SUMMIT FERTILIZERS Winter 2015

FERTILIZER NEWS

The nitrogen sulphur balance

Good summer rains followed by rain in May has allowed early sowing of cereals and canola in many areas. A longer growing season and the potential for grain to fill during the cooler months presents a great opportunity for growers to target higher crop yields. Growers favoured by these conditions need to make sure they don't miss out on extra yield because of suboptimal crop nutrition.

If the conditions are right, additional nitrogen can be highly profitable, so in the coming weeks farmers across the state will make important decisions on matching nitrogen inputs of crops to their yield potential.

Nitrogen is the most important element for plant growth and is taken up by crops and pastures in the largest quantities of any nutrient. Nitrogen is an essential part of many plant compounds such as amino acids and proteins. It also has an essential role in the production of chlorophyll and is essential for photosynthesis.

Most nitrogen responses come from increased tillers and head number, or grains per head. Tillering occurs early as does floret initiation, therefore some nitrogen is required early. However, peak demand for nitrogen is during stem elongation so adequate nitrogen needs to be in the system by then to ensure tiller and floret survival, producing more heads and grains per head, as well as increasing leaf area for photosynthesis for grain fill.

Nitrogen is mobile in the plant and soil so it can be managed better during the season than, say phosphorus, depending on the conditions.

Sulphur is linked to nitrogen and also needs to be considered when planning any nitrogen applications. Sulphur is also important in the synthesis of amino acids and a wide range of metabolic processes. It is of major importance in its effect on the amount of protein produced by plants and in grain quality.

Sulphur is also mobile in the plant and soil and the application timing for sulphur is very similar to nitrogen and, if required, can be applied together.

Cereals typically have a requirement for a N:S ratio of 15:1 in plant material or grain, whereas canola requires an N:S ratio of 7:1. So the relative sulphur demand for canola is twice the demand of cereals. This is why we need to consider sulphur for canola as a separate issue. The demand for most nutrients for wheat or canola crops are similar, but canola will need twice the sulphur of cereals.

Wheat and canola will respond quite well to top dressed nitrogen and sulphur as late as booting (wheat) or first flowers (canola), but the efficiency of the nitrogen will be less than an application made during the period of peak demand (stem elongation in both wheat and canola).

How much nitrogen is required is determined by potential yield. In cereals, about 30 kg of N is required to grow each tonne of grain. About 20 kg of N moves to the grain and is removed at harvest and about 10 kg N remains behind in the straw.

No nitrogen fertilizer application will be 100

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For more information on plant analysis, talk with your Summit Area Manager

The nitrogen sulphur balance

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percent efficient, all incur some losses. Typically 35 to 40 kg of N is needed to grow each tonne of cereal grain and maintain soil fertility.

Nitrogen will need to come from soil nitrogen reserves through mineralisation of organic matter, or it will need to be applied to the crop as fertilizer. A nitrogen budget based on soil and plant analysis results will assist in determining the nitrogen to be applied to help the crop reach its yield potential.

Plant analysis can be used in conjunction with Summit Fertilizers' Fuel Gauge strips to also give some assistance in managing nitrogen and sulphur in a crop.

When budgeting for nitrogen in canola, about 55 kg N is needed to produce a tonne of grain, with 40 kg of N ending up in the grain and about 15 kg of N remaining in the stubble. Seventy to 80 kg of N is needed to grow each tonne of canola seed.

When deciding how much nitrogen to apply you should ensure that there is adequate sulphur available to the crop so it is not limiting the response to applied nitrogen.

Table 1. Products that supply nitrogen and sulphur

Product	Rate to supply 25kg N	Nitrogen (%)	Sulphur (%)
Urea	54	46	
UreaPlus	67	37.2	8.4
UreaMax	60	41.6	4.2
Nitroplus	75	33.5	12
Sulphate of ammonia	119	21	24
Amsul	120	20.9	23.9
UAN (w/w)	59 (L)	32	
MAXamFLO (w/w)	90 (L)	22	6.2

Summit has a broad range of high quality nitrogen and sulphur fertilizers. Your product choice will be determined by the crops you grow, the nutrients you need and whether your application systems are set up for granular or liquid products. If nitrogen is the only nutrient required then urea or UAN are the products to use.

If your crops or pastures require both nitrogen and sulphur, then granular options like UreaPlus or NitroPlus would be the product of choice. MAXamFLO provides nitrogen and sulphur in a liquid form and is very competitively priced. If nitrogen, sulphur and potassium are required then a NKS product will provide all these nutrients in the one product.

Plant analysis can be used as a monitoring tool to ensure nutrient levels are adequate, or as a diagnostic tool to explain crop growth variability.

If used for monitoring purposes the analysis results are compared to standards derived from plant nutrition trials over time. When used to diagnose whether nutrition is a factor in differences in crop growth, comparative samples should be taken from good and poor growth areas of the paddock.

Summit plant analysis:

- ☑ Independent laboratory;
- ☑ Rapid turnaround times;
- ☑ Wide range of nutrients measured.

Getting the best from

The Fuel Gauge concept is based on the fact that it's often hard to detect nutritional deficiencies in actively growing crops and pastures if you are not able to compare them directly against crops and pastures with sufficient nutrient supply.

The easiest way to do that is to create strips with sufficient nutrients applied at non limiting (but not excessive) amounts.

Summit Fuel Gauges are nutrient rich strips set up in crop and pasture paddocks at the beginning of the season. They may consist of high

Summit Area Manager Tony Carew-Reid sets up a Fuel Gauge site at Newdegate. The Fuel Gauge process is an objective assessment of nutrient responses. Whilst not a fully replicated trial, Fuel Gauges can be employed in large numbers of paddocks across an area to give real time nutrient responses that are of bona fide value to farmers.

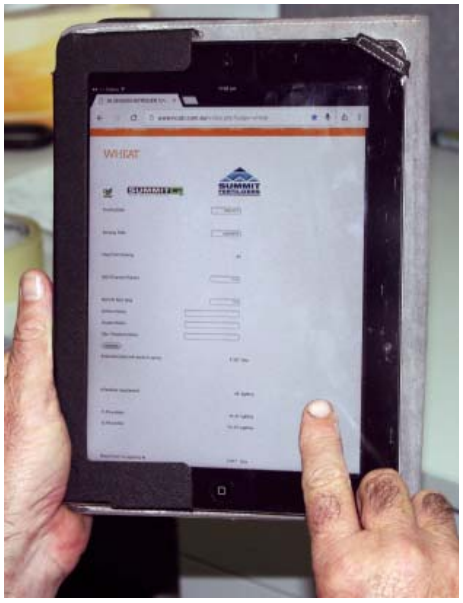
your investment

rates of nitrogen, phosphorus or potassium (or a combination of these nutrients). The strips are usually 2m to 4m wide and 100m long across the paddock workings.

A GreenSeeker® is then used to measure changes in colour and growth of the crop (or pasture) two to three times during the season. GreenSeeker readings are taken by Summit Area Managers. Fuel Gauge sites can be soil and plant tested to add to the information needed to assess the results.

Fuel Gauge sites can help growers make adjustments to planned nutrient applications as the season develops. The main nutrition focus at this time of year is on nitrogen (N), however the Fuel Gauges are revealing that without the right balance of all nutrients, there is no sense in over applying N.

It's really a way to make sure clients get the best out of their fertilizer budget. Fuel Gauge strips compare grower fertilizer practice to abundant or non limiting nutrition. Contact your Summit Area Manager for more information.



The nitrogen calculator utilises Greenseeker (NDVI) readings taken in the field to calculate the rate of nitrogen required to optimise yields and grain protein.

Summit field trials in 2015

Summit Fertilizers has continued to increase the size of its trial program which has seen more than 30 trials established in 2015 on a range of sites. Summit has also continued to increase the number of staff working in this area. This increased investment means there is a larger footprint of trials across the state from Binnu to Darkan to Esperance to Moorine Rock.

Many of the trials undertaken are in conjunction with grower groups to allow growers to view these trials at field days and receive the results through newsletter articles or at autumn updates.

This year trials will be run in conjunction with Northern Agri, Mingenew-Irwin, West Midlands, FEAR and SEPWA groups. Local field walks will be held on other trials established this year.

The trials are investigating nutrient responses in cereals and canola and have protocols that allow for sound statistical analysis of the data to ensure the outcomes are more than trends. Many of the trial protocols are repeated over a number of locations and years to determine the crop responses under a range of seasonal conditions.

Thorough investigation of nutrient responses ensures that the use of this information in Summit Fertilizer recommendations to growers is sound.

The main areas of investigation in 2015 include:

- phosphorus and nitrogen interactions in wheat;
- phosphorus responses in wheat after wheat or canola;
- phosphorus responses in wheat after liming;
- potassium sources, placement and timing in wheat;
- potassium and nitrogen interactions in wheat;
- validation of N-gauges.

Summit Fertilizers continues to assist growers with fertilizer decisions by laying down nutrient rich strips in grower paddocks and using these to determine nitrogen rates. Nine trials established across varying soil types and rainfall areas will be used to validate the recommendations generated by our nitrogen calculator.

Trial work continues to investigate how to get the best crop response to applied potassium. More information on Summit Fertilizer trials is available from your local Area Manager.

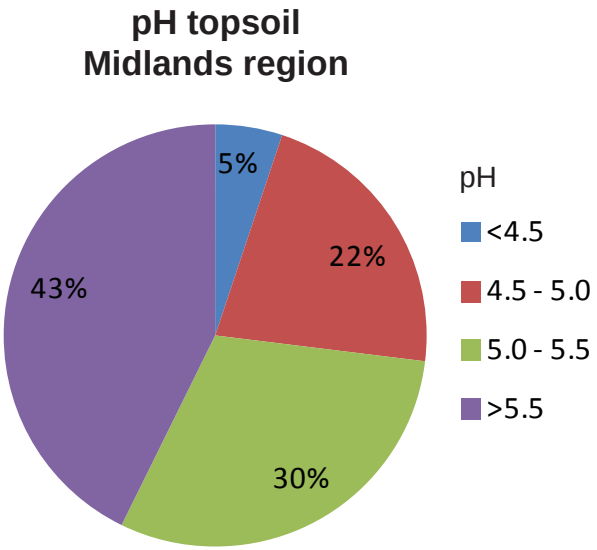
What this years soil tests have revealed

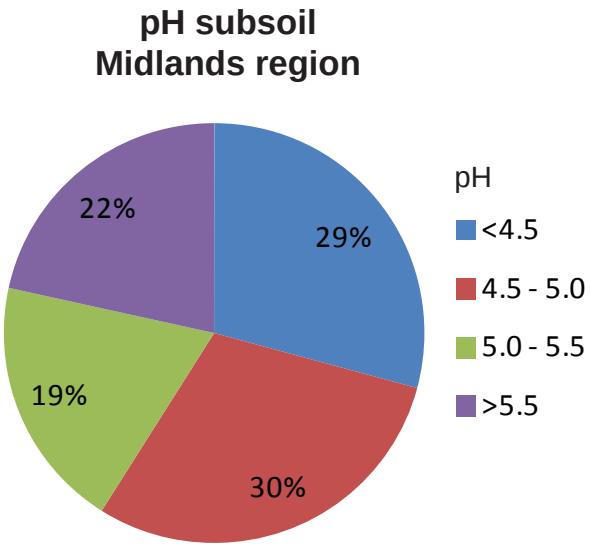
Every year Summit Fertilizers receives thousands of soil samples from across the state. Results of these samples are discussed at an individual level with farmers. However there is always some interesting patterns thrown up if we look at the data across a region.

This past season we have analysed 16000 samples that amongst other things examined phosphorus (P), potassium (K) and pH. We have selected some examples from across the state to show here. Full details for each region will be made available on the Summit website - www.summitfertz.com.au

pH

Soil pH has been the hot topic around Western Australia for a number of years. DAFWA has put considerable resources into looking at rates, timing and incorporation of lime and has come up with some critical values for soil pH. Simply put, topsoil pH should be kept above 5.5 (in $CaCl_2$) and subsoils above 4.8.

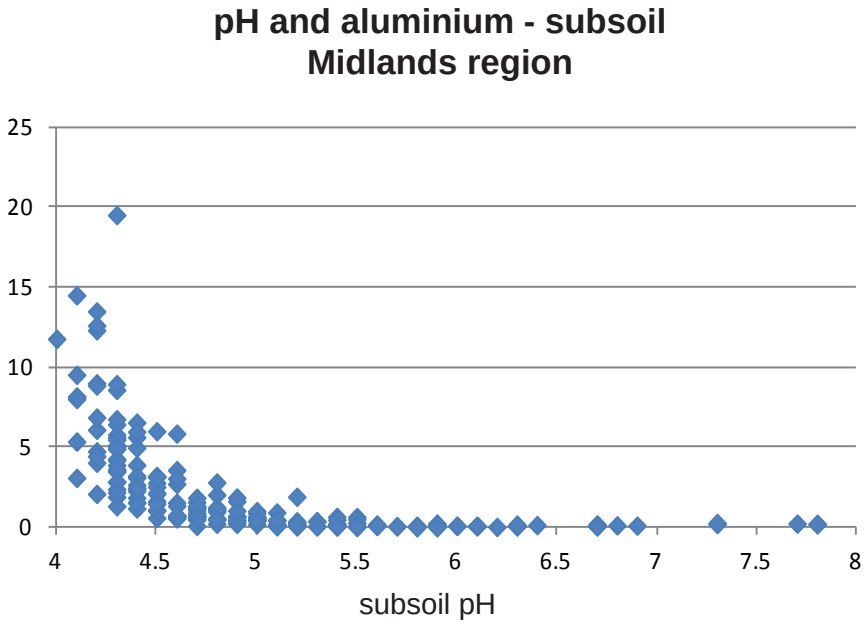




The comparisons above between topsoil and subsoil pH levels across Summit Area Manager Juliet McDonald's area (Shires of Mingenew, Three Springs, Carnamah, Coorow, Morawa and Perenjori), highlight the importance of subsoil sampling. These charts show an increasing number of low pH at sites sampled at depth. Nearly 60% of subsoils were below the recommended level.

The chart right shows the effect of declining soil pH on the levels of aluminium. With lower pH there can be resultant higher levels of aluminium which can lead to stunted roots, reducing the plants ability to access nutrients and water. Aluminium levels above 5 can be a problem and canola and clovers can be more sensitive than wheat and oats.

pH also affects nutrient availability and the survival of soil organisms such as bacteria, legume inoculum, and earthworms.



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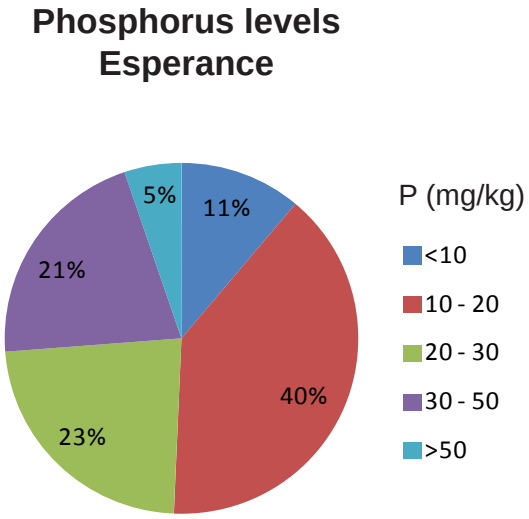
Phosphorus

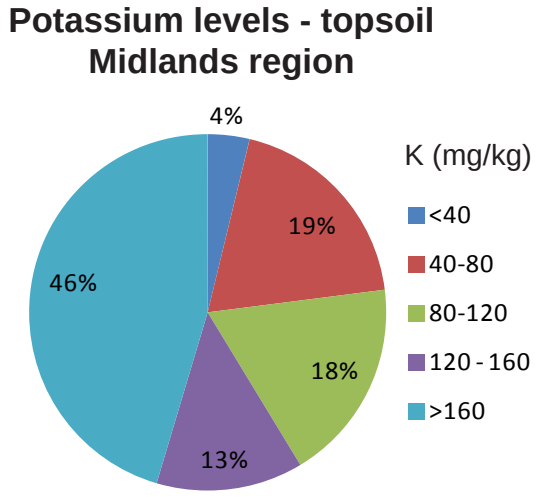


Phosphorus (P) is the driver of crop growth in Western Australia. Low plant available P reduces growth of young tissue - including roots - which reduces the plants' ability to explore as large a volume of soil as usual. In turn the plant can't access water or other nutrients. One major issue with phosphorus is that there is no practical way of topping up levels after the crop has germinated, so you need to get it right at the start. Critical values for P are hard to define without overlaying soil type, rainfall and intended enterprise details on the data. This data, from the Esperance and Ravensthorpe area covered by Summit Area Managers Nick Donkin and Mark Clare, show approximately 50% of soil P levels were low this year. 25% were high or extremely high.

Some of the low levels may be high rainfall coastal sands where it is difficult to build P levels. A desirable level may be nearer to 12 or 15mg/kg than 20mg/kg and some may be a result of some good yields in the past few seasons.

Potassium

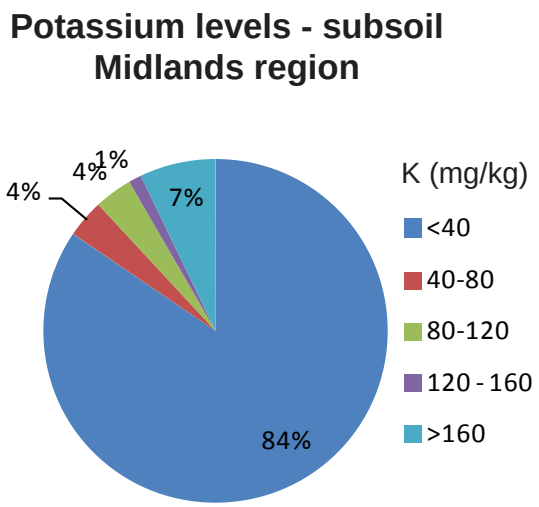
Potassium (K) is a nutrient that can be hard to define, as far as responses go. Many of our soils are duplex and hold a considerable amount of potassium at depth, but still within the root zone of most of our crops. Some crops, such as canola and lupins, are better able to extract potassium from the soil than wheat or clover.



In Summit Area Manager, Kobus Marais' area (which covers the shires of Nungarin, Mukinbudin, Westonia, Merredin, Yilgarn and Kellerberin), only 4% of topsoil samples fell below 40mg/kg, which is where canola and lupins respond to applied K.

This leapt to over 80% in the subsoils. Another 20% of topsoils are below 80mg/kg and 4% of subsoils. 80mg/kg is about where cereals stop responding to K and canola and lupins stop about 40mg/kg. Some clovers (eg Balansa) in high rainfall areas may respond to applied K where soil levels are 150mg/kg.

Responses do vary, so reference to your own soil test data is recommended. Subsoil sampling down to 30cm is also recommended in 10cm increments. We need to examine the K levels in the 3 zones to determine determine if crops or pasture will respond to fertilizer K. Plant analysis is also a useful tool to use to see if adequate potassium is being accessed by the plant.



Wheat response to potassium and nitrogen

Potassium (K) research is receiving increased attention in WA due to the role of this nutrient in the ability of plants to tolerate stresses such as drought, frost, pests and disease. This Summit trial was designed to test whether wheat growing on soil with low K close to the surface - but increasing with depth, would benefit from K application at seeding, enabling it to make full use of applied nitrogen (N) during the crop growth cycle.

During early vegetative growth, most plants require equal or greater amounts of K than other nutrients. Adequate K nutrition is essential to ensure efficient recovery and utilisation of other nutrients, in particular N. Even if the correct recommended rate of nitrogen is applied, if the soil and the crop is K deficient, the efficient recovery and utilisation of the N will be impaired.

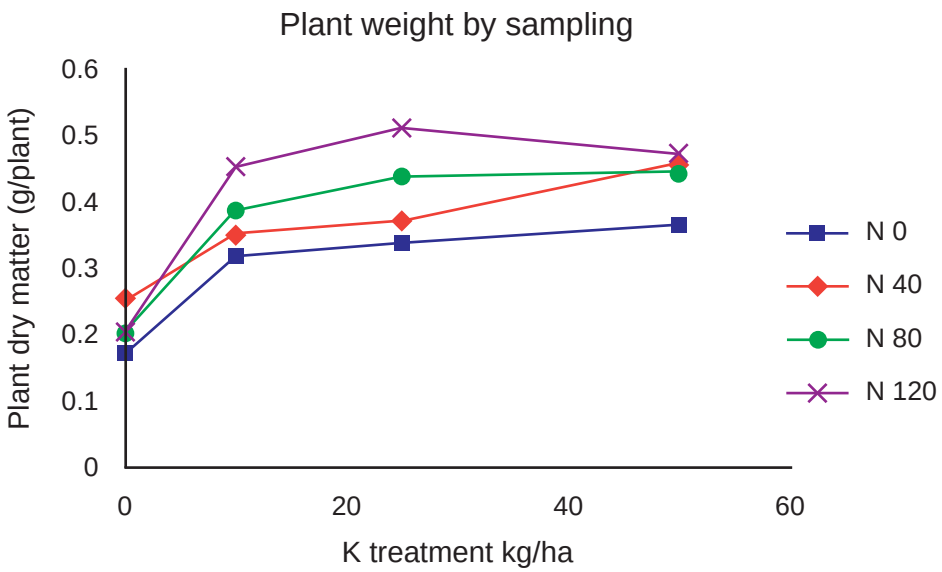
In this K x N trial at Yealering in 2014, Mace wheat was showing growth response to both K and N applications early in the season (Figure 1). Plant dry matter biomass was visually lower where no K or N was applied and showed significantly lower potassium and nitrate concentrations in the leaves. Plots had only received their second N top-up application one week prior to sampling.

By harvest, the response to N was still evident, but the K response had moderated. This may be a result of roots being able to access more K at depth in the duplex soil.

Whilst the number of heads produced was significantly increased by both N and K treatments (Figure 2), grain yield responded significantly only to N, not K. Grain yields ranged from 2.58 t/ha with no N or K applied, to 3.99 t/ha with 80 kg N/ha and 25 kg K/ha.

The experience of Summit and others with the wheat variety Mace is that it tends to utilise nutrients, especially nitrogen, in the production of grain yield in preference to grain quality. Certainly yield response to N treatments was evident in this trial, however, increasing N also significantly increased protein resulting in a range of delivery grade qualities from ASW to APW1 (Table 3).

Figure 1. Effect of N and K application rates on mid-season crop growth. Plant dry matter taken on 30 July, 2014



If considered individually, a number of the plots at 120 kg N/ha would have met the H2 grade with protein above 11.5%. While grade premiums are worth some consideration, yield remains the main driver of grower returns.

While yield considerations are important, gross margin will indicate the potential grower return from fertilizer treatments. Cost of N and K nutrition at rates used in the trial ranged from $0 to $247 per hectare. Assuming all other costs being equal between treatments, crude gross margin achieved from 2014 yields has been calculated in Table 3. Gross margin peaked at 80 kg N/ha plus 25 kg K/ha. Similar returns were indicatively achieved with 40 kg N/ha plus 10 kg K/ha. However, returns of $200 - $300 per hectare and associated higher premium delivery grades were consistently seen at and above 80 kg N/ha.

Recommended N, and to some extent, K rates will be dependent on paddock history, soil type, fertilizer pricing and also seasonal rainfall. In 2014 Yealering experienced close to its long-term average of 300 mm rainfall for the growing season for all months except June – coinciding with the first UAN top-up application. The drier June may have limited the nitrogen moving into the root zone of the wheat and it is possible that with an average June, the 80 and 120 kg N/ha treatments would have produced more heads, higher yields and greater grower returns than 40 N kg/ha.

Table 2. Soil test results

	NO_3 N	NH_4 N	P	K	S	PBI	pH (CaCl2)	Al	OC%
0-10cm	3	7	19	50	7	25	4.3	2.7	1.2
10-20cm	1	3	11	60	7	30	4.1	4.8	0.5
20-30cm	0	1	4	85	7	42	4.8	0.3	0.25

Figure 2. Effect of N and K application rates on crop head density, grain yield and grain protein content

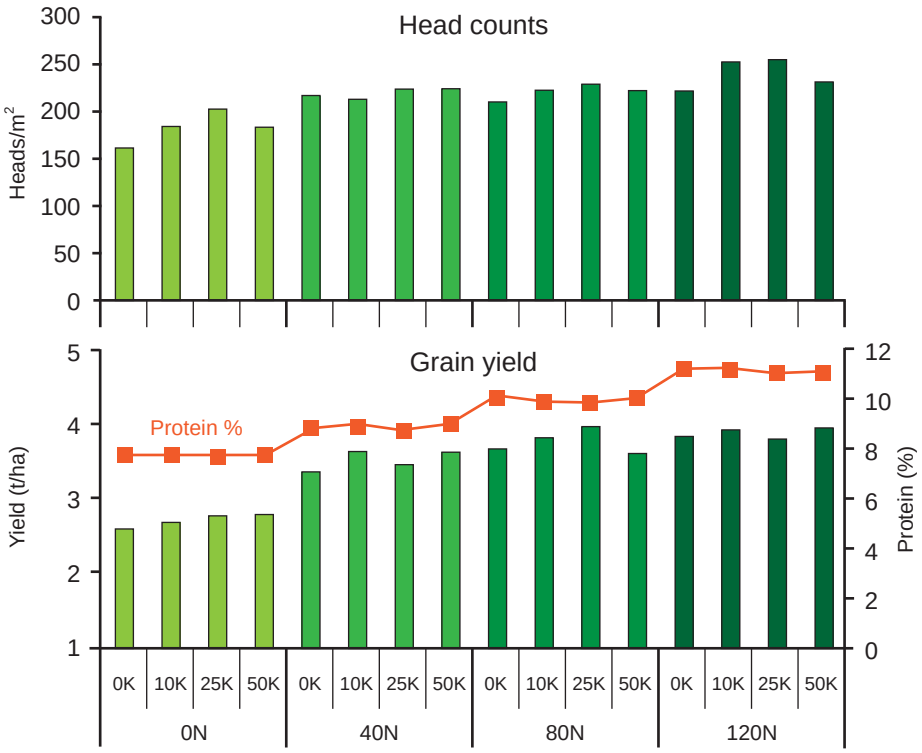


Table 3. Wheat growth, yield and gross margin returns from various N and K application rates

N	K	Heads per m²	Yield t/ha	Protein* %	Weight* kg/hl	Screenings* %	Delivery Grade*	#Fert input $/ha	Returns ^ $/ha
0	0	162	2.58	7.7	80.0	2.2	ASW	-	-
	10	186	2.70	7.7	79.7	2.1	ASW	12	25
	25	203	2.77	7.7	79.7	2.2	ASW	31	27
	50	186	2.79	7.7	79.8	2.0	ASW	62	3
40	0	218	3.38	8.8	79.3	2.2	ASW	57	189
	10	214	3.63	8.9	78.5	2.7	ASW	70	253
	25	225	3.45	8.7	79.3	2.5	ASW	88	179
	50	225	3.64	9.0	78.9	2.7	ASW	119	206
80	0	211	3.67	10.1	78.5	3.0	APW2	121	239
	10	224	3.82	9.9	77.3	3.2	ASW	134	247
	25	231	3.99	9.8	78.1	2.8	ASW	152	281
	50	225	3.61	10.0	77.6	3.1	APW2	183	158
120	0	223	3.84	11.2	76.3	4.2	APW1	185	236
	10	253	3.92	11.2	74.6	5.0	APW1	198	249
	25	255	3.81	11.0	75.1	4.8	APW1	216	196
	50	232	3.93	11.1	75.6	4.7	APW1	247	203
CV		8.8	6.01	3.03	0.57	8.8			
LSD 5%		31.8	0.348	0.48					

Notes: All prices net delivered/received Kwinana and GST exclusive
**Delivery grade $/t Kwinana 19 December 2014: ASW $307 APW1 $316, APW2 $314.*
 # March 2014 retail price (per kg ex Kwinana), N Urea $1.30, K MOP $1.24, June 2014 UAN $1.60
^Gross margin attributed to fertilizer. Calculated using yield and grade value, subtracting the cost of fertilizer applied and compared to the grain yield value when no fertilizer was applied.

Trial conclusions, wheat response to K & N

Both N and K influenced wheat growth at this site, to varying degrees.

Based on the soil sample analyses at this site, Summit's soil test interpretation model recommended 90 kg N for a 3 t/ha wheat crop. With a growing season rainfall of 300 mm and the responses in this trial, an N recommendation of 80 kg/ha appears appropriate.

Potassium recommendations from the Summit model were 20 kg K for a 3 t/ha wheat crop. Potassium recommendations would be much more dependent on soil characteristics and laboratory test results, but even on the duplex soil at the site, 10 to 20 kg K/ha looked to be of benefit in helping plants maximise the potential growth responses from top-up nitrogen applications.

Mace wheat utilises N nutrition for yield, on the whole, but protein does increase somewhat with increasing N application and targeting higher delivery grades is possible if desired.

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