Soil testing (7-3)

Some knowledge and skill is required to take soil tests which accurately reflect the soil fertility of a farm. For this reason it is best to leave this task to a professional, although some awareness of the process is useful.

Why soil test?

The average dairy farmer spends about $0.45 per kg MS on fertiliser. Fertiliser costs are frequently the largest item of discretionary spend on the farm. The bank of nutrients in the topsoil of any farm represents a major investment and like all investments it needs to be monitored. The only way to do this is to set-up and maintain a robust soil fertility-monitoring programme.

How to soil test

Pasture
1. Divide the farm into blocks – areas of similar: soil group (sedimentary, volcanic, pumice, peat, sands), current and past management (effluent, non-effluent, silage/hay paddocks, day/night paddocks, length of ownership, fertiliser history) and slope (flat, rolling, easy, steep).
2. Select a paddock or group of paddocks which is/are representative of each block and define a path (transect) from which the samples are to be collected.
3. Take one soil sample from each representative area (a soil sample normally consists of 15-20 cores 0-75 mm depth) using a standard soil auger (do not use a spade or trowel) and do not include broken cores (sampling depth is important).
4. Studiously avoid: dung and urine patches, stock camping areas (e.g. gates, fence-lines, troughs etc.). This may mean not taking soil samples from a freshly grazed paddock because the urine patches will not be visible (Just 1 core from a nutrient rich area will greatly elevate the soil K and S levels).
5. Mark the transects from which the soil samples have been collected on a farm map or by painting the appropriate fence posts. GPS co-ordinates, while useful are not necessary. Use these same transects at the next sampling date (preferably every year).
6. Do not bulk together samples from different transects.
7. Clearly mark each bag with the correct transect label and send the samples to the lab as soon as possible (If this cannot be done store the samples in a refrigerator).

Cropping
1. As above except use a 0-150mm soil auger and sample the cropping paddocks prior to cultivation.
When to soil test

1. Soil nutrient levels are variable over time so it is best to soil test at the same time as done in previous years so that the results are consistent.

2. If setting up a new soil testing regime then it does not matter whether the samples are taken in autumn, winter or spring. But thereafter stick to the same month subject to point 3 below.

3. Do not sample when the soils are either waterlogged or too dry (i.e. cannot insert the auger).

4. Do not soil sample after fertiliser is applied (except urea). Wait until the fertiliser has dissolved and there is no trace of any fertiliser granules on the soil. (This will normally take 1-2 months or after 25 mm of rainfall).

Soil test variability

Like all biological measurements, soil test results can be variable. This does not invalidate their use. However, it does mean that care is needed to ensure that variations are minimised and that it is taken into account when interpreting results. Tests taken from the same area over a number of years are more valuable than one single test.

The two main sources of variation are spatial and temporal.

1. **Spatial variability** means soil fertility varies from spot to spot within a paddock. This is due to uneven distribution of dung and urine and the variability of soil with respect to properties such as topsoil depth, texture and moisture. This is the largest source of variation. There is likely to be more variation within a paddock than between paddocks of the same block.

2. **Temporal variation** relates to variation over-time. This may be the consequence of a major leaching event, changes in the rate of mineralisation of organic matter, the addition of fertiliser or the changes in the moisture content of the soil.

The table shows typical variation that can be expected for the major tests when using proper sampling technique.

<table>
<thead>
<tr>
<th>Soil test</th>
<th>Variation (%)</th>
<th>Example result and range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>2-5</td>
<td>6.0 ± 0.3</td>
</tr>
<tr>
<td>Ca</td>
<td>10-15</td>
<td>6 ± 2</td>
</tr>
<tr>
<td>K</td>
<td>20-30</td>
<td>6 ± 3</td>
</tr>
<tr>
<td>Mg</td>
<td>10-15</td>
<td>12 ± 3</td>
</tr>
<tr>
<td>Olsen P</td>
<td>15-20</td>
<td>25 ± 10</td>
</tr>
<tr>
<td>Sulphate S</td>
<td>20-40</td>
<td>10 ± 6</td>
</tr>
</tbody>
</table>

Getting the best results from your soil tests

Because soil test levels are variable over time and space, the results are best used by looking at the trends over time, relative to the optimal levels for each test (see Farmfact 7-5 Critical nutrient levels for pasture). This is a good way to 'see' what is happening on any given block. If for example, they are above the optimal range and are still trending up, this suggests that too much of that particular fertiliser is being applied. Alternatively if a given soil nutrient is declining and is below the optimal range then more of that nutrient is required.

Further Reading: Roberts and Morton 2009: Fertiliser Use on New Zealand Dairy Farms. Fert Research.