

Don't treat your soils like dirt

Cheyenne Stein

cheyenne.stein@nzx.co.nz

@CheyStein2

With winter fast approaching it's time to start thinking about keeping your soils intact in the wet months.

AgResearch soil scientist and science team leader David Houlbrooke says there are two types of damage done by animal treading – compaction damage and pugging. The difference between the two comes down to the soil moisture content at the time of damage.

Soil structure is important for pasture production. Water and air must be able to move freely in and out of the soil and between soil aggregates, which allows plant roots, earthworms and micro-organisms to function normally. Treading causes damage to the soil structure, which leads to a decrease in pasture production.

Soil compaction and pugging

Soil compaction happens when a force greater than the bearing strength of soil is applied, compressing the soil macropores. Soil macroporosity describes the percentage of air spaces within soils and is used as a measure of soil physical quality. This occurs when soil moisture content starts to increase, lubricating the soil aggregates and decreasing their resistance to compactive forces. Soil pugging involves the deformation and remoulding of soil when animal weight exceeds a soil's bearing capacity. It happens when soils are very wet and soil macropores are likely to contain water, such as when they are draining.

Effect of soil damage

The loss of soil macroporosity from soil compaction applies a "hand brake" to pasture production that can stick around for the long-term. There is often

a cumulative effect, particularly if land management doesn't change.

"The soil's physical structure isn't as good at transmitting air, root exploration is decreased and plant available water isn't held in the soil profile to the same extent when it's compact," Houlbrooke says.

The infiltration rate of the soil is decreased. This is the rate at which water moves into and through soil and therefore affects the soil's drainage capability. Less drainage capacity leads to higher soil moisture levels which will make soils more prone to pugging damage.

"It's also likely that greater overland flow will be generated which means a greater loss of contaminants like phosphorus and microbes to surface water."

Digging a hole is the easiest way to identify compaction. When digging through the top soils, if you're picking up large chunks of soil aggregate and roots aren't exploring nicely you know you have some compaction. If the soil is nice and crumbly there is no compaction. Pugging, on the other hand, has an immediate detrimental effect on pasture. Pasture is essentially buried in the soil, meaning a greater short-term production loss. One pugging event can depress pasture production by 20-60% depending on soil type and grazing conditions and the effects can last for four to eight months, Houlbrooke says.

Factors influencing soil damage

Soil texture is an important driver when it comes to soil's pre-disposition to treading damage. Lighter country with coarse soils, like silt loams and sandy silt loams, provides greater resistance to soil compaction because of their freer draining

properties. Heavier country with greater clay content is more prone to compaction partly because of how often it's wet and the poor draining ability.

"Lighter country has good drainage and is less likely to have soil moisture content to be at risk and if they are in that state, they have mineralogy that is more resistant to compactive forces damaging soil aggregates."

Vegetative cover also plays a role in soil damage with some protection being provided by the pasture root mass, which promotes aggregate formation and therefore improves structural stability and pore space.

Repairing soil damage

Soil has a natural ability to repair itself and recover from both soil compaction and pugging if given a period of rest from intensive grazing. Natural soil processes like earthworm activity, root development and decay enhance soil recovery.

Compaction damage can also be repaired by using sub-soilers or aerators which loosen the soil and break up the compaction, but management also needs to be improved to reduce future compaction damage to be effective in the long term.

For severe pugging damage from a single event, Houlbrooke says consideration should be given to re-grassing as part of a pasture renewal programme. Moderate to minor damage can often be left to recover naturally by limiting grazing intensity, by grazing lighter young stock or decreasing grazing frequency.

PREVENTION

Management strategies for treading in the wet period should be based on your farm's soil type, Houlbrooke says, and prevention is more economical than repairing.

- Reduce stock numbers
- Decrease grazing duration
- Make use of off-pasture systems
- Graze lighter young stock on heavy soils
- Strategically grazing areas by soil type
- Maintain good pasture covers
- Put a back fence behind fresh breaks to prevent previously undamaged or partially damaged soils from becoming further damaged.

Figure 1. Illustration of soil damage with increasing soil wetness (from Betteridge et al. 2003).

