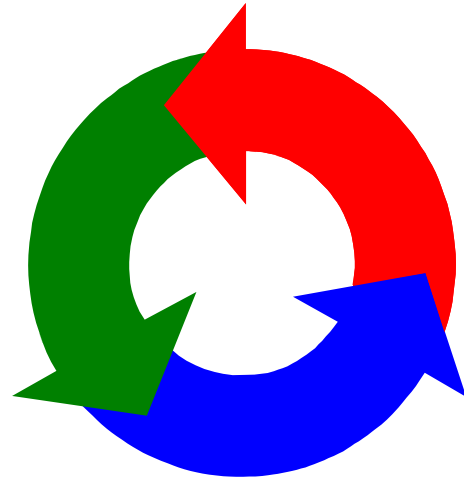


SWEP FACT SHEET #4

What is a Balanced Soil?



There is always a lot of talk about balance, with everything from diet to interior décor, but what does it mean? In Soil, balance generally refers to the relative proportions of various minerals, but confusion arises when people accustomed to thinking about plant nutrition try to assess the value of soil balancing recommendations.

In this Fact Sheet, we look at what constitutes a balanced soil, what it takes to achieve this and what the benefits to production really are.

There are lots people talking about balanced soils, but what do they mean?

First, a little history. During the first half of the 20th Century, Dr William Albrecht studied soils and developed the first properly documented balancing system. He was the first to attempt an understanding of how soils ‘behave’ and how plants obtain their nutrients from soil. One of his papers: *Insoluble yet Available* he noted that plants actively acquired the nutrients they need, rather than simply wait for them to be washed in by water.

This means that we **cannot** treat the soil as a chemical sponge – putting in fertiliser and taking it out again as a crop. Rather, we need to optimise the processes in the soil that naturally supply nutrients to plants in a consistent and timely manner. In Dr Albrecht’s own words: “Feed the soil first, then the plant”.

Later (beginning in the 1960s and without knowing of Albrecht’s work) Ted Mikhail also developed a soil balancing system with a number of similarities to Albrecht’s. However, where Albrecht began by comparing soils of varying productivity to find a common theme, Mikhail began with a simple idea: “Soil is a Living System with three main components – Structure, Nutrients and Biology. These need to be balanced both within themselves and between each other for the soil to be in balance”.

The balance concept he used in developing what we now call the Mikhail System can be compared to what we think of when talking about a balanced diet for ourselves. That is, the soil and human body both have structure. For people this means strong healthy bones and these require the right balance of Calcium, Magnesium and Phosphorus. In the soil, this balance requires Calcium, Magnesium, Sodium, Potassium and Hydrogen.

Of course a healthy skeleton is required to support the tissues and muscle of the body and these things require balanced proportions of protein, carbohydrate and fat. Similarly, good soil structure is the foundation that supports the development of good soil fertility – by which we mean the right balance of Nitrogen, Phosphorus, Potassium and Sulphur. Naturally healthy people also require vitamins and minerals in their diet – so to plants need Trace elements.

But balance does not end there for either soil or people. Healthy people also need the right balance of good bacteria in the digestive systems and on their skin. Soil is no different and in both cases their function is to aid in making nutrients available and to protect against disease.

How do we Balance Soil?

Soil is more than just rock dust. Soil colloids (clay and humus particles) have a kind of static charge, to which various elements are attracted and held in an “exchangeable” form. There are many elements in the soil, but of those present in an exchangeable form, the most abundant are Calcium, Magnesium, Potassium, Sodium and Hydrogen and they compete with each other for the available space on the surfaces of the colloids.

The relative proportions of these minerals can have dramatic effects on the physical nature of the soil. For example, when Calcium is low and Magnesium is high even a sandy soil may set rock hard when dry. The ideal proportions are shown in Table 1.

To achieve a proper balance, we first need to know the relative proportions of these important elements, but one problem can be the amount of Hydrogen. This is found in very high quantities in the organic matter of soil and if we try to balance all the exchangeable Hydrogen with Calcium and Magnesium, the result will be over-liming.

For this reason, the amount of Hydrogen must be adjusted according to the amount of organic matter in the soil. Then the objective is to fill 65% to 70% of the available exchange sites with Calcium and 12% to 15% with Magnesium. Three materials are available to add Calcium to the soil – Lime, Dolomite and Gypsum. Lime is used where we need to replace excess Hydrogen with Calcium and Gypsum is used when we need to replace excess Magnesium and/or Sodium with Calcium.

A similar choice applies to soils that need Magnesium. In this case we can use either Dolomite, Magnesium Oxide, or Magnesium Sulphate.

How does soil balancing improve production?

A balanced soil has better structure; it is more porous and so permits better access by plant roots. It also has the full range of nutrient elements in a consistently available supply, but perhaps most importantly it has a high level of microbial activity.

Plants do not depend entirely on their roots to obtain nutrients; they also have partnerships with micro-organisms in the soil. These associations are vital to their health and productivity.

The problem with assessing the benefits of soil balancing is that things don't get gradually better as the balance improves. If the balance is not right the soil system doesn't work properly and will not do so until the proper balance is reached. However, when this point is reached, a substantial improvement in vigour and productivity of both plants and livestock can be seen. On pasture, the first sign may be a striking preference by livestock for a treated paddock over any other.

For more information on the material covered in this Fact Sheet, contact SWEP on (03) 9701 6007 or visit our website: www.swep.com.au

Exchangeable Cation	Calcium	Magnesium	Sodium	Potassium	Adjusted Hydrogen
Ideal proportion of the Adjusted Cation Exchange Capacity	65-70%	12-15%	< 5%	3-5%	< 20%

Table 1. Soils with these proportions of exchangeable cations will show excellent structure and optimal nutrient availability, maximising productivity and making management easier.