Micronutrient Field Evaluations - Horsham, Nhill, 2011

The objective of this experiment, conducted at two sites in 2011 was to assess the response of wheat to zinc and/or copper in a standard cropping system.
The sites selected were at Horsham and at Nhill, both on vertosols. No past history is available. Table 1 gives a soil test summary for both sites and shows DTPA zinc levels above critical, while the DTPA copper levels low at Horsham and marginal at Nhill. The Nutrient Advantage Advice recommendation report indicated values above marginal for both micronutrients.

Table 1. Soil test result summary for the experimental sites in 2011.

Site	pH (1:5 water)	OC %	Colwell P mg/kg	PBI	Zinc (DTPA) mg/kg	Copper (DTPA) mg/kg
Horsham	8.2	1.3	44	110	1.30	0.40
Nhill	8.0	1.2	22	110	1.30	0.68
Critical level*					0.8	0.7

Critical levels taken from Peverill et al. 2005, Soil Analysis – An Interpretation Manual, CSIRO Publishing.

Sites were sown using district best practice for seeding rate and crop protection. Fertilizers used were MAP, MAP supplements with 3 kg/ha copper, MAP supplemented with 3 kg/ha zinc and MAP supplemented with both 3 kg/ha copper and 3 kg/ha zinc. There were no nil fertilizer controls. Table 2 shows the mean yields for each treatment at the two sites, and indicates there were no significant differences due to the use of either micronutrient alone or in combination.

Table 2: The effect of micronutrient application on wheat yield at two sites in the Wimmera in 2011.

Treatment	Horsham Yield (t/ha)	Nhill Yield (t/ha)
MAP	4.22	4.07
MAP + Cu	4.31	4.04
MAP + Zn	4.20	3.87
MAP + Cu + Zn	4.25	3.92
SE Mean	0.07	0.25

Grain from these experiments were analyzed for their elemental composition using ICP-OES through Waite Analytical Services (University of Adelaide). This provides a 20 element analysis, with Cr and Ti analysis used as checks for soil contamination. Table 3 gives the effect of added micronutrients on the grain content of phosphorus, zinc, copper, manganese and boron. Molybdenum levels in the grain were all below the analytic limit for this method of 0.04 mg/kg.

The only significant effect of the treatments on grain nutrient content was a small decrease on grain B (p=0.008) when either micronutrient was applied. Critical wheat grain nutrient contents for the micronutrients are given as <15 for Mn, <1 for Cu and <10 for Zn, while for B values >2 are considered adequate. These values are taken from Reuter and Robinson (Plant Analysis, an interpretation manual, CSIRO). Based on these limits, it would seem that B could even be a little low possibly due to the wet conditions leaching B – but the degree of deficiency does not seem to be large or significant. Grain B contents can be low if the grain gets wet at or near maturity as the B is very mobile and is leached from the grain.
Table 3 The effect of micronutrient application on grain nutrient composition at two sites in the Wimmera in 2011.

Treatment	Horsham					Nhill				
	P mg/kg	Cu mg/kg	Zn mg/kg	B mg/kg	Mn mg/kg	P mg/kg	Cu mg/kg	Zn mg/kg	B mg/kg	Mn mg/kg
MAP	2350	5.1	29	1.2	43	2600	4.8	20	1.7	51
MAP + Cu	2250	5.0	27	1.1	41	2567	4.5	19	1.5	46
MAP + Zn	2200	4.9	28	1.1	38	2633	4.6	20	1.5	47
MAP + Cu + Zn	2200	5.0	25	1.1	43	2733	4.8	21	1.5	49
SE Mean	*51*	*0.1*	*1.1*	*0.1*	*2*	*100*	*0.2*	*1*	*0.04*	*2*

After harvest, soil tests from samples from 10-40 cm were taken and these showed copper levels of 1.1 mg/kg DTPA but Zinc levels at these soil depths were less than 0.2 mg/kg DTPA. These suggest that the may be adequate Cu at depth in these soils and this may help explain some of the unreliability of top 10 soil testing for micronutrients.

Conclusion

On these two sites, the addition of copper or zinc supplements to MAP had no effect on grain yield or grain Cu or Zn content. Based on the soil test, the Horsham site could have been considered marginal for Cu, but Zn levels were not considered limiting. Soil tests for micronutrients are unreliable and diagnosis of paddocks where crops can benefit from micronutrient supplements is also unpredictable.