

Using soil assessment for pasture production that considers both physical and chemical factors in the topsoil and subsoil

Ben Watts

"Belgravia", Orange NSW 2800

Abstract: Historically at Belgravia, soil quality has been measured by pasture production in a grazing system. Whilst this has given a good measure of how soils are currently performing, it has not provided any information on the full potential of soils or areas at high risk.

This paper describes how soil samples collected in 65 sites specific locations (not bulked) to a depth of 1.4 meters have given a more detailed account of soil condition both chemically and physically than traditional top soil bulk tests.

The data from this has been used to create colour coded "soil factor" maps that highlighted 16 key factors affecting soil health.

Analysis of this information has allowed a soil repair program to be developed that prioritises high-risk areas and highlights areas of high potential for future intensive production, whilst soils with limiting physical conditions are planned for native pasture restoration.

The "soil factor" maps have identified areas of high salinity that required immediate attention to prevent damage down stream in the Bell River catchment.

Introduction

At Belgravia staff are using a mix of on farm experience and detailed soil reports to maximize soil productivity in two ways:

1. Planning soil repair programs to optimise soil quality for pasture renovation / restoration.
2. Managing grazing programs to ensure plant health is not sacrificed allowing roots to penetrate to the subsoil moisture and nutrient bank.

Why did Belgravia use soil mapping?

In an area such as Orange where the soils can change dramatically from one paddock to another it is hard for property managers to estimate the underlying problems that may be looming in undeveloped paddocks. It is equally difficult to identify soils with high potential if the existing pasture or land use is not demonstrating this.

In the past, pastures have been sown that have not had a strong and even establishment or have not persisted for as long as expected. This has generally been blamed on poor rainfall after sowing or dry autumns at the first seed set.

In actual fact it was that the pasture mix sown in that paddock was not suitable for the soil in its current state, be it sub soil acidity, compaction or low levels of essential nutrients.

How strong an effect has sub soil conditions had on pasture performance?

Many paddocks with lower than desired performance had been tested to a depth of 10cm and had shown there were no extremely low nutrient levels.

These tests missed two factors that were affecting plant growth:

1. Sub soil acidity and very low levels of sulphur were preventing plant roots from penetrating this layer where a large amount of moisture and soil nutrients were stored.
2. Compaction in the upper subsoil (30-60 cm) was preventing root and water penetration into the sub soil.

Deep tillage with a chisel plough in February 2004 was used to break up a compacted soil at 10 – 15 cm depth. The paddock was a clover grass mix that performed well in good times but dried off quickly in summer.

The sub soil had a smeared effect over a hard pan from a disc plough in wet conditions 8 years before.

An oats crop was sown and the roots of this crop quickly penetrated to one meter deep and thrived on the nutrients that had been locked away in the subsoil.

By understanding subsoil characteristics pasture improvement plans can be set out with more confidence that the pasture sown will persist well into the future providing a valuable production asset to the farm business.

How does a soil map improve the economics of pasture management?

Understanding the soils across a property allows managers to make well-informed decisions to tailor their pasture and grazing management to suit.

Firstly a soil map highlights areas that would lend themselves to intensive operations such as hay production and cropping. At Belgravia some of these soils were simply the paddocks at the back of the property so the pastures had never been as high on the priority list as the already improved paddocks seen every day at the front of the property.

By identifying light soils with low levels of sulphur and phosphorus, then planning a native pasture species mix to suit, these soils can be used to their full potential and managed to promote summer feed through rotational grazing.

The cost of sowing an improved pasture in these light soils only to find the next season that it has not survived far outweighs the cost of the soil mapping exercise.

How has a soil map changed grazing management?

Soils with a high organic matter level and high cation exchange capacity seem to have a strong correlation with lower compaction than lighter soils.

Therefore, these heavier soils are able to withstand heavy grazing during wet periods and not form compaction layers.

By predicting soil behaviour in different seasons along with pasture growth cycles the grazing program can be fine-tuned to allow both plant and soil health to be managed together.

Summary

Collecting information already held on farm along with observed pasture performance gave a strong indication of what was expected in soil pits. Some pits were as expected, but many gave explanations as to why pastures had limited growth, be it a chemical or physical restraint.

After completing the 65 pits and becoming familiar with field inspections to quickly gather basic information on soil health, staff were able to better understand firstly what was restricting pasture growth and secondly how to improve the soil.

A paddock by paddock improvement plan has been developed to fit in with production and budget requirements to allow a continuing pasture improvement program to steadily increase carrying capacity towards the desired level whilst improving soil health and preserving valuable topsoil.

Each paddock has its own recommendations covering any tillage requirements e.g. Deep tillage for compaction, ameliorant recommendations eg Gypsum to improve soil structure whilst providing sulphur, Fertilizer recommendations and pasture species mix and sowing rates.

Paddock subdivision plans are also included to ensure paddocks fit into a rotational grazing system to reduce the incidence of overgrazing.

By reducing input costs on low productivity soils with a high cost of repair and focusing improvements on soils with high production capability, the return per dollar invested in pasture improvement can be significantly increased.