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Need More Fertiliser P?

Phosphorus (P) is essential to all living organisms. Grazing animals obtain the P they require from plants, which in turn extract it from the soil in which they grow. Humans derive the P they need by eating primary produce. Clearly then, to sustain our modern intensive agricultural system and the human population, it is critical that an adequate level of P is present in the soil.

Historically, NZ soils were deficient in P. Over the last few decades, this has resulted in ongoing P fertiliser additions to improve not only soil P levels but also farm productivity as well. Today soil P levels are much higher, with most soils recording over 1000 kg/ha (1T/ha) of P present in the root zone of every hectare of soil. Is this enough or is more still required?

Common sense would suggest that if a range of indicators point to soil P levels being adequate, it does not make economic sense to keep adding more and more indefinitely. Surely it makes better sense to look into other factors which may enhance the availability of those soil reserves.

The amount of plant material grown around the country varies, depending on factors other than just the soil P status. If we assume that a hectare of pasture produces 15 tonnes of dry matter/year, and that dry matter contains 0.35% P, then that pasture will extract just over 50 kg of P during the year. Most of this P will be returned to the soil in organic matter, dung etc. True losses, such as removal in products or cull animals might only be of the order of 0.5 - 1.0kg P per stock unit. Hence, if we assume an average stocking rate of 15 SU/ha, then only 7.5 – 15kg P/ha is actually removed from the soil system annually or say a net loss of 10 kg/ha/yr.

If total P reserves are greater than 1000kg/ha, then the P remaining in the soil reservoir is 100 times greater than the P that is actually lost and still 20 times more than the gross pasture P requirement!

Is such a big soil P reservoir required? How much of the P reserve is plant available? Is it still necessary to keep applying 250kg/ha/yr of Superphosphate (or equivalent) to maintain or improve productivity?

There is no one simple answer to these questions. Each soil, farming system, landscape and environment is different. Some soils fix and make unavailable large amounts of P, others don't fix much at all. Some farms are intensive, with higher P demands, while others are more extensive, with lower demands. Some soils have high levels of organic P, others have less. Some soils are alive "biologically", while others are practically dead. Some soils have good physical characteristics, while others are rather poor. Fertiliser approaches and technologies also differ. The point being that there is a huge amount of variability across the NZ farming landscape. Many of these factors will have relevance and need to be taken into account in any discussion of soil P reserves and plant availability of P on any individual farm.

There are several tests that endeavour to measure levels of plant available P. Each has its place and can provide helpful information but none is “bullet proof” – each has advantages and disadvantages. To rely completely on one test result, without some understanding of other related matters can lead to fertiliser decisions that are based more on misinformation than meaningful data.

Olsen P is highly regarded when it comes to plant available P. It is a useful indicator but no more than that. To regard it as the final word on plant P availability, in isolation of other important considerations, is a mistake. Yet this is exactly the approach taken by many farmers. Sadly, the same approach is also adopted by many of their “expert” advisors, which only serves to reinforce this erroneous mindset. For many, Olsen P is not just the final word it is the only word! Armed with an Olsen P test result, they “know” the P status of a soil and how much P fertiliser to order this season!

Now of course, a farmer doesn't want every decision to become over complicated. Over analysis can lead to paralysis in terms of decision making. So what's the bottom line? Take a balanced approach; give due weight to as many factors as possible when assessing P fertiliser requirements. If your soil P status is already good, adding more fertiliser P is not likely to be the best option, rather you might get “more bang for your buck” by improving the biological and physical functioning of the soil, so that the soil P present is cycled and made available more effectively.