



Get productive with phosphorus

Phosphorus is one of the key drivers of pasture production and getting it right can help optimise the productivity and profitability of your enterprise, according to Incitec Pivot Fertilisers' technical agronomists Lee Menhenett and Jim Laycock.

Current soil science and pasture nutrition knowledge don't offer any substitutes for phosphorus when it comes to growing and maintaining high performing, productive pastures.

Phosphorus feeds the legume content of the pasture, which provides nitrogen to the improved grass species. It helps maintain overall pasture quality and quantity.

Phosphorus losses through fixation, erosion and removal in fodder and animal products can be substantial and most dairy farmers and graziers will need to apply phosphorus every year to sustain high levels of production and maintain fertility.

Often, there are also opportunities to increase pasture productivity to support a higher stocking rate by lifting phosphorus fertility to optimum levels.

The first step to getting productive with phosphorus is to soil test to determine the current soil fertility. There are two tests currently used to measure phosphorus in soils, Olsen P and Colwell P.

If you are using the Olsen P test, an extensive sheep/beef enterprise looking to achieve 90-95% of potential pasture production would require a critical Olsen P in the range of 12-15 mg/kg.

Dairy farmers are generally targeting greater pasture performance, in the 95-98% potential pasture production range. This would require an Olsen P in the range of 21-27 mg/kg.

If you are using the Colwell P test, the critical value varies with the soil's Phosphorus Buffering Index (PBI). PBI is an important soil property that influences the amount of P fertiliser available for plant uptake.

A soil with a high PBI requires more phosphorus to increase fertility and productivity than a soil with a low PBI. Soil tests are the only way to determine PBI and PBIs are like finger prints in that they don't change over time.

Most pasture soils in New South Wales and Victoria are in the PBI range of 70-140, however there are some basalt soils with PBIs in excess of 800, so individual paddock soil sampling is critical.



In the 70-140 PBI range, it is generally only when soil test results reach 27- 35 mg/kg Colwell P when graziers can reduce phosphorus applications to maintenance rates and still target 90-95% of potential yield. If the PBI was 800, the critical Colwell P range would lift to 40-60 mg/kg.

Dairy farmers targeting the 95-98% potential pasture production range would need a Colwell P of 46-61 mg/kg at a PBI of 70-140.

Soil test guidelines for 0-10 cm samples in relation to pasture performance goals

Beef or sheep type system aiming for 90-95% potential yield at 'adequate' soil test result					
Pasture performance compared to potential	<80%	80-90%	90-95%	95-98%	>98%
	Deficient – capital fertiliser required	Marginal – fertiliser required	Adequate – maintenance fertiliser required	High – possible low fertiliser maintenance	Very high – no fertiliser required
	Olsen P (mg/kg)				
All soils	<8	8-12	12-15	15-22	>22
	Colwell P (mg/kg)				
PBI 0-15 Very sandy	<11	11-18	18-23	23-30	>30
PBI 15-35 Sand, sandy loams	<12	12-20	20-26	26-34	>34
PBI 35-70 Sandy/Silty loams	<14	14-23	23-30	30-39	>39
PBI 70-140 Sandy/Silty clay loams	<16	16-27	27-35	35-45	>45
PBI 140-280 Clay loams	<19	19-32	32-42	42-54	>54
PBI 280-840 Clay loams and clay	<27	27-44	44-58	58-75	>75
PBI >840 Volcanic clays and peat	<40	40-60	60-80	80-120	>120

Source: Better Fertiliser Decisions. Department of Primary Industries, Victoria

Where soil test values meet or exceed critical phosphorus levels, no phosphorus or lower phosphorus rates should be considered.

Maintenance phosphorus rates can vary from 0.4 to 1.5 kg P/DSE depending on pasture base, soil fixation, topography and annual rainfall. Phosphorus removal from dairy cows is 1 kg P/1000 L of milk or 4-5 kgP/100 kg of milk solids.

The next step is to set a productive target or potential carrying capacity to target. Response curves are available to link your productive target to a target soil phosphorus fertility level.



Every paddock is different and there may be a number of different fertility and productivity strategies across the farm.

For example, on some non-improved hilly country, you may target a very low stocking rate and fertilise sparingly, instead focusing on building fertility on the improved pastures where responses will be greater and higher stocking rates can be supported.

However, try to stay close to the optimal phosphorus fertility range to avoid poor pasture quality, weed invasions and the risk of erosion from the loss of ground cover.

For boosting pasture growth, phosphorus should be applied prior to the autumn break. If phosphorus is being used only to maintain soil fertility levels, it can be applied in autumn or spring. For more information on application timing, read 'Stay one step ahead and spread early'.

Phosphorus from fertilisers is very immobile, with the distance the phosphate front moves from the fertiliser granule rarely more than 4-5 cm. (Glendinning, 1990)

In research, we have seen clover plants growing near a fertiliser granule become up to four times larger and contain five times more phosphorus than those plants growing 2.5 cm away.¹

This means a low analysis fertiliser can potentially supply more granules on the ground, feeding more plants and better boosting pasture growth, particularly where there are challenges such as sub-optimal phosphorus levels or applications made late to cold soils.

References:

¹ CH Williams, CSIRO Plant Industry, Canberra ACT "Effect of particle size on the availability of phosphorus and sulphur in single super"

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