The Effects of Trace Elements on Annuello Wheat Production

Background

Kangaroo Island agriculture relies on the application of the trace elements copper, zinc, molybdenum and manganese to support profitable production of crops and pastures. A deficiency of any one of these trace elements can reduce production by up to 30% before the plant shows visual signs. The increased usage of tissue testing by producers on the island is highlighting the current deficient status of many of our plants on the island.

A trial was set up on the property, Caledonia, located south east of Parndana and managed by Will Stanton to assess the yield response of Annuello wheat to the addition of trace elements.

There were 3 variable plots which looked at the yield effect of No Zinc, Only Zinc and No Trace Elements compared to a best practice plot which had molybdenum, boron, zinc and copper added during the growing period.

What was done

Soil tests where taken before planting and showed that the pH_{cacl2} at 0-10cm was 4.6 and at 10-100cm was 5.3 and thus the paddock should be limed.

Unfortunately the liming did not happen. Annuello wheat was sown on the 3rd May 2007 at 100kg/Ha with 92.5kg/Ha MAP and 5L/Tonne Smartrace Zinc applied to the seed prior to sowing. On the 18th of July, plant establishment counts showed an average of 179plants/m^2. All plots were treated the same until growth stage (GS) 23 when zinc sulphate and sodium molybdate were added to some plots as shown in Table 1.

Tissue tests where taken at GS 31. These showed that:

- molybdenum and copper levels were below adequate across all plots
- zinc was below adequate in half the plots
- manganese levels were adequate for all plots.

At GS 32 copper, boron and zinc were added to some of the plots based on the tissue tests taken at GS 31.

A second tissue test was taken at GS 49 from each of the plots with the results showing that:

- copper and manganese were adequate across all the plots
- molybdenum was adequate in the best practice plots
- molybdenum was below adequate in the other plots
- zinc on the seed was enough to get through the season
- there was no difference in Boron levels.

The trial was harvested on the 5th January 2007 with the average paddock yield being 3.7t/ha.

Results

The grain yield results are shown in Table 2. It can be seen from this table that unfortunately there was a strong paddock effect in this trial. As the plots got closer to the fence the best practice plots had a yield increase of 0.5t/ha. We have been unable to deduce any reasons for this strong effect. The site chosen was relatively flat and to the best of our knowledge there were no great differences in soil type across the site. Such an outcome shows that smaller, random and replicated plots are better for trial work than larger plots as used in this trial.

		GS 23	GS 32
PLOT 1	No 'in crop' zinc	11g NaMo	400ml – Cu, 180g – B, 10g NaMo
PLOT 2	Best practice	1.16kg ZnSO, 11g NaMo	400ml – Cu, 180g – B, 10g NaMo, 140ml – Zn
PLOT 3	Zinc only	1.16kg ZnSO	140ml – Zn
PLOT 4	Best practice	1.16kg ZnSO, 11g NaMo	400ml – Cu, 180g – B, 10g NaMo, 140ml – Zn
PLOT 5	No 'in crop' trace elements	-	-
PLOT 6	Best practice	1.16kg ZnSO, 11g NaMo	400ml – Cu, 180g – B, 10g NaMo, 140ml – Zn

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Table 1: Trace element trial layout.

KEY: NaMo – Sodium Molybdate, ZnSO – Zinc Sulphate, Cu – Coptrel, B – Boron, Zn – Twin Zinc

Treatment	Yield (t/ha)
No 'in crop' zinc	3.40
Best Practice	*3.55*
Zinc only	3.70
Best Practice	*3.71*
No 'in crop' trace elements	3.80
Best Practice	*4.04*

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Table 2: Yield results across the different plots.

Based on the tissue tests in this trial we can conclude that in soils with low pH, a seed dressing of zinc at sowing is enough to get the plants through the season. This was shown in the plot which had no zinc added after sowing yet still had adequate zinc levels in the plant at GS 49. It was also very evident that unlike zinc, which is readily available at low pH, molybdenum becomes less available at low pH. The tissue tests showed that even where molybdenum was applied during the season the levels in the plant where still below adequate (although levels were higher than which didn't receive any). This emphasises the importance of ensuring the soil is pH_{CaCl2} 5 for intensive cropping or between pH_{CaCl2} 5-5.5 for grazing to ensure the plants are able to make maximum use of the trace elements in the soil.

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Take home message

- Tissue test plants before applying trace elements to know what is and isn't needed by the plant
- Boron is an unknown entity
- When the pH is low, molybdenum remains at inadequate levels even after 'in crop' applications
- Lime when pH_{CaCl2} <4.8
- It would be good to repeat the trial on a limed paddock