Nutrition for grazing cereal and canola crops

Dual purpose crops will be important this year as a source of feed for stock and grain at harvest, but to get the best out of these crops they will need a good start with nutrition, particularly nitrogen and phosphorus.

Jim Laycock
IPF Senior Technical Agronomist

In setting paddocks up for success, there are three simple rules:

1. Fallows should be kept clean to maximise early sowing opportunities. Early establishment and growth are essential to fill the feed gap and allow heavily grazed pastures to recover during winter.
2. Make sure you take a soil test at least three to four weeks prior to planting. This should include both the surface (0-10 cm) and deep soil for nitrogen, sulphur. If deep nitrogen testing hasn't been done before segment the profile e.g., 10-30, 30-60, 60-90 and include EC, chloride, cations and also boron in southern areas to identify any sub-soil constraints.
3. When sowing dual purpose crops (especially canola), it is important to sow into moisture with soil temperatures in the top 10 cm less than 35°C (Acevedo et al, 2002) to maximise early emergence.

This insight covers the major nutrients for grazing cereals and canola. For micronutrients, confirm any suspected deficiencies or toxicities with tissue testing in crop.

PHOSPHORUS

Early availability of phosphorus is crucial. Phosphorus deficiency limits wheat grain yield principally by depressing early growth, leaf emergence rate and maximum rate of tiller emergence (Rodriguez et al. 1999). Remember, with phosphorus, there are no second chances. There is insufficient evidence to recommend foliar applied phosphorus for wheat as a phosphorus management strategy post planting (Fecelli, et al. 2016).

The right phosphorus rate will depend on the yield expectation for the crop, and the Colwell P level and Phosphorus Buffering Index (PBI) from this season's soil test or a recent soil test. Safe reductions in P inputs are possible where soil test values are above crop critical requirements and early April sowing with good soil moisture is available (Laycock et al, 2022).

Interrogation of the Better Fertiliser Decisions for Cropping Systems in Australia (Peverill et al, 2013) suggests a critical Colwell P of 34 mg/kg with a range of 29 to 40 for wheat where a cereal was the previous crop. See Table 1. In contrast, a critical Colwell P of 49 (range 17 to 140) for wheat following canola is suggested, albeit with a much smaller data set and with a weaker correlation.

Table 1. Critical Colwell P level (95% max yield) 0-10 cm for various rotations across NSW, Vic & SA

Rotation	Colwell P mg/kg 95% relative yield	R value	Number of trials
Wheat on wheat	34 (29-40)	0.47	242
Wheat on canola	49 (17-140)	0.24	34
Wheat on grain legume	30 (17-53)	0.35	26

Phosphorus is best banded with the seed at planting to encourage early root development and increase root area so that crops are better able to access soil moisture and soil phosphorus through the growing season.

The safe rate of starter fertilisers with the seed depends on soil moisture levels at planting, fertiliser nitrogen content and the seed bed utilisation percentage. Also, be aware that canola is more sensitive than cereals to the nitrogen in starter fertilisers when banded with the seed. For more information, please refer to the IPF guideline on safe rates of fertiliser with the seed.

NITROGEN

The primary objective when growing winter forage crops is to maximise dry matter production and efficiently use that dry matter. Early nitrogen is the key to getting to that first grazing quickly.

Ensure sufficient nitrogen up-front for good early biomass production. Target 100 to 150 kg/ha of starting nitrogen (soil and fertiliser) for March sown winter varieties and 100 kg N/ha for April sown spring varieties (Kirkegaard, pers com).

If possible, sow grazing crops early after a legume phase to capitalise on the residual water and N in a cost-effective way and reduce nitrogen fertiliser input costs. If deep N soil test results are showing more than 120 kg/ha of nitrogen, or the paddock is coming out of an early fallowed pasture phase with more than 30% productive legumes or a high biomass grain legume crop, then no additional nitrogen may be required. On low nitrogen

Nutrition for grazing cereal and canola crops

paddocks (deep soil nitrogen results of less than 60 kg/ha), additional nitrogen will be required.

Nitrogen rates will depend on the starting soil nitrogen level, paddock history, organic carbon percentage, rainfall and expected grain yield target. As a guide – for every 1 t/ha grain yield, wheat requires 40 kg/ha/N; while canola needs 80 kg/ha/N.

To account for the nitrogen removed in the grazed forage consider adding an extra amount equal to about half of that removed in grazing. So, if the forage was 5% N and sheep removed 2000 kg/ha of biomass (100kg) then add an extra 50 kg/N above the budget (Kirkegaard, pers com).

Where nitrogen is required it can be:

- broadcast in front of the seeder and incorporated at planting, or
- banded at planting below and to the side of the seed
- broadcast post-planting, ideally in front of 10 mm or more of rainfall.

Banding pre-plant is not recommended unless there is good soil moisture because of the potential loss of planting moisture. If broadcasting urea without incorporation before planting, beware of nitrogen losses from volatilisation. In northern soils these losses can be in the range of 5.4 to 19% (Schwenke et al, 2014).

Additional nitrogen can be applied post grazing through the growing season, depending on seasonal conditions. In higher rainfall areas delaying topdressing for two weeks after stock removal will increase the efficiency of use as the demand in the crop will be higher than that of freshly grazed crops

Consider the use of Green Urea NV when topdressing preplant and the late winter nitrogen application to reduce potential volatilisation losses. In a study conducted in southern Australia where NH_3 losses were measured in wheat during 31 July–11 August cumulative NH_3 losses were 7.6 kg/N/ha (9.5% of applied N) for the urea treatments and 0.8 kg/N/ha (1.0% of applied N) for the Green Urea NV (Turner et al, 2010).

High nitrite or nitrate levels in forage may be an issue in both canola and wheat if:

- the crop is immature,
- growth has been slow due to frosts,
- the weather has been cold and cloudy, or
- there has been intermittent waterlogging.

Plants will continue to take up and accumulate nitrate during periods of slow growth and most of that plant nitrate is located in the bottom third of the stalk. You can manage/reduce the risk of stock health issues with controlled grazing, including:

- offering carbohydrate in the diet
- avoiding grazing with hungry stock, and
- only grazing actively growing crops.

If the crop has been topdressed with urea after grazing and stock are to be re-introduced, allow the crop to regain leaf area and be actively growing first. Lock up time, before DC30 in wheat and bud elongation in canola, can also be managed depending on commodity prices, residual biomass targets and seasonal conditions (Kirkegaard, 2019).

POTASSIUM

If potassium deficiency is suspected in crop tissue testing is the preferred method for positive identification of potassium deficiency.

Canola tissue sample 0.31% potassium (optimum 2.8 – 5.5%) from Millthorpe Central Tablelands NSW 2021.

Nutrition for grazing cereal and canola crops

Cropping soils in the Central West of New South Wales generally have more than adequate soil potassium (K) levels as a result additional potassium is not required in most soils.

Only 8 out of 1930 samples received at the Nutrient Advantage laboratory between January and June 2018 were below the critical 0-10cm soil test level of 64 mg/kg of available soil potassium for wheat and canola (Brennan et.al, 2013).

Wheat forage has a high potassium (K) content of about three to four percent of dry matter and a very low sodium (Na) content, often less than 0.02 percent. This very high potassium to sodium (K:Na) ratio in wheat forage can reduce the absorption of magnesium in the gut of livestock and limit weight gains (Dove et al, 2009).

Most current wheat varieties have similar K:Na ratios, so supplementation when grazing wheat with a 1:1 Causmag (magnesium oxide) and sodium chloride mix is recommended (Dove et al, 2009).

Table 2. Nutrients in Kittyhawk(ϕ) wheat tissues, Millvale grazing trial 2018

Nutrient		Control	Chaff line
Total Nitrogen	%	4.8	4.6
Nitrate	mg/kg	630	520
Phosphorus	%	0.38	0.33
Potassium	%	5	4.6
Sulphur	%	0.36	0.34
Calcium	%	0.36	0.39
Magnesium	%	0.16	0.16
Sodium	%	0.01	0.01
Chloride	%	1.8	1.2
K:Na	Ratio	500	460

Source: Nutrient Advantage laboratory. Tissues sampled 6/6/2018.

Two whole top tissue samples were taken, one from the control plot and the other from an area in the trial where a chaff line was burnt four days pre plant, at Incitec Pivot Fertilisers' Millvale grazing wheat trial in 2018. Table 2 shows the detailed analysis of the nutrient content from those two tissue tests. The K:Na ratio was 460 or 500 to 1, compared with an implied required ratio of 5-7 to 1 (Dove et al, 2009).

Sheep grazing on Kittyhawk wheat at Incitec Pivot Fertilisers' trial site at Millvale, New South Wales, 2018.

SULPHUR

As sulphur (S) is a dynamic nutrient which can come into the soil pool through mineralisation during the season and is mobile in soils, it should be included in the deep N sampling program.

In most areas, 0-10 cm sulphur levels are more than adequate for cereals. The KCl-40 S critical soil test values 2.4 to 3.2 mg/kg can be used widely on soil types where soil sulphate is not leached during the growing season (Geoffrey et al, 2013). When KCl-40 S critical soil test values are less than 31.0 kg ha when using a sampling depth of 60 cm for canola grown in NSW (Geoffrey et al, 2013) canola may respond to the application of sulphate sulphur.

FURTHER INFORMATION

For more information and advice about fertiliser programs for grazing cereal and canola crops this season, please contact me on 0427 006 047 or email jim.laycock@incitecpivot.com.au.

REFERENCES

Acevedo E, Silva P and Silva H (2002) 'Wheat growth and physiology', in Curtis BC, Rajaram S and Gomez Macpherson H (eds) (2002) *Bread wheat improvement and production*, Food and Agriculture Organization of the United Nations, Rome.

Rodriguez D, Andrade FH and Goudriaan J (1999) Effects of phosphorus nutrition on tiller emergence in wheat. Plant and Soil 209, 283-295.

Nutrition for grazing cereal and canola crops

Facelli E, Peirce C, McBeath T, McLaughlin MJ (2016) Foliar phosphorus 'top-ups' deliver inconsistent wheat growth responses GroundCover™ Supplement Issue: 123, 04 Jul.

Peverill K, Conyers M, Reuter D and Norton R. (2013) Making better fertiliser decisions for cropping systems in Australia. Crop & Pasture Science Vol 64, Issue 5:417-547.

Kirkegaard K, Sprague S, Lilley J, Bell L and Swan T (2019) Maximising systems benefits from dual-purpose crops – early sowing and grazing strategies. GRDC Grower Update, Coolah.

Schwenke GD, Manning M and Haigh BM (2014) Ammonia volatilisation from nitrogen fertilisers surface applied to bare fallows, wheat crops and perennial-grass based pastures on Vertosols, Soil Research, 52, 805–821.

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

Dove H and McMullen KG (2009) Diet selection, herbage intake and liveweight gain in young sheep grazing dual-purpose wheats and sheep responses to mineral supplements. Animal Production Science, 49.

Anderson GC, Peverill KI and Brennan RF (2013) Soil sulfur – crop response calibration relationships and criteria for field crops grown in Australia Crop & Pasture Science, 64, 523–530.

Laycock J, Mason S, Norton R and Sandral S (2022) Balancing risk and reward with high phosphorus and nitrogen input costs. GRDC Grower Update, Northern Region 2022.

Turner DA et al. (2010) Determination and mitigation of ammonia loss from urea applied to winter wheat with N-(n-butyl) thiophosphorictriamide. Agric. Ecosyst. Environ. doi:10.1016/j.agee.2010.02.011.

DISCLAIMER

This is a guide only, which we hope you find useful as a general tool. While Incitec Pivot Fertilisers has taken all reasonable care in the preparation of this guide, it should not be relied on as a substitute for tailored professional advice and Incitec Pivot Fertilisers accepts no liability in connection with this guide.

Incitec Pivot Fertilisers manufactures and sources fertilisers from other suppliers. The fertiliser supply chain extends beyond the company's direct control, both overseas and within Australia. Incitec Pivot Fertilisers hereby expressly disclaims liability to any person, property or thing in respect of any of the consequences of anything done or omitted to be done by any person in reliance, whether wholly or in part, upon the whole or any part of the contents of this article.