SOUTHERN AUSTRALIA FOCUS

COVERING CROPPING SYSTEMS OF SOUTHERN NSW, VICTORIA, TASMANIA, SOUTH AUSTRALIA & WESTERN AUSTRALIA

Beyond P – why secondary trace elements matter in dry seasons

By Samuel Stacey, Senior Research Fellow, University of Adelaide

MANAGING SECONDARY OR TRACE NUTRIENTS

Balanced crop nutrition is extremely important to optimise crop yields under dry conditions. In 2007 field trials were planted at Goolagong in NSW to test wheat (cv. Ventura) responses to sulfur (S), zinc (Zn), magnesium (Mg) and potassium (K).

Yields showed significant responses to secondary and micronutrients, compared with the application of MAP + urea alone.

And very importantly, gross margin calculations showed that a balanced fertiliser program would substantially increase farm profitability.

Field site and fertilisers used

The soil type selected for this study was a grey/black vertosol with a pH ($CaCl_2$) of 6.0. Table 1 shows the nutrient analyses of fertilisers used in this study. Each plot was 12 m long by 1.6 m wide and received the equivalent of 22 kg P per hectare. Nitrogen rates were 18 kg per hectare, balanced between plots using granular urea.

The fertilisers were applied in a randomised complete block design. Each treatment was replicated four times.

The field trials were sown in early May 2007. Whole shoot samples were cut between the time of flag leaf emergence and early boot stage (Feekes Stage 9–10). Three one metre length samples were randomly selected and cut from the centre rows of each plot. The samples were dried, weighed and analysed for their nutrient contents.

...ii ▷

AT A GLANCE

- With high grain prices, small increases in productivity can significantly improve farm profitability.
- A balanced crop nutrition program is extremely important to optimise crop yields.
- At Goolagong, NSW, wheat yields were significantly increased by the use of a balanced fertiliser regime including N, P, K, S, Mg and Zn.
- An analysis of gross margins showed that the application of secondary and trace elements would have significantly improved farm profitability.

Consultants' Corner

Consultants' Corner is a new initiative by *Australian Grain*. This series of articles will highlight current GRDC-funded research with a particular focus on the commercial implications of adopting cutting-edge research.

◁i...BEYOND P

Grain harvest weights were recorded at maturity. Analysis of Variance (ANOVA) was used to determine whether there were significant grain yield and nutrient uptake responses to each fertiliser treatment.

Trial results

Zinc application significantly ($P \leq 0.05$) increased wheat grain yield by 14 per cent compared with MAP+urea alone (Table 1).

Shoot nutrient analysis showed that Zn concentrations were within the deficient range – below 15 mg/kg at Feekes stage 10.

There was no significant S response at the site either applied alone or with Zn and/or a K + Mg fertiliser. Shoot analysis showed that all plants had S concentrations within the adequate range.

Dr Samuel Stacey and Prof. Mike McLaughlin, University of Adelaide.

The K + Mg fertiliser significantly increased wheat grain yield by 15 per cent over MAP alone (Table 1). The grain K concentrations were below the accepted critical levels, which explains why the crop responded to the K + Mg application.

TABLE 1: Response of wheat to MAP, S, K, Mg, and Zn at Goolagong in 2007

Fertiliser	Wheat grain yield (t/ha)	Yield increase over MAP (%)
MAP	2.18 a	
MAP + 10%S	2.25 a,b	ns
MAP+10%S+1%Zn*	2.43 b,c	11.68
MAP + 1%Zn + 3.6%K + 2.3% Mg*	2.45 b,c	12.60
MAP + 1%Zn	2.48 c	13.84
MAP + 3.6%K + 2.3% Mg*	2.49 c	14.67
MAP+10%S+1%Zn + 3.6%K + 2.3% Mg*	2.53 c	16.09

Within columns, values with the same letter were not significantly different ($P > 0.05$)
* Fertilisers tested in this trial were MicroEssentials SZ and KMag

Potassium deficiency can show up as header trail 'waves' in cereal crops.

Gross margins

Gross margins were calculated to determine the profitability of applying secondary and micronutrients at the trial site.

Based on a wheat price of $345 per tonne estimated silo return (ESR), the application of Zn and, Mg and K would be profitable (compared with applying MAP alone) by keeping the application cost (based on 1.4 kg Zn per hectare) below $117.70 per hectare.

The application of Zn would be profitable if the cost of 1.4 kg Zn per hectare were below $101 per hectare.

At current fertiliser prices and by using the products tested in this trial, the application of balanced N, P, Mg, K and Zn would increase wheat gross margins by approximately $77.60 per hectare.

Further trials will help determine the distribution of K, Mg, S and Zn responsive soils in southern Australia.

Thanks to Mosaic L.L.C. for funding and supplying fertilisers for these trials and Chris Dowling and David Harbison for their trial management.

The GRDC Southern Region kicked off the 2008 Updates series with Adviser Updates at Adelaide, Wagga Wagga and Ballarat, and a grower update at Corowa. Around 1000 advisers, researchers, industry representatives and growers started 2008 by hearing the latest in grain research and extension.

This edition of Consultants' Corner features Dr Samuel Stacey's Adviser Updates research paper, with consultants comments coming from Peter McInerney.

THE CHEMISTRY OF P PLACEMENT: BANDING VERSUS BROADCAST

In P responsive soils, fertiliser banding is used to increase efficiency by improving early root contact with the fertiliser.

Banding was also traditionally thought to increase efficiency by decreasing the area of contact between the soil and the fertiliser and so reducing P fixation.

The main mechanism reducing P availability in calcareous soils is P precipitation in the form of calcium phosphates, such as apatite.

But in acidic soils, the precipitation of P is mainly due to the formation of compounds with aluminium and iron. High P concentrations may increase precipitation.

Given these differing chemical responses, research has set out to determine whether concentrating P fertilisers into bands would increase P precipitation in calcareous soils.

A laboratory and glasshouse study using isotope dilution techniques showed that banding P fertiliser granules did not significantly increase or decrease P fixation on the majority of soils tested. The results suggest that increased granular fertiliser efficiency with banding was primarily due to improvements in early root contact with fertiliser P rather than its effect on P fixation.

When powdered MAP was mixed uniformly throughout the soils (this treatment would traditionally be thought of as a bad practice due to P fixation), the availability of P was much greater in the calcareous soils.

This work reinforces previous findings that suspensions and fluid fertilisers perform better on these soil types because they reduce P concentrations locally around the point of fertilisation – this reduces precipitation of fertiliser P.

The primary researchers for this P placement work were Kylie Dodd, Ganga Hettiarachchi and Mike McLaughlin.

EMERGING TECHNOLOGIES FOR MANAGING TRACE ELEMENT DEFICIENCIES

The University of Adelaide and CSIRO Land and Water have developed two novel chelating agents which may help improve the efficiency of trace element fertilisers.

Chelates, as used in fertilisers, are compounds that form soluble complexes with trace elements. They are used to prevent trace element precipitation and increase their solubility in soils. The most common chelates used in fertilisers are EDTA and DTPA.

But plant roots have difficulty absorbing these complexed forms of Zn.

One of the new chelates, called rhamnolipid, forms lipid (membrane) soluble complexes with Zn. This improves Zn absorption across root membranes and increases Zn uptake by plants compared with both $ZnSO_4$ (zinc sulfate) and ZnEDTA (zinc saturated EDTA).

Trials have shown that in calcareous soils, rhamnolipid has significantly improved Zn uptake by both bread and durum wheats.

The second chelate, a positively charged polymer, also facilitates Zn uptake by roots and has significantly improved Zn uptake in wheat and canola under field conditions on SA's Eyre Peninsula and in NSW.

Further field trials are needed to confirm the efficiency of these products under field conditions in a wider variety of soil and climatic environments.

For further information, please contact
Dr Samuel Stacey (08) 8303 7284;
E: samuel.stacey@adelaide.edu.au
Prof. Mike McLaughlin;
E: michael.mclaughlin@adelaide.edu.au ■

THE COMMERCIAL VIEW

By Peter McInerney, Consultant, Wagga Wagga

Coming into this season most growers are under a degree of financial pressure, and when under this kind of pressure decision making can be adversely affected. Good decision making this season is all about looking forward – not looking back. What worked last year in an extreme drought situation might not be appropriate this year if we get an average season.

There has been a great deal of excitement about trace elements and their ability to boost yields when used effectively. But if your area is not recognised as deficient you may not need to spend money on trace element applications. We need to pay attention to trace elements but we might not get a response everywhere we apply them.

Match the inputs to the potential

Input decisions should be made on a paddock-by-paddock basis and growers must be familiar with their own paddocks and input requirements. Reduced inputs in 2007 looked good due to low yield potential. Where paddocks have good potential in 2008, input levels need to be aimed at capturing that potential. Where you've got paddocks with good yield potential and a reasonable growing season rainfall outlook, you don't want to cut back too far on inputs.

Growers should use current soil testing information whilst also considering the yield potential of each paddock. Simple on-farm trials can compare last year's rate, a zero rate, and this year's rate gained from soil testing. On-farm trials can be surprisingly easy to conduct, particularly if you have a yield monitor or you are using yield mapping.

On-farm verification of the science will assist decision making before spending the dollars. It will show to some extent how far you can cut the rate and whether in the past your rates have been too high.

If growers cut inputs too far it can cost yield and impact on profitability. Even a small yield reduction is worth a lot of money with the current high grain prices. If you are going to make a mistake, make the mistake of applying $10 per hectare too much fertiliser, rather than harvesting $150 per hectare too little crop.

By ensuring you get optimum yield, you can cover the cost of the inputs and maximise your farm profitability.

Managing Director of GRDC Peter Reading, consultant Peter McInerney, and GRDC Southern Panel Chair David Shannon, pictured at the 2008 GRDC Adviser Update at Wagga Wagga.