restoring structure of pore spaces.

### Renovation methods

Possible pasture and soil renovation methods include:

#### Natural regeneration

Pugging by cattle can severely damage pasture and soil structure, but some natural regeneration of pasture and soil physical conditions does occur. This natural regeneration is a result of a number of processes, including:

- Wetting and drying cycles cause the shrinking, swelling and cracking of a soil (especially in clay and clayloam soils).
- The growth and decay of plant roots leaving root channels, especially by grasses.
- Burrowing action of earth worms promote root channels.

The rate of natural regeneration can vary considerably depending on the soil type and conditions. New Zealand research in the Hauraki plains clay soils has indicated that soil structure had not completely regenerated 14 months after a single pugging event. Experience suggests that this process may take as long or longer on some Australian soils, especially if a number of pugging incidents have occurred.

On soil types that regenerate quickly or where minimal pugging occurs natural regeneration may be sufficient to repair soil. On some other soil types the natural processes may be too slow to counter the effects of a serious or repeated pugging events, so some of the following renovation methods can be used.

#### Smudging or harrowing

A common method of levelling and reducing soil surface roughness caused by pugging is by smudging or heavy harrowing. These methods break off mounds of soil and help fill in the pug marks. Smudgers are usually constructed out of heavy railway line welded together and dragged behind the tractor. A variety of other implements such as chain, diamond or pasture harrows can be used to level the soil surface.

Smudging and harrowing should be done in spring when the soil is dry enough for sufficient shattering of the soil mounds to occur and to fill the pug marks. If soil is too

wet, smearing and compaction of the soil can result, causing further damage. These procedures will not improve the soil structure.

Harrowing usually rips out some plants from the pasture, further reducing plant density. Spreading pasture seed on the treated area has been found to be beneficial. A New Zealand example shows that broadcasting ryegrass seed after harrowing resulted in a 16% dry matter production increase during the following spring, compared to treatments that was harrowing only.

### **Rolling**

Rolling is another method used to level a pugged soil surface. It involves towing a heavy roller over the paddock to flatten out the pugged marks caused by cows treading on wet soil.

Rolling is often more effective when the soil is still moist enough for the mounds to be pushed back into the soil. However care should be taken as rolling when the soil is still moist can cause further compaction of an already damaged soil. This compaction can cause further problems such as reduced water infiltration, reduced root growth and reduced aeration resulting in reductions in future pasture growth.

Rolling usually results in less damage to pasture species. As with smudging and harrowing applying pasture seed by drilling or broadcasting will help restore adequate plant density.

### **Cultivation and resowing**

A full cultivation of the soil together with re-sowing the pasture will level the soil surface, increase the density of productive plants and to some extent improve soil structure damaged by pugging. This is the most time consuming and expensive option but the most reliable option to return pasture to a productive state. This option would generally be selected in the case of severe damage.

A paddock can sometimes be sown straight back to pasture following winter pugging by completely resowing in spring if conditions allow. The re-sowing would be done once the soil has dried sufficiently for cultivation. Another option is to sow a summer fodder crop and resow the pasture in autumn. Surface drainage works should also be repaired at the time of cultivation.

### **Direct drilling in seed**

Introducing seed into a damaged pasture by direct drilling can improve damaged pastures increasing the density of the productive species. New Zealand research has shown pastures that had been oversown following winter pugging produced 16% more dry matter over a two year period than pasture that had not been resown.

It can be difficult to oversow by direct drilling into pugged ground that has a rough surface. The uneven surface makes it difficult to achieve good seed placement and coverage. Direct drilling is often done following harrowing to level the paddock and will improve the consistency of depth with which the seed is sown at. Direct drilling can be particularly effective when there is a large amount of bare ground for seedlings to establish. Best results are often achieved in autumn when soils are wetting up after the dry summer conditions.

### **Sub soiling or ripping**

In addition to causing a rough soil surface pugging can also cause a compacted layer below the pugging depth. This compacted zone can impede water infiltration and restrict subsequent pasture growth. In some situations it has been beneficial to treat the compacted layer by ripping or subsoiling. To remedy sub-soil compaction the soil must be loosened at the level of the compacted layers.

To identify where a compacted layer exists in the soil several holes can be dug to 50cm depth and examined. Indications of a compacted layer include, an accumulation of roots or water at a particular level in the soil profile, soil that appears to be bluish-grey in colour (result of long term waterlogging), or poor root or earth worm activity. Investigating suspect levels by scratching them with a knife may indicate dense compacted layers.

A range of subsoiling equipment is available, most being heavy tyne or “deep-ripper” types. Subsoiling is a relatively expensive and time consuming, operation should not be undertaken lightly. Results can be quite variable and local experience on the particular soil type can be the best guide.

*The previous version of this note was published in February 2002.*

**The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.**