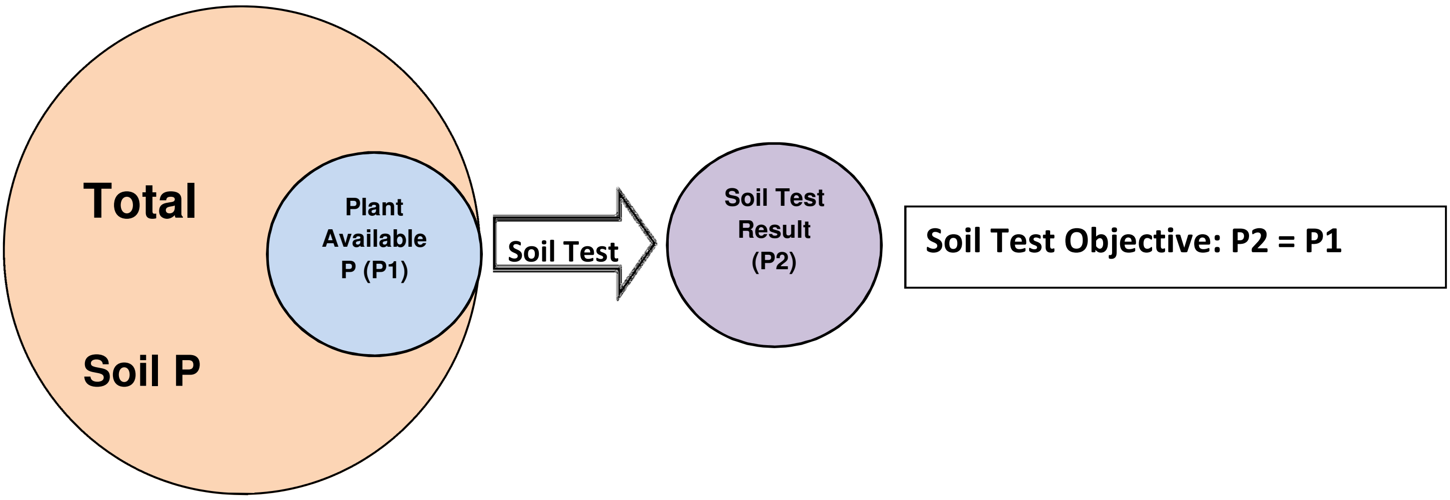
Soil Phosphorus (Part 3) – **Soil Testing: Assessing Plant Available Soil Phosphorus**

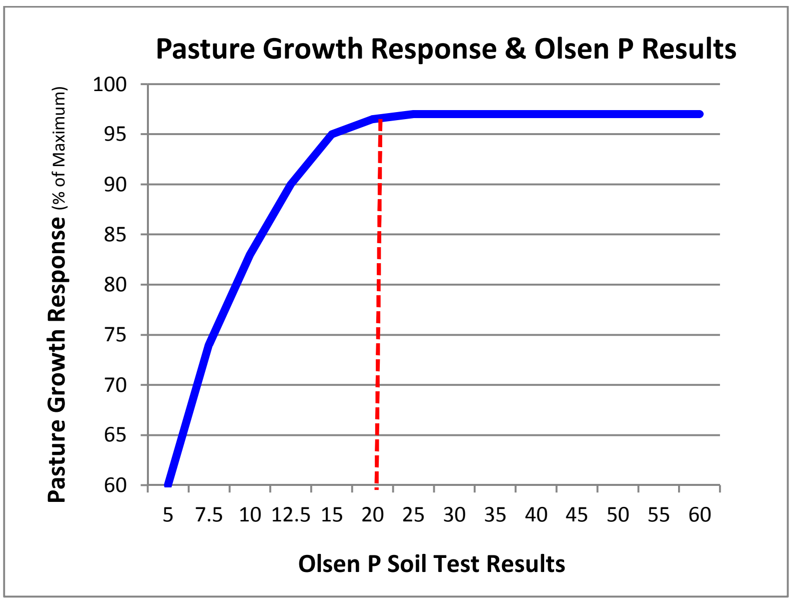
In the previous articles in this series on Soil Phosphorus (P) we have looked at how soil P status changes over time during soil development (Part 1), and taken a brief introductory look at some of the processes/products involved in the P cycle (Part 2). At any point in time, P can exist in a variety of different forms in the soil, depending on the prevailing soil conditions (pH, moisture, temperature, concentration of ions present etc).

Historically, NZ soils have often been deficient in soil P, therefore it is vital to know that there is enough plant available P in the soil, so that production is not limited by a P deficiency. Soil tests are an excellent tool to help ascertain levels of plant available P in the soil. The objective with soil testing is to derive a quick, cheap, robust and reliable laboratory test in which the result obtained (P2 cf figure below) correlates closely to the actual level of plant available P in the soil (P1), and thus provide a good indication of fertiliser P requirements.



Over the years, a variety of different soil tests have been devised in an attempt to achieve the above objective (Olsen, Bray, Truog, Mehlich, Colwell, Modified Morgan (Reams) and Resin etc). Some tests are more reliable in some soil conditions, whilst others are more useful in other conditions but generally speaking, each test tends to have some limitations as to its usefulness. Over time, the Olsen P (OP) test emerged as the de facto standard for soil P testing, although in more recent times the Resin and Mehlich tests have become more prominent.

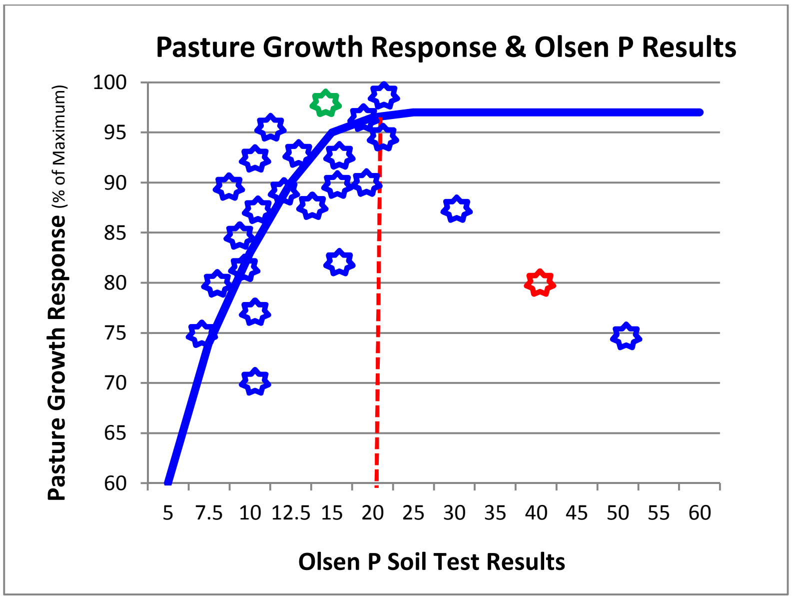
OP uses a bi-carbonate alkaline extractant which has a tendency to overestimate plant available P in low pH and high P retention soils (ash parent material), whilst underestimating plant available P in the following types of soil situations: higher pH and/or recently limed soils, and soils which have been fertilised with RPR fertilisers. Nevertheless, OP has one big advantage – it has been extensively calibrated with respect to plant growth response over a wide range of NZ soils.



The adjacent figure illustrates the typical correlation between pasture growth and the Olsen P soil test results for NZ soils. It shows that once the Olsen P test result reaches about 20, there is generally very little increase in growth response, and thus little benefit in adding additional P fertiliser i.e. once the Olsen P test results reach a value of 20, it is assumed that pasture growth response is at a maximum.

Whilst this correlation is a helpful guide or "rule of thumb", it is important to remember that in reality, the line on the graph is not an absolute determination that applies to each and every individual soil in NZ. It is an arbitary line of "best fit" which depicts the average situation of all the soils tested in the original calibration trials. For instance, a soil test may give an

Olsen P result of 15 (well below the optimal value of 20), but despite this, that same soil may still produce a maximum pasture growth response. How come? Because the latter soil type does not fit exactly on the graph line of best fit and/or because this soil functions in a slightly differently way with regard to P than the norm!



The figure on the left illustrates this point more clearly i.e. the green data point (OP 15) produces a growth response better than the line of best fit would predict. On the other hand, the red data point (OP 40), generates a growth response which is significantly lower than the line of best fit would predict!

The data points in this illustration are purely hypothetical points but they do demonstrate clearly both the strengths and the weaknesses of this approach. What's the bottom line message? The OP growth response correlation is a helpful tool but not an absolute indication of growth response.

For the above reasons, at Soitech, we have found it useful to test plant available P levels in the soil using the OP test in combination with the Resin P test. The latter test is generally an excellent indicator of plant available P across a range of different soils, without some of the interpretive qualifications which apply to the Olsen P test. Though the Resin P test has not been extensively calibrated for NZ conditions like the Olsen P test, this is not really a disadvantage, since there is generally an excellent correlation between Olsen P test results and the Resin P test results.

Using one test to confirm the results of the other generates a greater level of confidence as to the actual soil level of plant available P. And, given that soil P levels markedly affect plant growth and productivity, we believe the benefit of greater confidence in assessing plant available P soil levels is well worth the small additional cost involved in conducting both an OP and Resin P soil test.

Dave McKie
Soiltech Soil Scientist

soiltech
soil fertility specialists