POTASSIUM—NEW SOUTH WALES

Key points

- Deficiency symptoms first occur in the older leaves, and can be mistaken for disease infections.
- Soil testing combined with plant tissue testing is the most effective means of determining potassium requirements.
- Banding away from the seed, at or within 4 weeks of sowing, is the most effective way to apply potassium when the requirement is less than 15 kg/ha.

Background

Potassium (K) is an essential plant nutrient. Potassium has many functions including the regulation of the opening and closing of stomata, the breathing holes on plant leaves that control moisture loss from the plant. Adequate potassium increases vigour and disease resistance of plants, helps to form and move starches, sugars and oils. Available potassium exists as an exchangeable cation associated with clay particles and humus.

Potassium deficiency

Potassium deficiency occurs most in sandy soils and so is not a widespread problem in NSW, although it does occur on some volcanic and heavier textured soils, particularly in the southern highlands. Potassium can become deficient on intensively used areas such as irrigated lucerne paddocks, and areas constantly cut for hay or silage. Localised potassium deficiency can also occur from nutrient transfer such as in strip grazing where animals return dung and urine to a different area.

Visual symptoms

Potassium deficiency symptoms appear first on older leaves, initially as a light green to yellow colour of the older leaves, progressing to marginal scorch of the edges and tips. As the severity increases these symptoms progress towards the top of the plant (figure 1).

Figure 1: *Potassium deficiency in Lucerne. Photo: NSW Department of Primary Industries*

These characteristic symptoms of potassium deficiency can often be mistaken for leaf diseases such as yellow spot and *Septoria nodorum* blotch in wheat or brown leaf spot in lupins. Other symptoms include slow plant growth, weak stems and lodging, high screenings levels in the harvested grain and reduced disease resistance.

Deficiency in legumes

Pasture legumes can be affected by potassium deficiency even when cereal yields remain unaffected. Unless plant symptoms are recognised, or soil or tissue testing done, the first signs of potassium deficiency in a paddock may be poor growth and a gradual disappearance of the pasture legume component.

Assessing potassium requirements

Soil and plant tissue analysis together give insight into the availability of potassium in the soil. Growers should not rely on soil testing alone as results are subject to many potential sources of error.

Tissue analysis of whole tops of crop plants will determine whether a deficiency exists but doesn't define a potassium requirement. These results are generally too late to be useful in the current season, but inform the need to assess potassium requirements for the next crop.

Potassium available in the soil is measured by the Colwell K or Exchangeable K soil tests. The amount of potassium needed for plant nutrition depends on soil texture (table 1).

Table 1: *Critical (Colwell) soil test thresholds for potassium (ppm).*

CROP/PASTURE	DEFICIENT	MODERATE	SUFFICIENT
Cereals, canola, lupins etc. (Brennan & Bell 2013)	<50	50–70	>70
Pasture legumes (Gourley et al. 2007)	<100 (sand) <150 (clay loam)	100–140 (sand) 150–180 (clay loam)	>140 (sand) >180 (clay loam)

Sandy soils require less potassium to be present, but are more likely to show deficiencies. Clay soils require more potassium to be present, but are more capable of supplying replacement potassium through the weathering of clay minerals.

Potassium lost through product removal should be replaced once paddocks fall below sufficient potassium levels, rather than waiting for deficiency symptoms to appear. Replacement requirements for each crop differ (table 2), and this must be accounted for when budgeting potassium requirements for the coming season.

Table 2: *Potassium (K) removal per tonne of produce.*

CROP TYPE	ANNUAL K REMOVAL (kg)
Wheat	4
Barley	5
Oats	5
Canola	9
Lupins	10
Oaten Hay	25

Much of a grain crop's potassium is present in the leaves and stems, so retaining stubble residues in situ helps to return potassium in the soil.

Fertiliser types

Sulphate of potash (SOP—potassium sulphate) is usually recommended if potassium is deficient. Applying the cheaper muriate of potash (MOP—potassium chloride) also corrects potassium deficiency, but it also adds chloride to the soil, which contributes to overall salinity and can decrease the establishment of seedlings.

Potassium magnesium sulphate can also be used where magnesium and sulphate are also required. This form is often used in 'complete' fertiliser blends. Potassium nitrate supplies nitrogen and potassium in a highly water soluble (and available) form, but is rarely used in broadacre farming because of its cost.

Fertiliser placement and timing

Potassium generally stays very close to where it is placed in the soil. Banded potassium has been shown to be twice as accessible to the crop as top-dressed potassium. This is thought to be related to improved availability for the emerging crop, and decreased availability for weeds. Seed must be sown within 50 mm of the potassium drill row or seedlings may miss the higher levels of potassium. High band rates (>15 kg/ha) of potassium can inhibit sensitive crops (e.g. lupins, canola). If a paddock is severely deficient then potassium needs to be applied early in the season, at seeding or up to 4 weeks after.

Further reading and references

Brennan RF & Bell MJ (2013) 'Soil potassium—crop response calibration relationships and criteria for field crops grown in Australia', *Crop & Pasture Science* **64**, 514–522.

Gourley CJP et al. (2007) Making Better Fertiliser Decisions for Grazed Pastures in Australia, Victorian Government Department of Primary Industries. (online)

The New South Wales Department of Primary Industries has a range of useful information on soil fertility and its management in NSW (online)

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