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OLSEN P: The Best Test for Soil phosphorus?

Phosphorus (P) is of critical importance in NZ agriculture, mainly because it exists at plant available levels in most soils which are too low for optimal production. This situation provided the impetus necessary to search for a test to aid primary producers to determine levels of plant available P in their soils. The Olsen P test demonstrated itself to be the best test available at the time and so, in the mid 1970's, it was adopted as the standard soil test for phosphorus in NZ.

For almost a generation now, the Olsen P test has grown in stature and reputation. Its' position is so dominant that a casual observer might easily conclude that the Olsen P test is the definitive statement on soil P, perhaps even the de facto test for soil fertility. The "Olsen P mindset" is so ingrained that for many farmers, ongoing applications of P fertiliser are regarded as mandatory until Olsen P test readings of between 20-30 are achieved. The need for discernment in the use of the Olsen P test appears to have been overlooked, as has an appreciation of the limitations of this test. Readings of 20-30 are after all only an arbitary target or guideline, not an absolute assessment of available P. Several factors impinge on the reading obtained.

The Olsen P test was originally developed in North America to estimate plant available levels of P in alkaline soils. There are however, a number of other useful tests available today as well. Some of these include the Resin P test, the Total Phosphorus test and the P retention test. When combined with the Olsen P test, they give a better appreciation of the P status in a soil than the Olsen P test alone.

Most NZ soils are acidic (pH < 7.0). Where soils are quite acidic (< pH 5.5), the Olsen P test can give an inaccurate assessment, overestimating plant available P. In these circumstances the Olsen P test result suggests that P levels are adequate, whereas this may not be the case. Even in alkaline soils, Olsen P can give a misleading result, underestimating the levels of plant available P. This is especially the case on recently limed soils i.e. a low Olsen P test result is obtained and the conclusion is drawn that more fertiliser P is required, whereas actual plant available levels may be more than adequate. In other situations, such as where a slow release P fertiliser like RPR (reactive phosphate rock) or a liquid fertiliser have been used, Olsen P also tends to underestimate plant available P levels.

Olsen P estimates plant available inorganic P levels; it makes no assessment of the organic component of P in the soil. If the organic fraction comprises 50% of the total P in a soil (as it often does), then the Olsen P test ignores a sizeable fraction of the P that will be mineralised by the decomposition of organic matter.

The Olsen P test can produce variable results, often in the order of 20%. If an Olsen P test gives a reading of 15, then this could equate to a concentration of P in the sample anywhere between 12-18mg/Litre.

Soil is a dynamic system; it is constantly changing. Some of this variability is inherent to soil properties (P retention level, texture, depth etc); some is related to climatic factors (soil moisture status and season etc) and some to topography (stock camps on ridges, depressions etc). Olsen P test results can differ simply as a result of sampling technique and/or variation in the lab.

Now obviously, these comments also apply to other P tests as well but collectively they warn us that a soil test P test is not an absolute and unequivocal determination. Every test has some inherent limitations. A test for available P is simply an estimate at one point in time in a system which is constantly changing. If however, testing has been undertaken for several years, then the end-user can put more confidence in the results obtained i.e. a trend is usually of more value than one isolated individual result.

Given the other P tests that are available today, it is hardly wise "to put all your soil test P eggs" in the "Olsen P basket" even though Olsen P has been a useful test over the years. A more prudent approach is to utilise a combination of soil P tests to establish a more comprehensive picture of the soil P landscape.

The Resin P test has been available for many years now. Though it also has some limitations, it does overcome many of the anomalies associated with the Olsen P test. Perhaps foremost of these is that it extracts P at soil field pH (rather than pH 8.5) using water (rather than a bicarbonate solution). This gives a closer approximation of actual plant available P levels in the soil as well as more closely correlating to the P nutrient status experienced by a plant root. A related advantage is that it more directly accounts for the P retention status of the soil i.e. it directly estimates plant available P without the need to make adjustments for soil type etc. The Resin P test is also more accurate when RPR has been used and in other situations where P exists in lower soil quantities.

The Total P test estimates the amount of inorganic and organic P in a soil. It is therefore a useful diagnostic test in that it gives a better appreciation of the reason plants may not be performing optimally in a certain soil i.e. it helps to determine whether this is because P levels in the soil are simply too low (and thus more fertiliser should be added) or whether the problem is simply one of P availability (there is an adequate total amount present in the soil). In the latter case, availability may be improved by methods other than applying fertiliser i.e. stimulating soil microbes to breakdown organic matter and speed up nutrient cycling or altering pH to levels that are more optimal for P availability.

P Retention is a useful test in its own right but in combination with those mentioned above it provides valuable information with which to assess plant available P levels. In soils with lower P retention, more plant available P is usually available than in high P retention soils. However, high P retention soils which have received P fertiliser for many years have a greater potential to release P back into plant available forms.

When a farmer decides to carry out a soil test, Olsen P is often the only phosphorus test offered. Requesting other tests may cost more, however, when one considers the cost of applying fertiliser, especially if it may not be required, the small extra cost should more correctly be viewed as an investment rather than a liability. In some cases, the price of the soil test also includes a comprehensive report and interpretation of the results by technical experts. Therefore it pays to check what you are actually buying. The temptation may be to take the cheapest option but in soil testing, as in other areas, "you get what you pay for."