

# Soil health in blueberries

Kevin Quinlan, Leader, Northern Horticulture, NSW Department of Primary Industries

## What is soil health?

The term 'soil health' gets used a lot and there is always agreement that it is important, but the term soil health means different things to everyone, with there being lots of different opinions on what makes a soil healthy.

At the core of soil health is the concept that all aspects of soil, that is, physical structure, chemical components and biological life are considered together. By managing structure, nutrients and biology in the soil, farmers can use soils within their capability so that the soils can be used productively without being degraded.

## A healthy soil:

- Supplies nutrients, water and oxygen for healthy plant growth
- Allows water to infiltrate freely
- Resists erosion
- Stores water
- Readily exchanges gases with the atmosphere
- Retains nutrients
- Resists disease
- Contains a large and diverse population of soil biota
- Is free from constraints such as sodicity and salinity
- Has a range of pore spaces to house organisms, nutrients and water

## To maintain and improve soil health, farmers need to manage their production system so that it doesn't degrade the soil by;

- Controlling waterflow to prevent erosion
- maintaining soil structure
- maintaining or improving soil organic matter levels
- maintaining or improving nutrient levels and water holding capacity of the soil
- fostering beneficial soil biological activity

## Controlling Waterflow

The significant rainfall events experienced in NSW over the past two years have highlighted the need to have in place ways of controlling waterflow. There are three general areas to focus upon for controlling waterflow – run-on, stable water courses (run-off) and within a block.

### Run-on

To control run-on, the best strategy is to have ways of intercepting water before it runs into a block and directing it around the block. Often referred to as "head drains" the use of a grassed over bank is the most common way of doing this. The bank and the channel created on the upslope side of the bank then need to be directed around the block and discharged into a stable grassed watercourse (the run-off system). Other options are to use roadways as both a trafficable area and a drain, but care must be taken when doing this to ensure the roadway is stable and not subject to erosion.

There are many considerations when designing and constructing systems, such as ensuring the peak water-flow can be accommodated, they are trafficable and stable. Ensuring these drains are maintained is also a critical factor in their successful use.

### Stable water courses (Run-off)

Natural drainage lines are a critical part of your management processes. Ensuring these are managed to maintain a high level of groundcover (>95%) is critical. Ensuring plantings do not run through natural drainage lines is important. Where scouring or soil movement is noticeable, work to address the cause such as loss of groundcover. For stability, ensuring where drainage lines are grassed, they are kept short by frequent mowing is advisable as this reduces the resistance to waterflow and avoids the grass being torn out in adverse rain events.

## Within a block

Ensuring that water flow is managed within a block is critical. Often this is the most difficult area for managing waterflow as there is a need to balance production decisions and water management. Ensuring mounds are designed and constructed to shed water to the interrow and maintaining groundcover is a critical aspect. Careful management of the covered mound and interrow is critical to avoid scalping along the edge of the mound.

## Maintaining soil structure

Good soil structure is important as it provides the basis of creating an environment that is conducive to root growth, which underpins healthy plants. Soil is composed of sand, silt, clay and organic matter. The tiny particles of sand and silt are bound by clay and organic matter into aggregates.

The arrangement of aggregates gives soil its structure. Good soil structure has adequate spaces (pores) between aggregates to allow water and air to enter the soil and drain easily, while holding enough moisture to maintain plant growth. Poor soil structure has few aggregates and few pores between soil particles.

There are a range of factors that impact upon soil structure, such as tilling, compaction, soil chemistry (e.g. sodicity) and the level of organic matter. Ensuring you do not till wet paddocks (e.g. when establishing an orchard), using light weight machinery and/or not driving on wet soil to avoid compaction and undertaking soil chemical analysis to determine any constraints like sodicity are all important for ensuring good soil structure.

**Soil sodicity is the accumulation of sodium salt relative to other types of salt cations, especially calcium.**

Above all, ensuring the soil has high levels of organic matter will ensure the soil has good structure. A key way that organic matter does this is by feeding the soils biology (e.g. earthworms). Organic matter will not only lift soil structure, it will also increase the soils ability to hold nutrients (through increased cation exchange capacity).

To provide adequate organic matter you can either produce it within the orchard (e.g. cover crops) or bring it in (e.g. add compost to mounds). The cover crop species selected can also provide advantages such as increasing nitrogen levels (e.g. legumes like clover), help to control soil pathogens (e.g. Brassica species) and provide a habitat for beneficial insects. When establishing or replanting a block is the ideal time to incorporate organic matter into the plant mound.

## Maintaining Soil Chemistry

Ensuring the soil chemistry is balanced is critical for good soil health. The availability of nutrients is related to the soil pH. The pH of a soil is considered a master variable – ensuring it is within an adequate range for not only crop production, but also beneficial microbial growth is critical.

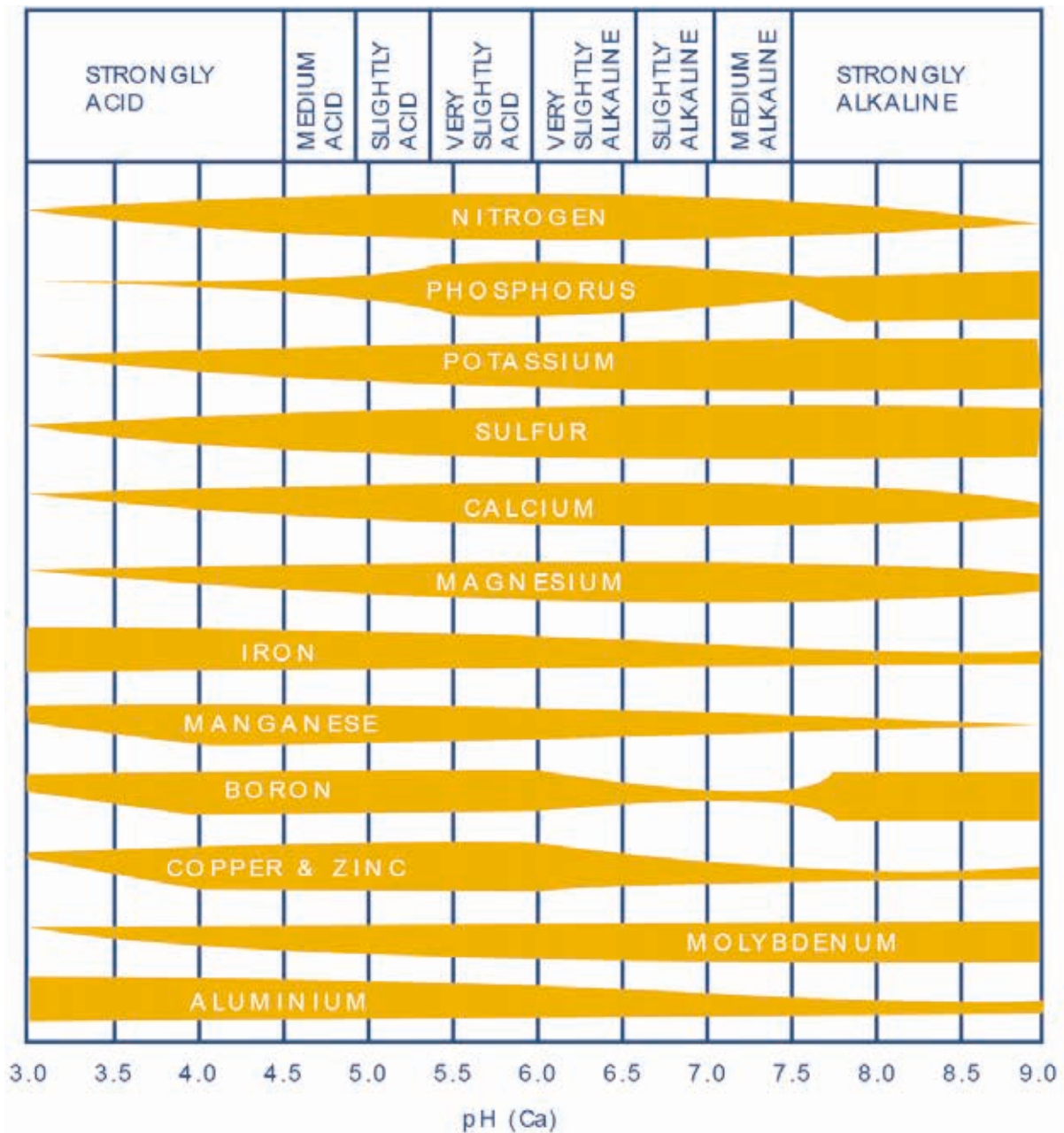
As blueberry is an acid loving plant, a pH between 4.5-5.5 is considered optimum for production. It should be noted that this should be measured within the mound, as this is where the active rootzone of blueberries is found. Within the interrow a different pH can and may be favourable to exist. You may find you have a naturally higher pH in the interrow and this could be beneficial for cover crop growth, soil microbes and soil carbon accumulation.

If you were aiming to establish a legume based cover crop, knowing your interrow pH is critical because many legumes will not nodulate at lower pH and growth will be restricted. It would be advisable to consider your plant mound and your interrow as separate cropping areas.

Monitoring nutrient levels within your soil is critical to ensure you do not have excess or deficiency of an element required for plant growth. As pH will control the availability of elements, ensuring you monitor your soil levels is critical to ensure you are not creating a deficit or excess of a particular element.

If you are looking to grow specific cover crops, undertaking a soil test within the interrow would assist with ensuring there is sufficient available nutrients for the species you select. Monitoring will allow you to fine tune your application rates to meet plant requirements.

The availability of specific nutrients in soils changes with the pH. The thicker the yellow band, the more soluble the element is at that level of soil acidity or alkalinity.



### Water holding capacity of the soil

The water holding capacity of a soil is a measure of the soil's ability to retain and provide water not only for plant growth but also microbes. From a production point of view, the higher a soil's water holding capacity, the less irrigation you will need.

Increasing your soil's organic matter levels will increase its water holding capacity. With increased organic matter in dry times your soil will have more resilience and could reduce the frequency of irrigation you need. An increased water holding capacity will also improve nutrient cycling and availability.

## Fostering beneficial soil biological activity

Soil biological activity is a critical aspect of soil health. The aim is to create a soil environment that promotes the growth and reproduction of good soil biology and in turn suppresses the growth of bad (often disease causing) soil biology.

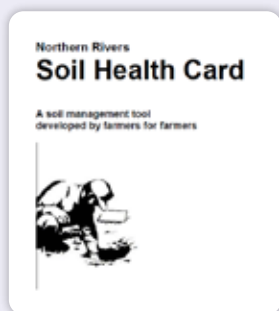
To sustain soil biology, you need to ensure the microbes within your soil have a home to live in and food to eat. To achieve this, make sure there is good soil structure and balanced soil chemistry.

Soil microbes require carbon, and this can be provided by organic matter. You can do this through the addition of material such as compost or mulch, or through the growth of interrow crops. A diverse interrow crop will provide the opportunity to sustain a diverse soil microbiology. Many plants produce and release root exudates that attract soil biology, which can perform functions like releasing nutrients from organic matter or bound to soil.

As a general rule, the amount of biomass a plant has above ground is equivalent to what it has below ground, increasing a cover crop's biomass will provide more food to soil microbes which can then assist with crop production.

## Northern Rivers Soil Health Card

The Northern Rivers Soil Health Card is a tool that was created by farmers for farmers to use to measure their soil health. It has 10 easy to use tests to check your soil health. These tests can be carried out to continually measure your soil health and see changes over time.



### North Rivers Soil Health Card

This tool can be downloaded from [bit.ly/Soil-Health-Card](https://bit.ly/Soil-Health-Card)

## Summary

Having a healthy soil is the foundation for healthy crop production. Ensuring you have good soil structure and balanced soil chemistry is critical to sustaining strong soil biology. When all three are working together, your soil health will be high.

Controlling water flow to prevent erosion will ensure you keep your soil in place. Organic matter is a key component of soil and ensuring it remains healthy. It should be noted that when implementing management practices to maintain or improve soil health, one action can have multiple benefits to a farming system.

For instance, the planting and maintenance of a cover crop could improve soil structure, increase soil carbon, prevent erosion and increase biodiversity. It can be provided by additions or generated from within the interrow. Using cover crops to generate organic matter within the orchard can serve many purposes and offers growers the opportunity to produce organic matter cheaply.

## More Information

Soil CRC – Soil health – why it matters  
<https://soilcra.com.au/soil-health-why-it-matters/>

Agriculture Victoria – What is soil health? [https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth\\_what\\_is](https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth_what_is)

Soil and Water Management Practices for Blueberry growers in Northern NSW - Northern Rivers Soil Health Card  
[https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0007/168703/northern-rivers-soil-health-card.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/168703/northern-rivers-soil-health-card.pdf)

Irrigation and moisture monitoring in blueberries  
[https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0016/303325/Irrigation-and-moisture-monitoring-in-blueberries.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0016/303325/Irrigation-and-moisture-monitoring-in-blueberries.pdf)

Forage Brassicas – quality crops for livestock production  
[https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0003/146730/forage-brassicac-quality-crops-for-livestock-production.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/146730/forage-brassicac-quality-crops-for-livestock-production.pdf)

Growth and physiological characteristics of four blueberry cultivars under different high soil pH treatments <https://www.sciencedirect.com/science/article/pii/S0098847222000648>

Effects of soil acidity <https://www.agric.wa.gov.au/soil-acidity/effects-soil-acidity?page=0%2C2>

Impact of soil acidity on crop yield and management in Central Western NSW <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2016/07/soil-acidity-crop-yield-impacts-and-management-in-central-western-nsw>

Macadamia grower's guide: nutrition and soil health – the foundations  
<https://www.dpi.nsw.gov.au/agriculture/horticulture/nuts/growing-guides/macadamia-growers-guide-nutrition-and-soil-health-the-foundations>



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