Characteristics of North Coast Soils

FACT SHEET 5

Chemical analyses of over 200 soil samples collected from across the north coast region were reviewed to identify key features of soils of the area. A component of the Understanding our Soils project, these data were also collated and submitted to the Soil and Land Information System (SALIS) database.

North Coast Soils

Soils of the region are typically very old and strongly weathered, the majority originating over 20 million years ago predominantly due to volcanic eruptions of Mount Warning/ Wollumbin. Soils vary widely over short distances so the concept of discussion of 'averages' in reference to soil chemical analyses is not particularly useful but will be used for the purpose of summarising data here.

Land use and management actions such as the addition of soil amendments or fertiliser will also contribute to change the inherent chemical composition of soils. These factors were not considered in this summary.

The samples were collected from within the Richmond, Brunswick and Tweed River Catchments from a wide range of soil types and land use. The majority (85%) of soils sampled were collected from grazed pastures with the remainder from a range of horticultural crop soils.

All soil samples were collected to 10cm depth and chemical analysis was conducted by the Environmental Analyses Laboratory (EAL) located at the Southern Cross University, Lismore. The guidelines provided by EAL provide the basis for comments on the summary of results.

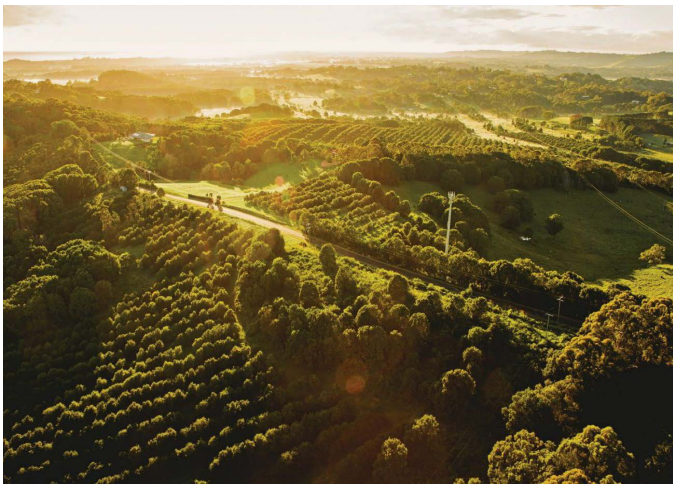

Figure 1: Soil samples were collected from a range of soil types, position in the landscape and different types of land use within the North Coast region.

Features of local soils

Carbon levels, although mostly less than ideal (5%), were generally in the acceptable range across the majority of soils tested. The median was 4.2% and ranged from 0.9% up to 19.9% in a swampy peat soil. However, the carbon:nitrogen ratio (C:N) of the majority of soils was relatively high indicating poor levels of biological activity required to effectively cycle carbon. The ideal C:N ratio is between 10 and 12 and the median level recorded among the coastal samples was over 13 and ranged from 9.7 to 26.8.

Soil pH levels tended to be slightly more acidic than what is generally considered ideal for plant growth. The average pH (1:5 water) was 5.85 where the ideal levels range from 6 - 6.5.

Cation exchange capacity varied widely among the soils sampled, from 2.5 to 79 $cmol^+/kg$. The median CEC of 14.2 cmol+/kg reflects the age and degree of weathering of many North Coast soils.

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Calcium:Magnesium ratios were consistently low and averaged less than 2:1. Ideally in heavy soils the Ca:Mg ratio will be around 6:1 and in light sandy soil 3:1. Less than 6% of soils sampled exhibited close to an ideal ratio with 30% of soils having less than 40% Ca occupying exchange sites. Soils with low percentage of calcium occupying exchange sites were often associated with the presence of high levels of aluminium.

In the majority of cases the primary cause of a low Ca:Mg ratio was excessive magnesium. Where the CEC is occupied by excessive magnesium soil tends to be more compacted with low bulk density, low porosity and poor soil water infiltration.

Electrical conductivity (EC) levels were low for the majority of soils sampled. Ideally levels will range between 0.2 and 0.1 dS/m. The median EC was 0.05 dS/m with only 11% of soils exceeding 0.1 dS/m. Often described as a measure of salinity and discussed in conjunction with Exchangeable Sodium Percentage (ESP) no relationship was not observed in the North Coast soils data. Three soil samples with adequate EC levels were associated with high sodium (>3% Na), although 15% of samples registered high Na only 2 samples could be considered sodic (>5% Na) and these soils did not register high EC levels. Half the soils with EC >0.1 dS/m were associated with higher potassium levels.

Phosphorus (P) levels for plant available forms of phosphorus were generally low. At only 2% of sites P levels could be considered adequate and 2% of sites recorded excessive available P. All other sites were deficient in available phosphorus based on the soil sample analyses interpretation standards provided by EAL. The median level of Bray 1 phosphorus tests across all samples was 6.7 mg/kg.

Of all soils sampled for chemical analyses 56% were tested for total nutrients, as well as plant available nutrients. Considering this subset of samples the available proportion of the total phosphorus pool was on average 0.9%. Much of the total P pool was presumably bound with Iron and aluminium, both of which were present in high amounts in North Coast soils.

Potassium (K) levels in North Coast soils were quite variable although in most samples were within the acceptable limits for the range of soil types. Ideally contributing between 3 and 8% of exchange site composition, average K % of all soils were within this range at 5%. Potassium was present at below optimal levels at 23% of sites and in excess at 18% of sites.

Sulphur (S) levels were variable and on average were adequate with only a single example of an obvious acid sulphate soil. A total of 15% of soils sampled exhibited excessive levels of sulphur presumably a result of inappropriate application of sulphur fertilisers.

Trace elements

Iron (Fe) and **Aluminium** (Al) were the most abundant of the trace elements present in North Coast soils sampled. Iron was high in all samples tested, averaging 224 mg/kg. Of the soils sampled 20% recorded Al contributing in excess of 10% of the CEC.

Zinc (Zn) levels of between 3 and 6mg/kg, depending on soil type, are considered adequate. Of the North Coast soils sampled 45% recorded Zn below 3 mg/kg and 10% had levels in excess of 10 mg/kg.

Manganese (Mn) was present in variable amounts. Most samples contained appropriate levels of Mn, the median value of all records was 28 mg/kg. A total of 22% recorded deficient levels (<15 mg/kg) and 24% had Mn levels in excess of requirements (>50 mg/kg).

Copper (Cu) levels also exhibited a large degree of variability but tended to be marginally low. Ideally present at between 1.2 - 2.4 mg/kg, the median of all samples was 1.14 mg/kg and 45% of samples were deficient (<1 mg/kg) in Cu.

Boron (B) was the most deficient of all trace elements among North Coast soils with 88% of samples analysed recording levels less than 1 mg/kg. Of the four samples where B was present at >2 mg/kg, three were associated with an ideal percentage of calcium present on the exchange sites.

Details of the role of each nutrient in plant growth are provided in Factsheet 3 of this series.

More Information

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