



The following article was written by Soiltech
Soil Scientist, Dave McKie MAgSc (Hons)

FPF IMPROVES PHOSPHORUS USAGE

Pasture-based farming in NZ has a long tradition of relatively heavy application of phosphate fertilizers, generally based on Olsen P test readings. Olsen P and superphosphate application is now so much a part of pastoral farming that this approach is rarely questioned. However, there are other alternatives and today, increasing numbers of farmers are changing from this “status quo” fertilizer mindset and appreciating the benefits offered by Fine Particle Fertilizers (FPF).

Why Is Phosphorus Fertilizer Applied?

NZ agriculture is blessed by its location in a climatic zone on our planet which favours the fixation of nitrogen (essential to grass growth) by legumes such as clover. This is a huge economic benefit to the farmer i.e. the nitrogen requirements of his grasses are provided “gratis” by the legumes. All plants require phosphorus (P) but generally legumes require more P than grasses. Thus fertilizer P requirements are usually assessed with reference to the requirements of the legumes. Obviously, if pasture plants do not get sufficient (P) they perform poorly and the animals grazing them do not get sufficient feed. Clearly then, it is important to know that there is adequate P in the soil to meet pasture requirements. As a result, farmers regularly apply P fertilizer, often working from the premise that “if some is good, more must be better.”

Isn't It Better To Apply More Fertilizer To Ensure Pastures Have The Phosphorus They Need?

No! Excessive P fertilizer can be detrimental to both the soil microbes inhabiting mixed grass-clover pastures and to the environment: through increased runoff of soluble P into streams and water courses. High concentrations of P in the soil solution reduce the levels of mycorrhizal fungi in the soil. These microbes assist plant roots to fix nitrogen and uptake nutrients. Reducing their populations inhibits both the legumes ability to fix nitrogen and the ability of plant roots to uptake not only P but also other minerals (eg copper and zinc) and nutrients. Heavy applications of superphosphate can often lead to a flush of excessive P in the foliage. This “luxury” P is then consumed by the animal and the excess is largely excreted in the dung. Thus, in addition to being harmful, a high level of P fertilizer is simply just wasteful. Why pay for P that will not increase animal productivity but just end up as dung? A further consideration also needs to be borne in mind here. Often pasture response to superphosphate is attributed to P when in actual fact it is a response to the sulphur (S) in superphosphate. This highlights the importance of accurate and comprehensive soil testing to determine not only P status but also the status of other important plant nutrients! Mainland Minerals continues to offer its clients one of the best soil testing services available in NZ through its association with Soiltech – a soil consultancy.

What Happens To Phosphorus In The Soil?

P generally accumulates in the topsoil in forms relatively unavailable to plants. Less is lost by leaching (as compared to nitrogen) than by conversion to these inorganic forms and by accumulation as insoluble organic P. Farmers apply P fertilizer at a certain rate in the belief that this rate is essential for good pasture productivity. In reality, most of this P is simply accumulating within their soil. The good news is that most of this fertilizer applied P is still there! Better yet, some of this stored P can be made more accessible by optimising soil conditions.

Is Phosphorus Only Important For Pasture? What About The Livestock?

P is essential for an animal's healthy growth, especially for sound bones and teeth. P is also an important component of proteins. P should be in balance with calcium and magnesium. An excess of P can lead to problems such as bone fragility. In addition, when the balance of these (and other) elements is out of kilter, animal diseases can result due to a deficiency of other minerals brought on by excessive P. Such mineral

deficiencies and imbalances become more common as higher production levels are demanded from both pastures and livestock.

Should The Olsen P Test Be Used In Isolation?

The Olsen P test is one measure of plant available inorganic P within a soil. It is not a measure of soil fertility in general, nor is it a measure of the productive capacity of a farm! It is a good test but like all tests, it has its limitations. Results obtained from the test can vary depending on other factors i.e. rooting depth, soil structure, soil moisture holding capacity, pH, soil biological activity and P retention. Test results are further influenced by season, temperature, moisture status etc. As a consequence, on its own, the Olsen P test may be an unreliable estimator of P fertilizer requirements. Rather it is most useful when used in conjunction with other P tests which are increasingly available nowadays eg Resin P, P Retention, Total P etc.

Nor is the Olsen P test an absolute determinant of plant available P; rather it gives an indication, a “snapshot” if you prefer of these levels within a soil at the particular time of the test. The levels recorded do not stay constant through the year or over a season. Having said all this, Olsen P is still a very useful test. However, bearing in mind the considerations outlined above, it should not be viewed as a “silver bullet” for plant available P! It has benefits and limitations. A wise farmer will recognise these and be realistic about the information the Olsen P test gives him.

What Role Do Soil Microbes Have In Phosphorus Availability?

Most of the P taken up by plants (and eaten by livestock) is cycled back to the soil along with other important plant available nutrients. Large quantities of nutrients are stored in organic form i.e. in old leaves, roots, dung etc. The speed at which these nutrients are re-cycled and made available again is largely controlled by the biological activity of soil animal life (earthworms, fungi, bacteria and other microbes). If the rate of nutrient cycling is slow, nutrients can be “locked up” for long periods in organic forms. Alternatively, if soil biological activity is favoured, nutrient cycling is more rapid and thus essential nutrients are made available more quickly. Factors influencing nutrient cycling therefore are much the same as the factors favouring soil microbial activity i.e. temperature, moisture, nutrient levels and availability etc. Microbial levels are enhanced by good levels of available calcium.

How Does FPF Assist The Farmer With Phosphorus Availability?

Mainland Minerals specialises in Fine Particle Fertilizer (FPF) – fertilizer finely ground to a very small particle size (like talcum powder). This fertilizer is then accurately applied to pasture through highly advanced technological truck or helicopter mounted applicators. Because of the small particle size, FPF is rapidly assimilated within the soil and is readily available to the soil animals and microbes. This stimulates the rapid decomposition of organic matter (evidenced by faster dung breakdown, reduction in thatching etc), which in turn releases locked up nutrients and makes them available more quickly to the plants. FPF is usually blended and applied in response to a soil test. As a result, it is a balanced fertilizer – it supplies the quantities of both macro-nutrients (P, S etc) and trace elements required by the pasture (and livestock eating the pasture!) FPF is still a solid fertilizer but because it is so finely ground it is able to be held in a water suspension. There are many advantages of this approach but high on the list is the accurate application of known quantities of nutrients which are delivered evenly across a pasture. As a result, all the plants get the fertilizer they require, which leads to better, more even pasture growth. The stripping (overlapping in some areas, missing in others) effects so common with granular applications is effectively eliminated. Further, there is no wastage into areas such as gullies, riparian strips or waterways. FPF is a high value fertilizer system designed to meet the needs of the whole soil environment – plants and soil animals and microbes. It is also a more efficient fertilizer system: because plants get what they need, no additional quantity needs to be applied to allow for traditional fertilizer inefficiencies resulting from either poor application or poor uptake and use. Further, because FPF enhances nutrient recycling, the P already in the system is moved through the cycle more rapidly. As a result, less fertilizer P needs to be applied. When fertilizer P is required, its availability is further maximised by the use of high grade fertilizer products.

Increasingly, farmers are turning to FPF as a better, more comprehensive fertilizer system which addresses and seeks to keep in balance the whole pastoral system. FPF does require a change of thinking: it is different way of viewing the soil, pasture and animal system. For many farmers, adopting the FPF approach has transformed their farming operation.