Potassium for high-performing pastures

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Spring is a time of high potassium (K) uptake and removal in pastures, especially where large quantities of hay and silage are being cut. Graziers and dairy farmers can often benefit from adding potassium to their fertiliser programs in spring.

To assess whether potassium is a worthwhile investment, consider these questions:

1. Are soil potassium levels adequate?
2. How much potassium will the growing pasture need?
3. How much potassium will be removed and how will it be replaced?

Look at soil potassium levels

Table 1 shows the critical Colwell K soil test values in topsoil for various soil types and targeted pasture performance. Heavy soils, with more clay, have higher critical values, as do more intensive or higher production systems.

For example, in a dairy system on a clay loam soil type, if soil test results showed a Colwell K of 120, this would suggest soil potassium levels were only marginal, supporting 90-95% potential pasture yield. Higher potential pasture yields could be targeted by lifting soil potassium levels. If soil test results showed potassium levels in the very high range (for example a Colwell K of 300), applications could be reduced or dropped out of the fertiliser program because the soil would be able to supply enough potassium to meet the pasture's requirements.

Table 1: Soil test guidelines for 0-10 cm samples in relation to pasture performance goals in either a dairy or a beef/sheep system

Dairy type system aiming for 95-98% potential yield at 'adequate' soil test result					
Pasture performance compared to potential	<90%	90-95%	95-98%	98-99%	100%
	Deficient - capital fertiliser required	Marginal - fertiliser required	Adequate - maintenance fertiliser required	High - possible low fertiliser maintenance	Very high - no fertiliser required
			Colwell K (mg/kg)		
Sand	<70	70-120	120-170	170-230	>230
Sandy/Silty loam	<80	80-130	130-190	190-250	>250
Sandy/Silty clay loam	<90	90-130	130-190	190-260	>260
Clay loam and Clay	<100	100-150	150-220	220-280	>280

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
			Colwell K (mg/kg)		
Sand	<40	40-90	90-130	130-170	>170
Sandy/Silty loam	<50	50-100	100-150	150-190	>190
Sandy/Silty clay loam	<70	70-100	100-150	150-210	>210
Clay loam and clay	<80	80-120	120-160	160-220	>220

Source: Department of Primary Industries, Victoria

Supply potassium for high performance

Potassium uptake peaks during spring as pasture growth rates increase. If a pasture is growing more than 100 kg DM/ha/day, it is potentially using 2-3 kg K/ha/day. This is a major draw on the soil's supply, so supplementing with fertiliser can potentially help with maximising yields in these peak spring growth periods.

Pastures also vary in their response to potassium fertilisers, with legumes more responsive than grasses. Where there are significant percentages of legumes in the mix or in straight lucerne crops, graziers will generally see good results from applying potassium in spring. Researchers have even seen responses to potassium fertiliser in lucerne in the key spring growth period where there were adequate potassium levels showing in the 0-10 cm soil test, because of the huge draw down of potassium at that time of year.[1]

There is a strong relationship between root mass and potassium uptake. For shallow rooted pasture species (ryegrass and clover) the majority of potassium uptake will occur in the top 10 cm of soil. As root density decreases at depth, there will be less potassium taken up by the plant from these regions, even if potassium levels are increasing.

Anything that limits root growth will also limit potassium uptake, such as compaction, sodicity, moisture content, clay mineralogy, acidity, organic matter, soil temperature and other cations (calcium, magnesium and sodium).

Grasses with a more developed root system may be better able to source potassium from deeper in the soil. Soil tests can be used to assess whether there are useful potassium reserves at depth.

It is true that once soluble potassium is taken up by plants from the soil, it is replaced by other pools of potassium in the soil, such as exchangeable potassium, held on to clays and organic matter, to reach a natural equilibrium. However, this may not happen quickly enough or supply enough readily available potassium to meet pasture performance targets in spring, making fertiliser a valuable investment.

Think about replacing removal

As well as helping to grow more dry matter in spring, graziers and their advisers also need to consider the removal of potassium in hay and silage. Table 2 provides a guide to the potential nutrient removal rates from pasture hay and silage. For example, if a 3 t DM/ha lucerne hay crop is cut, 70 to 80 kg/ha of potassium may be removed from the property or to a different paddock when it is fed back to stock.

Table 2: Nutrients removed from typical pasture crops in spring

	Nitrogen (kg N/t DM)	Phosphorus (kg P/t DM)	Potassium (kg K/t DM)	Sulphur (kg S/t DM)	Calcium (kg Ca/t DM)
Lucerne hay	28	2	24	2.6	9.9
Grass/clover hay	21	2	18	1.7	5.3
Grass/clover silage	26	2.8	26	2.3	5.9

Source: 'Nutrient Concentrations in Harvested Agricultural Commodities' from the National Land and Water Resources Audit Project, Appendix 6, September 2001

Potassium fertiliser is usually supplied in combination with nitrogen and other nutrients to boost spring growth. There are a number of fertiliser products that are suitable for pastures. Where nitrogen is used in the blend, rates should be based on supplying 25-60 kg/ha of nitrogen for best nitrogen use efficiency. Next consider any phosphorus and potassium required for capital applications to build soil fertility, then the maintenance rates needed to replace removal.

When determining rates, potassium should be kept below 60 kg/ha per application. Pastures can take up luxury quantities of potassium, which can lead to poor returns on investment. More importantly, pastures with a high potassium content can cause animal health issues in sensitive stock.

There are three products from the tried and true Boosta® range of fertilisers with potassium. Where a nitrate nitrogen source is preferred, there are three Cal-Gran® blends containing potassium (See Table 3). These fertilisers can be applied more than once during spring if paddocks are to be cut numerous times for pasture silage or hay.

Table 3: Potassium fertiliser options for spring pastures

	N (%)	P (%)	K (%)	S (%)	Ca (%)
FodderBoosta®	11.5	7.6	19.5	6.1	
HayBoosta®	11.7	4.7	23.9	4.6	
PastureBoosta®	23.8	3.7	13.0	4.1	
Greentop K	32.8		11.0	2.9	
Cal-Gran® 150	18.6	3.0	12.5	1.4	4.4
Cal-Gran® 50/50	17.9		15.0	3.6	4.4
Cal-Gran® Aftergraze	20.6	3.0	7.5	3.8	4.4

Source: Incitec Pivot Fertilisers

For more information on potassium fertilisers for pastures, please contact me at lee.menhenett@incitecpivot.com.au or 0412 565 176.

These insights are also availabe to view and share via the IPF Youtube page.

References

[1] Professor Derrick Moot, Lincoln University (pers comm)