3.4.2 THE EFFECT OF ZINC AND COPPER DELIVERY SYSTEMS ON WHEAT YIELD AND PROTEIN IN HIGH RAINFALL ENVIRONMENTS

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Introduction:
A concurrent trial was conducted alongside the nitrogen trials to evaluate delivery systems for zinc and zinc requirement in high rainfall zones. While zinc deficiency has been associated with alkaline soils, recent research and anecdotal evidence has suggested the requirement for additional zinc in high rainfall zones on acid - neutral soils in certain circumstances.

Zinc supply to the crop may become limited:
1. Under water logged conditions.
2. Where sulfonyl urea herbicides reduce early root development.
3. In crops following canola.
4. Where root disease is present.
5. In the initial years of zero-till adoption where immobile zinc mineralising from organic matter accumulates in the surface layer above the root zone.
6. Under high soil pH.

While most soils in southern Victoria are usually referred to as acidic, this acidity often only occurs in the surface layer, with neutral and alkaline pH usually observed in the root zone.

Following significant yield increases (up to 15%) to zinc fortified fertiliser in a trial at Glenthompson in 2001, it was deemed necessary to investigate further.

Method:
The trials were sown on the same date as the respective N trials using Chara wheat. Basal N & S was supplied to give every treatment 60 kgN/ha & 15 kgS/ha with the balance mid row banded between alternate sowing rows. P rate was 25 kgP/ha for all treatments so that the only variable was zinc &/or copper application.

Results & discussion:
At Gnarwarre it is curious that the adjacent nitrogen trial (where 50 kgN/ha was applied) resulted in consistently higher yields and proteins than the zinc trial despite similar N supply. The only difference with the nitrogen trial was the basal starter fertiliser which supplied both zinc and copper. Although no significant yield differences were recorded in the zinc trial, a compounded entry containing zinc and copper (plus manganese) did increase yield by 200 kg/ha over the nearest rival. This is surprising given that soil zinc and copper levels appeared adequate and it does suggest a synergy between zinc and copper which was also observed in trials in the southern Wimmera in 2002. The other obvious conclusion was lower N supply under the zinc trial, although this was not verified as the trial was sampled by replicate.

At Lake Bolac, despite the absence of highly significant responses there is a suggestion of zinc supply to the crop improving production. Of the Granulock treatments supplying zinc the average yield increase was 8% suggesting strong return on investment. The full expression of zinc response may have been affected by moderate root disease and evident haying off at Lake Bolac in 2002. This will be revisited in 2003.

Table 29: Yield, Protein and Grain N Removal at Gnarwarre

Nitrogen rate, application method & timing	Gnarwarre			Lake Bolac		
	Yield kg/ha	Protein % 11% mb	Grain N removal kg/ha	Yield kg/ha	Protein % 11% mb	Grain N removal kg/ha
MAP	5065	10.00	89.0	3318	13.96	80.8
GL 2% Zn	5183	9.94	90.3	3623	13.54	85.8
GL 0.5% Zn	5102	9.85	88.6	3736	13.80	90.1
GL 1% Zn	5073	9.66	86.1	3181	14.11	78.6
MAP + ZnO cmpd	4872	10.69	92.0	3093	14.11	76.1
GL 1% Zn (low pH)	5211	9.98	91.2	3461	14.12	85.6
MAP Zn/Cu/Mn cmpd	5386	10.10	95.3	3457	13.70	82.8
MAP + ZnO S.D	4744	10.26	84.9	3610	13.74	86.7
GL 1% Zn + ZnO S.D	4937	10.64	92.5	4017	13.28	93.3
MAP + Foliar $ZnSO_4$	4974	9.95	86.6	3052	13.90	74.2
GL 1% Zn +Foliar $ZnSO_4$	4931	10.15	88.0	3537	13.51	83.6
GL 1% Zn 0.9% Cu	5036	10.26	90.2	3439	13.98	84.0
GL Copper	5056	10.66	93.9	3319	13.78	80.1
GL 12 + foliar CuOxy	5140	10.70	95.8	3395	13.67	81.0
GL Cu + foliar CuOcy	4559	11.47	90.6	3320	13.64	79.2
F pr	0.821	0.304	0.945	0.209	0.069	0.267
l.s.d.	**537.4**	**0.226**	**9.72**	**600.2**	**0.5122**	**16.74**
c.v.%	**6.8**	**1.8**	**8.7**	**1.3**	**1.9**	**2.6**

KEY
GL = granulock (zinc/copper compounded with MAP & AS)
MAP + ZnO cmpd = co-granulated MAP + zinc oxide
ZnO S.D. = zinc oxide seed dressing
Foliar $ZnSO_4$ = foliar zinc sulfate heptahydrate applied at DC23
CuOxy = foliar copper oxy-sulfate applied at DC39