Trace elements in a fluid fertiliser system at Mudamuckla

RESEARCH

Cathy Paterson, Wade Shepperd and Ian Richter
SARDI, Minnipa Agricultural Centre

Location: Mudamuckla
Peter Kuhlmann
Rainfall
Av. Annual: 291 mm
Av. GSR: 219 mm
2012 Total: 169 mm
2012 GSR: 128 mm
Yield
Potential: 0.8 t/ha (W)
Actual: 0.63 t/ha (treatment 6)
Paddock History
2012: Wheat
2011: Canola
2010: Wheat
2009: Wheat
2008: Wheat
Soil Type
Grey calcareous sandy loam
Soil Test
soil chemical analysis
Plot Size
1.4 m x 18 m x 4 reps
Yield Limiting Factors
Later sowing and dry spell

Key message

- **No further yield benefit was measured from applying other nutrients and trace elements over and above P and N in 2012.**

Why do the trial?

Phosphorus (P) has been a major limiting factor to crop growth on calcareous grey soils of the upper Eyre Peninsula. P deficiency causes plants to be low in vigour and fail to produce adequate tillers. Research with fluid fertilisers has not only confirmed P was the major limiting nutrient, but also that fluids increased the availability of P.

Research conducted by Holloway *et al* in the early-mid 2000's showed that the use of fluid P increased dry matter production by 20-30% compared to granular fertiliser at equivalent rates of P, but did not always result in a yield increase. This extra growth also increased the demand for other nutrients, which can cause other deficiencies and reduce the response to applied fertiliser (EPFS Summary 2004, pp 92-94).

During the 2012 farmer meetings concerns were raised about not getting the expected yield increases from using a fluid fertiliser system. This trial was designed to begin investigating what nutrients (macro and micro) are required to increase grain yield in a fluid fertiliser system.

How was it done?

The trial was sown on 19 June with Axe wheat @ 50 kg/ha with 8 treatments (Table 1), replicated 4 times. Measurements taken during the year included soil chemical analysis, plant establishment (not reported), dry matter at early tillering, anthesis and harvest, grain yield and grain quality.

What happened?

Soil chemical analysis performed before sowing measured the Colwell P level (0-10 cm) at 32 mg/kg, mineral nitrogen (N) (0-60 cm) 58 kg N/ha and trace element analysis (DTPA 0-10 cm) reported copper (Cu) 0.3 mg/kg, zinc (Zn) 0.8 mg/kg and manganese (Mn) 2.4 mg/kg. The iron (Fe) (0-10 cm) level was 1.7 mg/kg, sulphur (S) (0-10 cm) was 8.8 mg/kg, potassium (K) (0-10 cm) was 266 mg/kg and exchangeable magnesium (Mg) (0-10 cm) was 0.71 meg/100g. With the exception of copper all nutrient levels were above critical values.

Compared to the nil treatment there was more early dry matter production (Table 2) where P plus N was applied but no further increases in response to other nutrients applied. At anthesis there was a response to N+P+S but no further increases in response to other nutrients applied and at harvest all treatments had higher dry matter production where P was applied.

There was a grain yield benefit from applying P and N compared to applying no fertiliser, but no further increases in response to other nutrients applied. Grain test weight and protein levels were higher in response to P, and P and N respectively. Screenings were above 5% for all treatments with the lowest amount of screenings being achieved where P was applied.

Table 2 Plant dry matter production, grain yield and quality, Mudamuckla 2012

Treatment	Early DM (t/ha)	Anthesis DM (t/ha)	Harvest DM (t/ha)	Yield (t/ha)	Test Wt (kg/hL)	Protein (%)	Screenings (%)
Nil	0.12	1.01	1.65	0.42	82.9	12.5	8.5
N	0.14	0.89	1.67	0.59	83.1	12.6	8.7
P	0.21	1.08	1.80	0.58	84.2	12.9	6.2
N+P	0.35	1.33	2.02	0.61	83.7	13.5	5.8
N+P+S	0.37	1.42	1.83	0.56	83.7	13.4	5.8
N+P+S+K+MG	0.32	1.42	2.01	0.63	83.6	13.3	5.3
N+P+Zn+Mn+Cu	0.33	1.49	1.92	0.61	83.9	13.2	5.7
N+P+Zn+Mn+K+S+Mg+Cu	0.40	1.60	2.01	0.62	84.0	13.3	5.9
LSD (P=0.05)	*0.08*	*0.39*	*0.33*	*0.04*	*0.5*	*0.6*	*1.1*

What does this mean?

Grain yield increases were achieved with the application of P and N but there were no further benefits with applying other nutrients in 2012. The dry conditions experienced meant that these increases were small and the screenings of all treatments were over 5%, downgrading the grain from Hard to Feed 1. This site was only deficient in copper (The Wheat Book - Principles and Practice), although there was no benefit gained from applying this nutrient this season. The dry conditions and consequential low yields would have reduced the plants demand for all nutrients.

The results from this trial demonstrate that more work is required into the use of nutrients other than P in a fluid system across a range of seasonal conditions to investigate if these increases can be consistently achieved and what rate and form is most likely to provide an economic benefit.

Acknowledgements

Thanks to Peter Kuhlmann for the provision of land for this trial, Therese McBeath and Roy Latta for technical advice and support during the year and to GRDC for funding the EP Farming Systems 3 Project UA00107.