



## TECHNICAL NOTE

# SEASONAL AND ENVIRONMENTAL EFFECTS ON SOIL TEST RESULTS

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There is a need for soil testing to be conducted throughout the year so that recent test results are available to farmers and growers before they apply fertilisers, and also for a practical reason that advisors cannot take soil samples from all of their clients' properties at the same time.

There are some known effects on soil test results from different environmental conditions, predominantly soil temperature and moisture, which in turn create seasonal differences in soil test results.

### Effects of soil temperature and moisture:

Soil microbes will derive energy and release nutrients from soil organic matter provided that the soil temperature is higher than about 10 degrees C. The rate of microbial digestion of labile organic matter is much less affected by soil moisture deficit than the ability of plants to uptake nutrients from the soil.

- The effect is that 'plant available' nutrients nitrogen, phosphorus and sulphur are released into the soil at a faster rate than plants utilise them during drought or summer dry soil conditions. Soil test results for phosphorus (Olsen P) may be elevated slightly and sulphur (SO<sub>4</sub>-S) and potassium (K) elevated significantly.
- Mineral nitrogen (sum of nitrate-N and ammonium-N) may be higher than usual in dry conditions as the NO<sub>3</sub>-N fraction can accumulate when soil moisture low i.e. plant uptake and leaching both reduced. The routine cropping soil N test conducted is Available N (or Anaerobic Mineralisable N) and would not be significantly affected.
- An additional problem in summer is that dry soil is physically hard and the soil sampling probes tend to compress the soil, so that the true sampling depth is shallower than the intended depth.
- Soil pH may drop by up to 0.2 pH units during warm soil conditions due to the combined effect of organic acid release by microbes and growing plants roots.
- During wet winter conditions, pH generally increases slightly (back to 'normal') due to the reduction in the rate of microbial and plant growth. K and SO<sub>4</sub>-S may be lowered in soils that leach easily, after significant rain events. Phosphorus is not very mobile in the soil and does not readily leach in most soils, so soil tests (Olsen P) are little affected by wet conditions.
- During spring and autumn flush growth conditions, when soil temperature and moisture are not limiting, nutrient uptake by plants is rapid. Soil test results for phosphorus, potassium and sulphur may be temporarily depressed as the immediately available pool of nutrients is depleted.

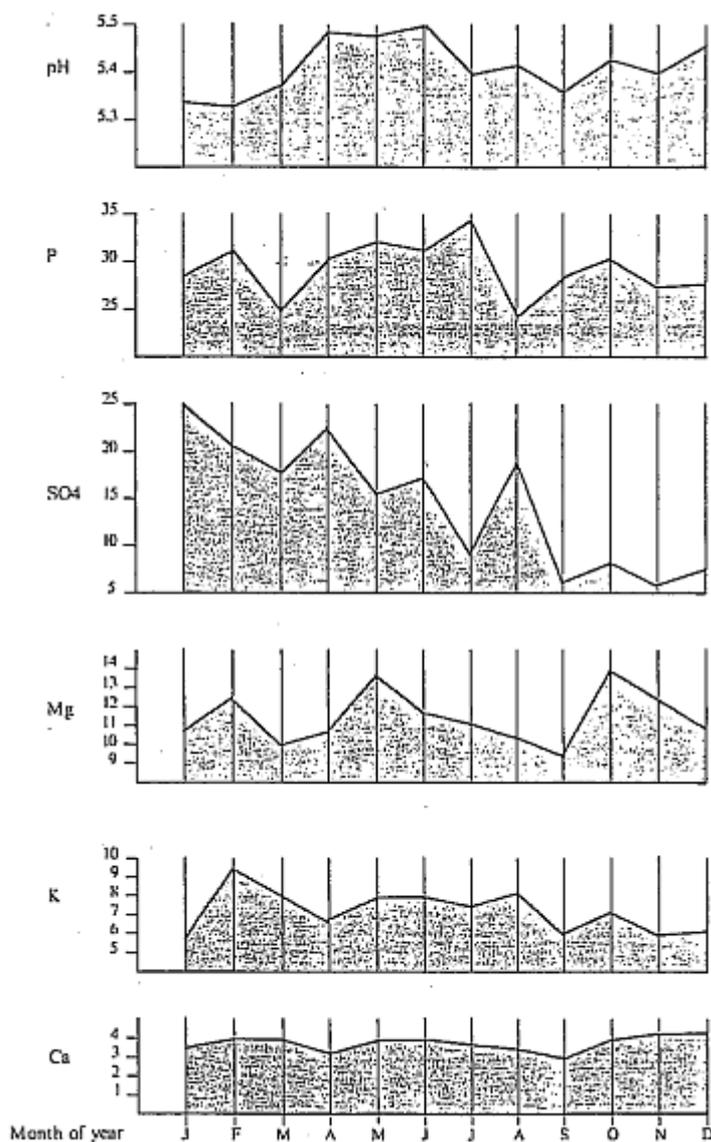


Fig 1. Variation in soil test values on a Taupo ash soil.

Fig 1 portrays the soil-test variability by month in a single paddock of a high-producing dairy farm from a study carried out several years ago by MAF, on a Taupo soil. (Ref: Edmeades, D.C., Cornforth, I.S. and Wheeler, D.M. Occasional article "Getting maximum benefit from soil testing". Ruakura Soil & Plant Research Station, Hamilton.

## Sampling

To minimise variability in soil test results arising from seasonal and environmental effects, it is recommended that samples are collected at the same time of year as previous samples taken – under similar conditions where possible. Avoiding extremely dry or wet conditions is advised. Collecting an adequate number of soil plugs is very important to reduce the variability across the sampled area. The full value in soil testing comes from repeat samplings over several years and graphing the results as trendlines to monitor mean levels and adjust fertiliser inputs where needed.

Please refer also to the companion Technical Note "Soil Test Variability" that discusses sample depth and other spatial effects on soil test results.