beef+lamb new zealand

FACTSHEET

SEPTEMBER 2021

PUGGING AND SOIL COMPACTION – WHAT INFLUENCES PUGGING?

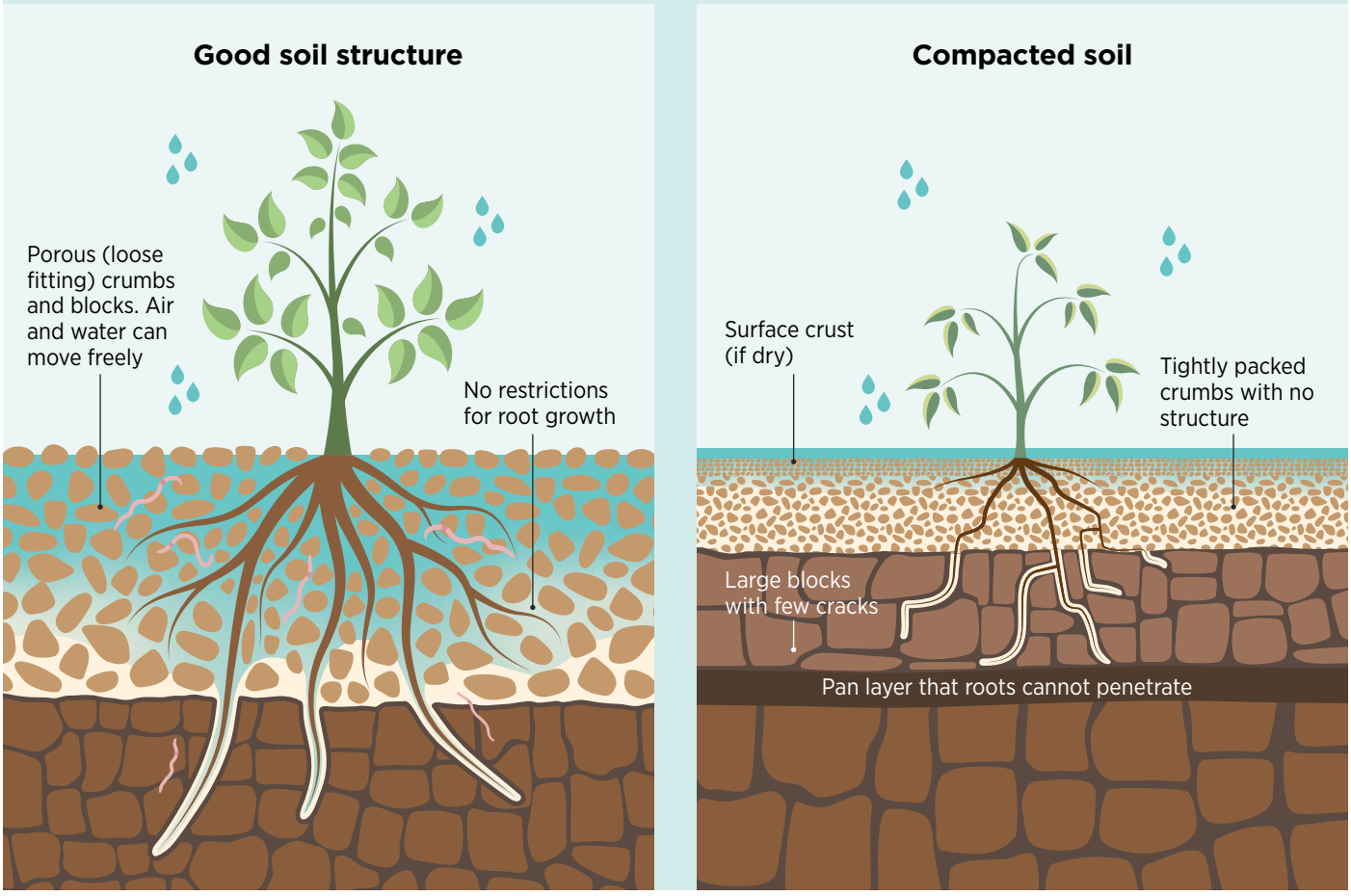
What is soil compaction?

In a soil with good structure around half the volume of the topsoil is known as pore space and contains water and air. Compaction of soil is when this pore space between the soil pores/aggregates is reduced. This usually occurs when soils are wet and there is a force applied to the soil surface in the form of animal or vehicle traffic.

Compacted soils can result in:

- **impeded drainage**
- **increased overland flow**
- **impeded root growth**
- **reduced plant production**

Good vs compacted soil structure



What is pugging?

Pugging is when soil structure is damaged by grazing animals or by heavy machinery during wet conditions. Pugging severity is increased in saturated, compacted soils. The result is a soil surface that looks rough, uneven and muddy.

Why is pugging a problem?

Pugged soil has negative impacts on two aspects:

1. Animal welfare

a. pugged soils require more effort for animals to walk on and can result in exhaustion or injury

b. there may be a lack of dry loafing/lying areas, exacerbating the issue of exhaustion and preventing animals from displaying natural behaviour

c. continued exposure to water can weaken hoof material and soften the skin of the interdigital space and coronet, leading to infection and lameness

d. excessive mud can lead to an increased incidence of mastitis.

2. Soil health/condition

a. Pugged soils have reduced subsequent pasture growth (even after the pugging event)

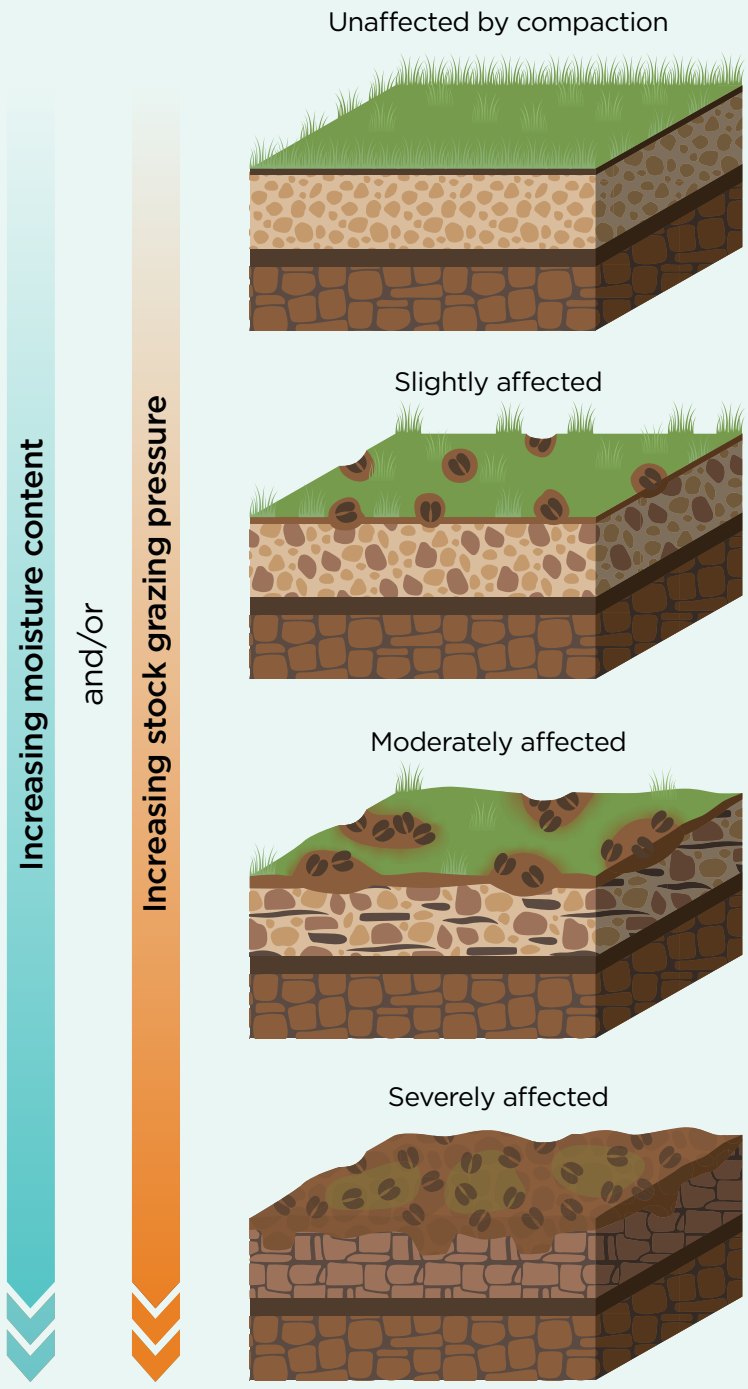
b. Pugged soils have a higher risk of sediment and contaminant runoff loss to waterways

c. Pugged soils have increased levels of soil compaction

d. Pugged soils have reduced drainage capacity and are more prone to further pugging

e. Pugged soils negatively affect nutrient cycling, resulting in increased fertiliser requirements.

Pugging of compacted soil



What influences pugging risk?

1. **Soil type** – heavy soils with a high clay content are more prone to pugging
2. **Winter rainfall** – high winter rainfall especially combined with heavy soils
3. **Soil drainage** – no drainage or ineffective drainage on soils prone to water-logging
4. **Stock type** – heavy animals are more likely to cause damage to wet soils resulting in pugging
5. **Stocking density** – higher stocking densities are more likely to cause damage to wet soils
6. **Soil cover** – bare (non-vegetated) soils are more at risk to pugging
7. **Soil structure** – compaction (from previous pugging) can impede drainage and result in an increased risk of future pugging
8. **Stock management** – set-stocking, not shifting regularly and/or not back-fencing during wet periods can increase the risk and/or severity of pugging
9. **Crop type**
10. **Crop establishment method** – full cultivation increases the risk of pugging
11. **Amount of residual crop left** – less vegetative cover, including less crop residual, can influence the amount of pugging

The more of the risk factors above that are present the higher the risk and severity of pugging.

What can you do to minimise pugging?

1. Identify your 'at-risk' paddocks and plan accordingly. Past experience can be a good indicator of where pugging is likely to occur given the soil conditions
2. Ideally direct-drill, or minimum-till as the next best option. Avoid full cultivation where possible
3. Fence off wetter areas of the paddock during periods with high soil moisture
4. Graze higher risk paddocks with lighter animals at lower stocking densities, or not at all during high risk periods
5. Avoid driving heavy machinery over wet soils
6. Avoid cultivating wet soils
7. Ensure there is good pasture cover going into winter
8. Have winter crops on lower risk areas of the farm/avoid winter cropping high risk soils
9. Have a 'Plan B' for wet weather events.

What can you do to remedy pugged soils?

The best course of action is to try and minimise any pugging damage and soil compaction in the first place. However, if you are in the situation where you have a pugging and soil compaction issue the first thing you need to do is to assess the level of soil damage.

Remember that pugging and soil compaction may not apply to a whole paddock, it may just be areas of a paddock such as gateways, around troughs, or feeding out areas. These areas may require some treatment and resowing to improve plant density and pasture production.

Where the soil is severely damaged you will find that the soil is highly compacted and plant production will be low. This will require sub-soiling or ripping to improve the condition of the soil and resolve the compaction issues. Following the ripping or sub-soiling a cultivation will be required.

What the sub-soiler (or aerator) does is to disturb the soil structure and remove any pans or deep compaction. It is best to get some expert advice from your farm consultant or contractor

Where there is some soil compaction but it's not severe there may be a requirement to roll the ground to improve the strike rate of the crop or pasture being sown.

Further information can be found here

https://www.waikatoregion.govt.nz/assets/WRC/WRC-2019/CNM-factsheet-soil-management_1-v2.pdf

https://www.gw.govt.nz/assets/Land-Management/Soil-Compaction-and-Pugging-on-Dairy-Farms.pdf

https://www.dairynz.co.nz/feed/feed-management/managing-pugging-damage/

More information

For further information freephone Beef + Lamb New Zealand on 0800 BEEFLAMB (0800 233 352) or email enquiries@beeflambnz.com or visit www.beeflambnz.com